INVESTIGATING THE IMPACT OF THE BLENDED LEARNING MODEL ON THE ACCESS TO HIGHER EDUCATION IN RWANDA

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Approval of the Thesis

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This Thesis by Vivens Hitiyaremye has been approved by the committee members below, who recommend it be accepted by the faculty of Unicaf University in Zambia in partial fulfilment of requirements for the degree of

Doctorate of Education (EdD).

Thesis Committee:

Dr Trevor Gerhardt, Supervisor

Dr Olga Novokhatskaya, Chair

Dr Kadhila Ngepathimo, External examiner

Dr Vinnaras Nithyanantham, Internal examiner

Abstract

INVESTIGATING THE IMPACT OF THE BLENDED LEARNING MODEL ON THE ACCESS TO HIGHER EDUCATION IN RWANDA

Vivens Hitiyaremye

Unicaf University in Zambia

This research investigated the impact of blended learning on access to higher education in Rwanda, and it involved 10 institutions that have integrated this model. The study targeted university students, lecturers, academic registrars, and IT senior staff. It applied to mixed-methods approach which considers both qualitative and quantitative data. Data collection included online surveys for students and lecturers, as well as face-to-face interviews with academic registrars and IT staff. Quantitative analysis used statistical methods like Chi-square and ANOVA, while qualitative data underwent thematic analysis.

Findings revealed that both students and lecturers had positive perceptions of blended learning due to its flexibility, cost-effectiveness, and ability to support self-paced and collaborative learning. The model was particularly beneficial for students who balance work and studies, which contributes to increased enrollment. Respondents highlighted that blended learning enabled more students to pursue education remotely, a crucial advantage during disruptions such as the COVID-19 pandemic.

Despite its benefits, challenges included limited digital skills among students and faculty, inadequate IT infrastructure, a shortage of technical support staff, and underdeveloped learning design. To address these issues, the study recommended upgrading IT facilities, providing continuous digital training, expanding technical support teams, and collaborating with stakeholders to enhance access to affordable IT devices. In conclusion, while challenges remain, the study revealed that blended learning enhances access to higher education by offering flexible study options and aligning with modern educational needs.

Declaration

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where stated otherwise by reference or acknowledgment, the work presented is entirely my own.

AI Acknowledgment

I acknowledge that I have not used any AI tools to create, proofread or produce any text or ideas related to any draft or final versions of this work.

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Dedication

This thesis is dedicated to my wife and children.

Acknowledgments

The successful completion of this doctoral thesis owes much to the invaluable contributions of various individuals, whom I would like to extend special gratitude towards.

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List of Abbreviations

AI: Artificial Intelligence

ANOVA: Analysis of Variance

BLF: Building Learning Foundations

COVID: Coronavirus disease

DOT: Digital Opportunity Trust

GoR: Government of Rwanda

HEC: Higher Education Council

ICT: Information, Communication and Technology

IT: Information Technology

KOICA: Korea International Cooperation Agency

MINEDUC: Ministry of Education

NGO: Non-Governmental Organization

NISR: National Institute of Statistics of Rwanda

OECD: The Organization for Economic Co-operation and Development

OLPC: One Laptop per Child

RwandaEQUIP: Rwanda Education Quality Improvement Program

TAM: Technology Acceptance Model

TPACK: Technological Pedagogical and Content Knowledge

TVET: Technical and Vocational Education and Training

UNESCO: The United Nations Educational, Scientific and Cultural Organization

UREC: Unicaf Research Ethics Committee

WEF: World Economic Forum

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CHAPTER 1: INTRODUCTION

Education is a dynamic field that has continually evolved, particularly with the advent of digital technology. Technological advancements have significantly reshaped education by improving content delivery, learning management systems, virtual classrooms, and personalized learning experiences (Okoye et al., 2023). Over the past two decades, students, educators, and institutions have increasingly embraced digital tools, resulting in a significant rise in online learning opportunities (UNESCO, 2023).

The internet is essential in broadening educational access. According to UNESCO (2023), participation in Massive Open Online Courses (MOOCs) has surged from zero in 2012 to at least 220 million in 2021. Additionally, global internet usage has risen from 16% in 2005 to 66% in 2022, with about half of schools worldwide integrating internet-based learning, especially in OECD countries. Beyond connectivity, technology has contributed to enhancing equity, inclusion, and education quality by enabling more geographically dispersed learners to access learning opportunities (Wallace et al., 2023).

The evolution of technology in education has led to numerous trends, including personalized learning, remote education, globalization of knowledge, lifelong learning, and open educational resources (Ratten, 2023). Adaptive learning technologies use data to customize educational experiences based on each student's unique needs, promoting more effective learning (Castro, 2019). Online and remote learning elements have been increasingly integrated into traditional education, making learning more flexible and accessible (Kömür et al., 2023). The globalization of education has allowed students to access diverse perspectives, while lifelong learning has gained traction in response to rapidly changing job markets and technological advancements (Cheshmehzangi et al., 2023). Free and open educational resources further support education accessibility by reducing costs (Schmidt & Tang, 2020).

Recent studies have examined the effectiveness and preferences of face-to-face and blended learning methods in higher education. Harper et al. (2024) indicate that while many students prefer traditional face-to-face instruction, a significant portion favors blended learning, with 50-60% of teachers and students reporting increased motivation in blended models. A 2010 meta-analysis by the U.S. Department of Education revealed that students engaged in online or blended learning environments tended to perform slightly better than their peers in traditional face-to-face settings.

However, learning preferences vary based on factors such as subject matter, technological access, institutional policies, pedagogical approaches, and socio-economic conditions. A 2023 survey by Tyton Partners revealed that 31% of students preferred in-person learning, while 69% favored fully online, hybrid, or blended learning models. In medical education, 53.1% of students preferred face-to-face instruction, while 60.6% of faculty members favored blended learning, highlighting differences in student and faculty perspectives.

In Rwanda, the government has implemented policies to integrate technology into education. Educational reforms have emphasized the importance of equipping teachers with digital skills (MINEDUC, 2023). The Education Sector Strategic Plan (2018–2024) prioritizes scientific and technological competency development at all educational levels (REB, 2022). The government, in collaboration with international stakeholders such as the Korea International Cooperation Agency (KOICA), has trained pre- and in-service teachers in technology-enhanced pedagogy (Migraines, 2021). Through partnerships, KOICA and the Ministry of Finance and Economic Planning have worked under UNESCO's framework to implement blended learning training for teachers in Rwanda (REB, 2023).

To further promote technology integration, the Higher Education Council (HEC) has authorized higher education institutions to adopt online and blended learning models. This

initiative aims to expand access to higher education, minimize disruptions such as those experienced during the COVID-19 pandemic, and enhance equitable and high-quality learning opportunities (HEC, 2021).

Blended learning, which integrates face-to-face teaching with online instruction, is gaining widespread adoption in higher education (Qianqian & Sang-Bing, 2021). It leverages technology to create flexible learning environments where students engage with course materials at their own pace (Fuller, 2021). Initially emerging in the late 1990s, blended learning has evolved from simple combinations of classroom instruction and online content to sophisticated digital platforms with interactive features (Whiteside et al., 2023). Educational institutions continue to refine this model to accommodate diverse learning preferences (Abbas et al., 2023).

The incorporation of both in-person and online teaching methodologies constitutes one of the key developments of education in various institutions of higher learning across the globe (Qianqian & Sang-Bing, 2021). The combination of both educational approaches is referred to as the blended learning model in education. Bended learning is described as the combination of instructor-led and online learning with the help of technology (Glazer, 2023). In addition, blended learning is described as a mixture of online and face-to-face instruction where in-class time for students is reduced (Dziuban et al., 2018). It was supported that technology-assisted teaching and learning may create a flexible learning approach that allows students to interact with content at their individual pace through the use of the internet (Fuller, 2021).

While face-to-face education has been the dominant mode of instruction for centuries, it faces limitations that hinder its effectiveness in addressing modern learning needs (Imran, 2023). Critics argue that traditional education is constrained by limited accessibility, inflexible schedules, large class sizes, one-size-fits-all instruction, and restricted resources (Dziuban et al., 2018). Traditional learning requires physical presence, which can be a barrier for students

with disabilities, those in remote areas, or individuals with work obligations (Kuzat, 2023). Large class sizes limit personalized attention, and teacher-centered instruction reduces student engagement and interaction (Tang et al., 2023). Additionally, standardized teaching approaches may not cater to diverse learning styles and paces, leading to decreased motivation and engagement (Pratama et al., 2023). The lack of personalization discourages critical thinking, creativity, and problem-solving skills (Rizvi et al., 2022).

On the point of limited accessibility, Kuzat (2023) stipulates that traditional teaching methods typically necessitate students to be present in a specific physical location, which poses accessibility challenges for individuals with, for example, disabilities, those residing in remote areas or those who have other obligations that prevent them from attending in-person classes. In addition to the limited accessibility, the traditional face-to-face teaching methods are generally accused of following a fixed classroom schedule and location. As a result, this might not cater for the diverse needs of students with different learning styles and preferences (Meyer, Shen & Plucker, 2023). Regarding gaps associated with class size, the traditional face-to-face methods usually allow all students to be gathered in the same classroom for learning; as a result, this can make the class size larger for effective management. In this regard, large class size can make it difficult for teachers to provide personalized attention to each student, and this can hence lead to some students falling behind or not receiving the support they need from teachers (Tang et al., 2023).

For one-size-fits-all approach, the traditional face-to-face teaching methods are often said to rely on an approach which may not cater for various learning styles and paces of individual students (Pratama, Sampelolo & Lura, 2023). To illustrate, Napiform (2023) argues that this traditional approach does not favour digital natives, individuals grown up in a digital-rich environment and who are naturally familiar and comfortable with using digital tools as their learning preferences due to their exposure from an early age. According to Vimbelo &

Bayaga (2023), this approach may lead to the lack of personalization, limited engagement and overlooking diverse talents as it tends to treat all students the same way by neglecting their unique learning needs and preferences. Consequently, certain students may not receive the necessary individualized support, and it can lead to decreased motivation in their learning practices.

Despite these challenges, traditional face-to-face learning has notable strengths, including immediate feedback, social interaction, strong teacher-student rapport, access to physical resources, and live discussions (Imran et al., 2023). Classroom settings allow real-time interaction, fostering critical thinking and communication skills (Gherheș et al., 2021). Many educators aim to blend traditional teaching with technology-enhanced methods to create a balanced educational model that expands access to learning and improves engagement (Melo-Becerra et al., 2023).

Enhancing access to higher education is a worldwide concern driven by multiple contributing factors such as population growth, workforce retraining, gender equality, and the demand for specialized programs (Laurillard et al., 2015). Technology-assisted education has proven effective in addressing these challenges by enabling flexible educational opportunities for learners who may not have the time or resources to attend on-campus programs (Allen et al., 2016).

The COVID-19 pandemic sped up the adoption of online education. With widespread school closures, institutions were compelled to transition to online learning to ensure academic continuity (Cathy, 2020). This shift underscored the need to improve digital literacy among students and teachers and demonstrated the viability of blended learning models beyond the pandemic period.

Blended learning has proven to be a resilient and adaptable educational model, allowing learning to continue despite disruptions. Many institutions have incorporated blended learning as a core teaching strategy (Glazer, 2023). Furthermore, blended learning supports collaborative learning communities, such as Communities of Practice (CoP) and Communities of Inquiry (CoI), which facilitate knowledge sharing and peer engagement (Garrison et al., 2023). These communities enhance collaboration, cognitive development, and social interaction, making learning more meaningful (Suharno et al., 2023).

Blended learning represents a shift from one-size-fits-all instruction to a more personalized, interactive approach that accommodates diverse learning styles and preferences (Brenya, 2023). It combines traditional in-person teaching with digital tools, creating an engaging and self-paced learning environment (Essa, 2023). While maintaining essential face-to-face interactions, blended learning leverages multimedia, online collaboration, and extensive digital resources to enhance the educational experience.

Like any educational model, blended learning has challenges, including technical difficulties, digital access disparities, time management issues, overwhelming learning choices, and varying quality of online content (Alotaibi & Alshehri, 2023). Technical problems such as unreliable internet connectivity can disrupt learning, and unequal access to digital devices remains a concern (Alenezi & Akour, 2023). Managing both in-person and online components requires effective time management skills for students and instructors. Moreover, ensuring high-quality online content is essential for effective learning outcomes.

Despite these challenges, studies have revealed that blended learning's advantages outweigh its drawbacks. It provides flexible learning opportunities, expands access to education, and accommodates different learning needs (Ascencio, 2023). By combining traditional and technology-enhanced methods, institutions can create a more inclusive and engaging learning environment that fosters success in the digital era (Aithal, 2023).

1.1.Statement of the Problem

Despite the adoption of the blended learning model in higher education institutions in Rwanda to enhance accessibility, there is a lack of empirical research assessing its actual impact on expanding learning opportunities for students facing barriers such as cost, distance, and time constraints. While the Rwandan government has made significant efforts to improve education and technology infrastructure (MINEDUC, 2020), it remains unclear whether blended learning effectively addresses the challenges of higher education accessibility in the country. This research gap necessitates an investigation into the extent to which blended learning contributes to expanding access to higher education in Rwanda.

Traditional face-to-face education has long been said to have some limitations in providing easy access to education, especially to people with busy schedule in terms of personal, social or business responsibilities assigned to them Staff (2020). Thanks to the technology advancement, internet has provided a lot of opportunities that can help people to access education they need from anyplace at any time (Naseer & Zahida, 2023). By considering the benefits of both traditional face-to-face and online educational methods, a number of higher education institutions have decided to mix both online and in-person educational approaches to expand access to education and improve educational outcomes. It is in this regard that the blended learning, a model combining traditional classroom instruction with online components, has garnered attention for its potential to improve access to education (Ascencio, 2023).

Access to higher education has historically been limited in Rwanda, particularly before 1994 when only one public institution existed. This higher learning institution only offered in-person learning that resulted in only 2,000 graduates over three decades. Since then, Rwanda has expanded to 40 higher education institutions, and the enrolment percentage has moved from 3 to 10.4% in higher educational institutions in Rwanda (HEC, 2020). However, barriers such as financial constraints, geographic inaccessibility, and inflexible schedules continue to hinder

student enrollment (Nieuwoudt & Pedler, 2023; McNamee & Ganss, 2023). The cost of higher education, including tuition fees, transportation, and living expenses, remains a major obstacle for many prospective students. In addition, students in rural or underserved areas struggle with the lack of nearby higher education institutions, which makes it difficult to access traditional in-person learning opportunities. Fixed class schedules further exacerbate accessibility issues for students who must balance education with work or family responsibilities (Kebritchi & McCaslin, 2023). Addressing these challenges requires an innovative educational model that provides flexibility and ensures equitable access to learning opportunities.

Blended learning has been implemented in various higher education institutions in Rwanda to offer a more adaptable and inclusive learning model (Ascencio, 2023). This approach is believed to extend educational opportunities to a wider and more diverse audience, particularly those in remote regions or with restricted access to traditional institutions. Studies have highlighted the potential benefits of blended learning, including flexible learning environments, customized learning paths, lifelong learning opportunities, and the development of digital literacy skills (Essa, 2023; Raes et al., 2020). By enabling students to access educational materials at their convenience, blended learning can accommodate different learning styles and personal circumstances. Furthermore, blended learning fosters interactive and engaging learning experiences through the integration of digital tools and resources, potentially improving knowledge retention and student engagement.

The Rwandan government has prioritized education and technology integration through different initiatives such as the National Strategy for Transformation (NST1) and the Smart Classroom project (MINEDUC, 2022). These efforts aim to enhance digital literacy and create an environment conducive to technology-based education. In this regard, the Rwandan government has demonstrated a firm dedication to broadening access to education across all levels. In this regard, the National Strategy for Transformation (NST1) prioritizes education

and emphasizes the integration of technology into learning (MINEDUC, 2022). It is in this context that Rwanda has made significant efforts in improving its technology infrastructure and connectivity (Laterite, 2023). The government's efforts, such as the deployment of high-speed internet and the "Smart Classroom" initiative, have aimed to enhance digital literacy and create a conducive environment that can facilitate the adoption of technology-based educational approaches (MINEDUC, 2023).

The COVID-19 pandemic highlighted the significance of digital learning solutions by hastening the global adoption of blended learning models, including in Rwanda. During the pandemic, higher education institutions rapidly transitioned to online platforms to ensure continuity of learning (Ngabonzima et al., 2020). In simple terms, the COVID-19 pandemic transformed the education sector on a global scale, leading to a reassessment of conventional educational frameworks and emphasizing the significance of resilience, flexibility, and inclusivity in providing high-quality education. Particularly in Rwanda, the government's commitment to leveraging technology in education, combined with partnerships and a supportive policy environment, lays a foundation for new educational approaches, like blended learning, to play a significant role in making education accessible through different flexible learning options (Rwanda Ministry of Education, 2021).

In Rwanda, blended learning has gained attention as a one of the potential solutions to higher education challenges. The integration of the blended learning model in educational programs is also in line with the government's efforts to improve education and technology infrastructure. The Rwandan government has demonstrated a firm dedication to broadening access to education across all levels. In this regard, the National Strategy for Transformation (NST1) prioritizes education and emphasizes the integration of technology into learning (MINEDUC, 2022). It is in this context that Rwanda has made significant efforts in improving its technology infrastructure and connectivity (Laterite, 2023). The government's efforts, such

as the deployment of high-speed internet and the "Smart Classroom" initiative, have aimed to enhance digital literacy and create a conducive environment that can facilitate the adoption of technology-based educational approaches (MINEDUC, 2023).

In brief, while blended learning presents significant opportunities to improve access to higher education in Rwanda, its actual impact remains uncertain. The model has the potential to address key barriers such as financial constraints, geographic limitations, and rigid scheduling, but challenges related to infrastructure, digital literacy, student engagement, and institutional readiness must be addressed. Given the substantial investments in education technology and government initiatives supporting blended learning, it is essential to conduct comprehensive research to investigate its impact on the accessibility of higher education. This study seeks to address this research gap by exploring the impact of blended learning on access to higher education in Rwanda, with the goal of offering data-driven recommendations for policymakers, institutions, and educators to enhance its implementation and maximize its benefits.

1.2.Purpose of the Study, Research Aims and Objectives

1.2.1. Purpose of the Study

The main purpose of this mixed-methods research was to investigate the impact of the blended learning model on the access to higher education. The study intended to investigate if this innovative teaching and learning model helps different institutions of higher education to address key challenges connected to the expansion of access to education such as students and faculty attitudes towards the model, cost-effectiveness, inflexible schedule, enrollment rates, etc . Expanding access to education holds significant importance for social mobility and human capital, as it enables a larger number of individuals to realize their full potential, ultimately benefiting both themselves and society at large (Mocca et al., 2019).

Limited access to higher education constitutes a significant challenge that many individuals, particularly those from distant areas, those who have different life responsibilities to bear, or those from underprivileged backgrounds, face when seeking to pursue their tertiary studies (Mulder et al., 2023). Limited access to higher education may be due to different factors that limit opportunities for individual and societal advancement. Those factors include financial obstacles, geographical barriers, admission requirement and information deficiency (Lee & Pirog, 2023). This implies that the substantial expenses related to tuition fees, textbooks, travel and living costs can discourage many potential students to join high education institutions. Similarly, scarcity of higher education institutions, stringent admission criteria and , particularly, a lack of information about available educational opportunities can dissuade potential students from pursuing higher education as well (Lee & Pirog, 2023).

Some scholars such as Anderson (2023) reported that limited access to education may result from the educational methods used in a certain educational system. The traditional face-to-face educational methods have been said not to fully consider aspects associated with the advancements in technology, globalization, personalized learning, accessibility, cost-efficiency, innovation in teaching, flexibility and convenience to respond to the current needs of students (Anderson, 2023). These aspects have led to the move from traditional to modern educational methods to effectively respond to changing societal, technological and educational demands (Zinchenko et al., 2023). The shift from traditional to modern educational methods is perceived as an ongoing process that seeks to better meet the evolving needs of students and the demands of a rapidly changing world (Adedoyin & Soykan, 2023). As both traditional and modern methods have their strengths and weaknesses, many educational institutions decided to employ a blend of both face-to-face and online approaches to provide good educational experience to all learners . In other words, the educational model needed in today's society is

the model that extends access to education in order to expand student's success and contribute to the ongoing evolution of educational practices.

Hence, the study intended to investigate if the blended learning model can be used as a tool to extend access to high education for a wide range of learners, with the case study of the higher education institutions in Rwanda. It intended to provide significant insights and information that can inform educational practices, influence policy development and decision-making in making the right decision about the most effective and efficient model that can help expand learning opportunities to many students in higher education.

1.2.2. Research Aim and Objectives

The study aim was to investigate the impact of the blended learning model on the access to higher education in Rwanda. Specifically, the study intended to:

- investigate both university students and teachers' perceptions of the blended learning model in their academic activities,
- analyze the students' enrolment status in higher education in Rwanda before and after using the blended learning model,
- critically analyze advantages of the blended learning model in higher education system in Rwanda,
- evaluate the challenges faced in the implementation of the blended learning model in higher education institutions in Rwanda,

1.3. Nature and Significance of the Study

1.3.1. Nature of the Study

The nature of a study can vary widely depending on its main goal, objectives, methodologies, and scope (McDermott, 2023). Due to its mixed-methods nature, this research

used both qualitative and quantitative approaches for deep analysis and understanding of the research findings (Harris, 2021).

Due to the research goal of investigating the impact of the blended learning model on the access to higher education in Rwanda, the proposed tools for data collection in this study include online questionnaire and face-to-face interviews that were conducted concurrently. The online questionnaire and face-to-face interviews were conducted concurrently as they were designed for different respondents. This also helped in triangulating the data, thereby strengthening the validity of the research findings. In this regard, 200 online questionnaires were distributed to students and lecturers from the higher educational institutions selected for this study, while a 10-15 minute face-to-face interviews were organized for 20 staff including 1 academic registrar and 1 IT senior staff from each of the selected higher educational institutions.

The target participants in this study mainly included university students, lecturers, academic registrars, and IT senior staff from 10 higher educational institutions having the blended learning model in their academic programs. Only the participants above 18 years old were considered in this study as they could provide informed consent for themselves.

Due to its mixed-methods nature, data was gathered through online surveys for students and lecturers, face-to-face interviews for both academic registrars and IT senior staff along with data from document check. Data presentation and analysis used statistical methods like Chi-square and ANOVA tests for quantitative data, while qualitative data underwent thematic analysis.

Throughout the data collection and analysis process, research ethics was ensured. As stated by Knottnerus & Tugwell (2018), integrity and ethics play a significant role, and they must be ensured in all phases of research. In conformity with ethical consideration, the

researcher clarified the research purpose to the participants in order to help them to freely take a decision to take part in the study or not. A consent for voluntary participation was also obtained from the participants before the start of the study. To keep the participants' privacy and anonymity in data collection process, an online questionnaire was prepared with a consent option for voluntary participation in the research or an option to leave the questionnaire if they don't want to consent.

1.3.2. Significance of the study

Traditional face-to-face education has long been said to have some limitations in providing easy access to education, especially to people with busy schedule of other responsibilities assigned to them (Staff, 2020). It has been accused of not responding to the students' current learning needs because it does not allow flexibility in terms of time and distance. This can create a challenge to students who may need to improve their education without necessarily being in school settings. Thanks to technology advancements, internet has provided a lot of opportunities that can help people have a flexible plan to follow their studies without necessarily being physically on campus (Laurillard, et al., 2015).

Due to its importance, the blended learning model is believed to bridge the gaps in educational access and to address educational inequities as it provides equal educational opportunities to students who can or cannot be able to attend in-person classes (Dumont & Ready, 2023). To contribute to more educated and skilled people, the blended learning model has been proved to have the capacity to broaden the horizons of educational possibilities for a more diverse range of students, such as those residing in remote or underserved regions, adult learners and learners with unique learning requirements (Lucas & Vicente, 2023). In addition, as blended learning requires some innovative skills connected to digital literacy, the model can enhance training and professional development required for educators and students to advance

teaching and learning practices and effective resource allocation in educational institutions (Wang et al., 2023).

Expanding access to higher education is of paramount importance for educational institutions. Access expansion to higher education refers to the efforts and strategies aimed at making educational opportunities available to a more diverse and inclusive population of students (Young, & Khalfani, 2023). According to Suhonen (2023), this initiative involves reducing barriers, improving affordability, and enhancing educational opportunities for individuals who may have traditionally faced limitations in pursuing higher education with the aim to provide a broader segment of society with the chance to acquire advanced knowledge and skills, thereby promoting social equity, economic development, and personal growth. In other words, it helps educational institutions to promote knowledge and skills of students from diverse backgrounds, promote social and economic equity, foster innovation, and enhancing the overall well-being of society and the educational institutions themselves.

Some scholars perceive various factors of limited access to higher education as the outcome of traditional face-to-face educational methods which have been the primary mode of education for centuries. In this respect, Aiello (2023) states that common limited access issues associated with the traditional in-person education methods depend on the nature of the instructional methods applied to an educational system. Common characteristics of traditional face-to-face educational methods include inflexibility in class schedule, high cost of education and imbalance between family and work responsibilities (Imran et al., 2023). These are the factors contributing to limited access, which eventually lead to low enrolment in higher education institutions.

As the main goal of the study was to investigate the impact of the blended learning model on the access to higher education in Rwanda, the study findings are expected to inform the community and the academic world about the benefits of blended learning, and if it can

contribute to access enhancement. In other words, the study findings would help people know the blended learning model can expand access to education without conflicting with people's busy schedule in terms of personal, social or business responsibilities assigned to them. Similarly, this would, for example, help people who want to advance their education while working full-time and managing family and other responsibilities. This would help them to make the right choice of the educational institutions that can facilitate them to further their studies without conflicting with their busy schedule.

The research findings are also expected to provide university students, lecturers, leaders and owners, decision and policy-makers with a clear picture of the appropriate model for education that can respond to the needs of the society today. In this regard, the findings can serve as an input to healthy policy and sound decision-making in terms of responding to educational needs of people and addressing different challenges associated with the expansion of access to education. Deep understanding of education from online perspective would generally help the community and academic world to have various options that can make education continue even in difficult moments, like in COVID 19 pandemic period.

While high student's enrolment in higher education brings numerous benefits, the research findings would additionally inform people in the field of education and beyond about how the blended learning model can transform education by increasing access for diverse learners in higher education institutions in Rwanda and beyond. In other words, by assessing the study population attitudes of the blended learning model, the prospective advantages and obstacles of the model in higher education and current students' enrolment in different higher education institutions, the research findings would inform education stakeholders about the right educational model that can enhance accessibility to higher education.

In the context of Rwanda, the findings of the study on the impact of blended learning on access to higher education would contribute to the existing literature in several significant ways. First, it would expand empirical evidence regarding the effectiveness of blended learning in improving access to higher education. Next, the study findings would specifically highlight challenges and barriers that students can face in accessing higher education through blended learning. This can provide a deep understanding of these issues and suggest areas for improvement. The study would also highlight best practices and recommendations for implementing blended learning effectively, offering actionable insights for educators, administrators, and policymakers.

In addition, the findings may inform policy discussions by providing evidence-based recommendations for enhancing access to higher education through blended learning initiatives, influencing educational policy at various levels. As blended learning requires the incorporation of technology into existing educational practices, the study findings can also contribute to understanding how technological innovations impact educational access and effectiveness.

Overall, this study would enrich the existing literature by filling knowledge gaps, providing new perspectives, and offering actionable insights that can drive future research, policy development, and practical implementations in the context of blended learning and higher education access in general, and in Rwanda in particular.

1.4. Research Questions and Hypotheses

Research Questions

Kraus, Mahto & Walsh (2023) state that well-formulated research questions are the foundation of a research study as they provide direction, clarity and structure that guide the entire research

process from its inception to its conclusion. This study was carried out with the intention to answer the following 4 questions:

RQ1

How do both students and teachers perceive the blended learning model in various higher educational institutions in Rwanda?

RQ2

What advantages do higher educational institutions gain from the blended learning model in Rwanda?

RQ3

How is the students' enrolment status in higher educational institutions in Rwanda before and after using the blended learning model?

RQ4

What are the key challenges faced in the implementation of the blended learning model in Rwanda?

Hypotheses

As stated by Saunders et al. (2019), a well-defined research approach and philosophy contribute to designing a coherent research project with effective methods of data collection and interpretation. Research hypotheses are essential in this process as they offer guidance and direction, clarity, and testable propositions that guide the collection, analysis, and interpretation of data (Mertens & Recker, 2023). Hypothesis testing is fundamental in determining the significance of research findings and assessing the strength of evidence supporting a particular research question (Corotto, 2022).

To investigate the impact of blended learning on access to higher education in Rwanda, the following hypotheses were formulated based on the study's research questions:

H1: Students and teachers have a generally positive perception of the blended learning model in higher education institutions in Rwanda.

H2: The blended learning model provides higher education institutions in Rwanda with different advantages.

H3: The implementation of the blended learning model has led to a significant increase in student enrollment in higher education institutions in Rwanda.

H4: The implementation of the blended learning model in Rwanda faces various challenges.

CHAPTER 2: LITERATURE

2.1.Introduction

The objective of this chapter is to examine the research and academic literature pertaining to blended learning and its impact on higher education accessibility. The chapter offers a more in-depth insight into the the existing research relevant to blended leaning and its impact on the access to higher education. It starts with the descriptions of the most relevant theories and the conceptual frameworks referred to in the study. The section on theoretical frameworks describes how the selected theories are in relation with the present study and the framework used in the development of the research questions. It also discusses different scholarly research sources related to the concept of blended learning and access to higher education as the study variables. Based on the study purpose and objectives, the literature review evaluates research findings on the following main topics related to the study variables: An Overview of Education System in Rwanda, 21st century teaching and learning in higher education, Access to higher education in Rwanda, Types of pedagogical approaches in higher education, Blended Learning in higher education, Impact of the Blended Learning model on the access to higher education, and Institutional challenges in the implementation of blended learning. Regarding the sources discussed, this chapter discusses relevant literature from current sources such as books, journals, reports, current peer-reviewed literature, and relevant online sources. The research through the above-mentioned topics was guided by the 2 key concepts related to the study variables, namely blended learning and access to education.

2.2.Theoretical Framework

The goal of this mixed-methods study is to investigate the impact of the blended learning model on the access to higher education in Rwanda. The study intends to investigate if this innovative teaching and learning model is addressing many of the key challenges faced by many higher education institutions including expansion of access to education. The study is

conducted in 10 selected higher education institutions in Rwanda having the blended learning model in their academic programs. The literature review in this chapter consists of a critical analysis and synthesis of the research conducted on the blended learning model and access to education as the study variables.

2.3.Theories Related to the Study

Looking at the study key concepts, this study is centered on *Constructivism Learning Theory, Connectivism Learning Theory, Humanism Learning Theory, Technology Acceptancy Model Theory, and Diffusion of Innovation Theory*.

2.3.1. Constructivism Learning Theory

As a theory of knowledge, learning and instruction, constructivism theory has been one of the major theoretical influences in contemporary education (Klaveren et.al, 2020). An underlying assumption of constructivists is that learning should not be an active process of acquiring knowledge, rather it should be an active process of constructing it. This implies that student-centered instructional strategies should be adopted to ensure that learners are active participants in their learning process. In this process, the instruction comes to support the construction rather than communication of that knowledge (Saunders et al., 2019). This assumption implies that students can only become knowledge makers when they are given the right task, guidance and enough time to accomplish it. In other words, Constructivism, as a theory of learning, suggests that learners engage in actively developing their own understanding and knowledge of the world by engaging with and reflecting on their experiences.

As a learning theory, Constructivism adheres to principles that highlight the active involvement of learners in constructing their understanding and knowledge of the world. It suggests that individuals actively build their knowledge by encountering and processing new

information and experiences based on their existing mental models or schemas (Dinata et al., 2023). In educational settings, applying constructivist principles involves creating learning environments that encourage exploration, interaction, critical thinking, and problem-solving. Activities might include discussions, projects, experiments, case studies, and hands-on experiences, fostering an active and engaged approach to learning (Qureshi et al., 2023).

The constructivist principles are in line with the goal of blended learning since it gives students time to think and make reflection on the actual world problems, and the opportunity to learn how to solve those problems (Olusegun, 2020). With this regard, his theory provides important perspectives on how learners interact with and gain from a combination of traditional face-to-face teaching and online learning as the combination of both components facilitate active engagement, collaboration and social learning, self-paced learning, reflection and application of knowledge (Gerberry, 2023).

From the students' standpoint, Constructivism theory underlies the key role played by student involvement and engagement in the classroom. In this regard, White (2019) stipulates that the blended learning model gives students enough time to actively engage in their learning at individual pace with the facilitation of a teacher. Unlike in the traditional classroom, students in the constructivist classroom learn how to learn and they are engaged in solving real-world problems with the support of a teacher who intervenes as a facilitator in this process (Narayan et.al, 2018). In traditional teaching approaches, the role of teachers is to impart knowledge, and the learners become recipient of the knowledge from the teacher. From a constructivist viewpoint, students are expected to actively engage in their learning process, while teachers assume the role of facilitators in guiding and supporting this process. These principles are reflected in blended learning approaches as they allow for various modes of learning, encouraging active participation from students through face-to-face interactions and online

activities, which leads to active involvement in the learning material, facilitates the construction of meaning, and contributes to the creation of understanding (Khushk et al., 2023).

As Constructivist Learning Theory supports a diversity of educational learner-centered approaches, it helps students to create new experience-based knowledge, which leads to better educational outcomes (Saunders et al., 2019). Hence, the blended learning model embraces the principles of Constructivism theory in the teaching and learning process where it enables both working and regular students to promote knowledge construction and collaborative learning skills through ICT support tools (Lindqvist & Forsberg, 2023). It enhances collaborative learning and the social construction of knowledge with the aim to enable students to collaborate, discuss, and share ideas beyond the confines of the classroom through discussion forums, group projects with the facilitation of online tools (Khalil et al., 2023).

Brief, through the application of Constructivism in blended learning, educators have the opportunity to create a learning setting that encourages active participation, collaboration, personalized learning experiences, and critical thinking (Harvey-Burks, 2023). Further, the theory guides the incorporation of in-person and digital components in a manner that stimulates learners to actively construct their knowledge (Perez et al., 2023), which results in a more impactful and engaging learning experience.

2.3.2. Connectivism Learning Theory

The technological rise of the 21st-century and widespread integration of those technologies into education are in line with Connectivism theory. Connectivism is a learning theory that focuses on how learning occurs in the digital era, by emphasizing the role of technology, networks, and connections in the learning process (Mampota et al., 2023). This theory insists on the point that people's learning and growth are associated with the connections they create in their lives (Dziubaniuk et al., 2023). It considers the skills related to information

navigation and critical evaluation as the back born of effective learning. With this respect, it highlights the importance of knowing how to find, evaluate, and use information effectively rather than storing vast amounts of information internally (Kilag et al., 2023). Connectivism theory can be applied to blended learning environment to help students make connections with the exciting and helpful things that can help them learn effectively (Kop & Hill, 2020). In learning, students are expected to create connections with their peers through collaborative learning activities; which helps them feel motivated about learning.

This theory is in connection with the blended learning model as it helps students learn through in-person and online modalities with the help of technology. This helps students create connections and relationships with their peers for self-motivation about learning. As technology significantly contributes to the blended learning implementation, the application of Connectivism Learning Theory would solve various learning problems connected to feelings of loneliness, confusion and low motivation. It would create an opportunity to improve collaborative learning and enhance teacher-student and student-student connection and interaction (Öberg et al, 2019). As a learning theory, Connectivism stipulates that students can make choices about their learning only when they can combine thoughts, theories, and general information with the help of technology (Downes, 2021). In this regard, it promotes learning through sources out of individual such as social media, online networks, blogs, or information databases. This learning system also contributes to collaborative learning, problem-solving, and effective analysis and interpretation of information (Downes, 2021).

Connectivism, as a learning theory, aligns closely with blended learning in several ways. As Connectivism highlights the significance of networks in learning, blended learning approaches also emphasize on students' engagement with diverse resources and platforms by forming a networked learning environment that includes both traditional classroom settings and online resources (Bakhshi Khilgavani et al., 2023). This mirrors the connectivism idea of

tapping into networks for knowledge acquisition. In addition, as blended learning heavily relies on digital resources and technology integration, Connectivism also acknowledges technology's role in facilitating learning via the utilization of online platforms, multimedia materials, and collaborative instruments. Similarly, the importance of social learning and collaboration is reflected in both connectivism and blended learning principles which encourage collaboration through online discussions, group projects, and peer interactions, by fostering the exchange of ideas and knowledge-sharing among learners (Chen & Xu, 2022).

In practice, connectivism encourages learners to develop skills in navigating information networks, critically evaluating online resources, participating in online communities, and leveraging technology to access and contribute to knowledge networks (Mampota et al., 2023). It further acknowledges the importance of staying updated with evolving information sources and adapting to the changing landscape of knowledge (Maxwell, 2023). In simple words, Connectivism aligns with the idea that learning in the digital age involves leveraging connections, networks, and technology to foster continuous learning and adaptability. Hence, applying blended learning strategies implies leveraging connectivism principles by designing learning experiences that encourage students to navigate networks of information, critically evaluate online resources, collaborate within digital communities, and develop skills for continuous learning and adaptability in an interconnected world (Peter, 2023).

2.3.3. Humanism Learning Theory

Generally, the motivation of human actions is associated with the achievements of certain needs (Huitt, 2021). Humanism Learning Theory directly puts emphasis on the self-actualization, the top element of the hierarchy of needs suggested by Abraham Maslow (Cherry, 2021). As a learning theory, Humanism focuses on the individual's innate potential for growth, self-fulfillment, and personal development. It emphasizes the learner's autonomy,

feelings, experiences, and personal agency in the learning process (Elfert, 2023). Humanism promotes the idea of self-actualization, where individuals strive to achieve their full potential and personal growth.

From a humanistic perspective, Education aims to facilitate this development by nurturing students' interests, passions, and talents. Humanistic views support that this goal can only be achieved if education advocates for a positive and supportive learning environment that encourages open communication, trust, and respect between educators and learners (Leach, 2022). Such an environment leads to intrinsic motivation and independent learning, and fosters a feeling of inclusion and ownership, and it encourages students to pursue learning out of curiosity, interest, and a desire for personal fulfilment rather than external rewards or pressures (Al-Obaydi, 2023).

In educational context, this theory can stipulate the reasons why students can choose to pursue their studies. One of the possible reasons is that they want to maximize the satisfaction of their needs up to the level of self-actualization. This can only be possible when the learning and teaching models adopted by different educational institutions help students to fulfill their emotional and physical needs (Drew, 2021) by considering personalized and flexible time frames (Cherry, 2021).

This theory is related to the blended learning model as it consists of a natural human development by providing an open accessibility to learning opportunities (Gandhi & Mukherji, 2023) that facilitate individualized learning and easy access to the online learning resources with the support of face-to-face instruction (Muhajirah, 2020). In the blended learning model, this works very well with working students who want to upgrade their level of education for different reasons including job promotion and retention at their work places. In the context of education, Humanism theory aligns with blended learning by emphasizing learner autonomy, personalized learning experiences, and holistic development. Similarly, blended learning

environments can integrate humanistic principles by offering diverse resources, personalized learning paths, opportunities for self-expression, collaborative projects, and supportive interactions between educators and students (Leach, 2022). By embracing humanistic principles within a blended learning framework, environments that nurture students' individuality, motivations, and holistic growth can be easily created (Al-Obaydi, 2023).

2.3.4 Technology Acceptancy Model Theory

As technology continues to advance and becomes increasingly integrated into both personal and professional spheres, the decision whether to embrace or decline it remains an ongoing query. Extensive research on the Technology Acceptance Model (TAM) spanning over a quarter of a century since its inception indicates its widespread recognition within the realm of technology acceptance (El Archi & Benbba, 2023). Initially rooted in the psychological theories of reasoned action and planned behavior, TAM has progressed to become a fundamental framework for comprehending the factors that impact human behavior concerning the potential acceptance or rejection of technology (Mahmood et al., 2023).

Fred Davis introduced the Technology Acceptance Model (TAM) in his paper "A Technology Acceptance Model for Empirically Testing New End-User Information Systems." published in 1986. In the early 2000s, Venkatesh and Davis proposed an extended version known as TAM2, which incorporated cognitive instrumental processes and social influence processes more comprehensively (Jnr & Petersen, 2023). The model aimed to explain and predict how users come adopt and utilize technology, specifically focusing on information systems. The foundational concepts of TAM revolve around users' perceptions and attitudes toward adopting new technologies (Ohanu et al., 2023).

As TAM Explains individuals' acceptance and use of technology, in the context of blended learning, TAM can elucidate the elements affecting students and teachers' willingness

to adopt and engage with the online components of the blended learning model which consists of the technology-based tools and platforms. In the context of blended learning, Huang et al. (2023b) argue that the TAM model can be evaluated in terms of perceived usefulness. In this regard, students and teachers assess whether the integration of online tools and resources alongside traditional face-to-face instruction is beneficial for their teaching and learning. They might consider if the online components can or cannot help them understand concepts better, access additional resources, or provide flexibility in their learning process for acceptance or rejection (Rejali, et al., 2023).

El Archi & Benbba (2023) stipulate that the acceptance or refusal may also be influenced by the perceived simplicity of use. According to the same author, students evaluate the ease with which they can navigate and utilize the technological tools incorporated into the blended learning environment. This includes considerations about the user interface, accessibility of materials, and the overall usability of online platforms (Zin et al., 2023). In addition, the perceived simplicity of use is aligned with the attitude towards its use. In this aspect, Granić (2023) asserts that students' attitudes toward blended learning technology play a crucial role in their acceptance and engagement. Favorable attitudes, fueled by perceived usefulness and ease of use, can result in increased acceptance and active participation in the blended learning process. On the same point, behavioral intention of users to use technology also can influence the decision to accept or reject it. With respect to this, it is suggested that a user's intention to utilize technology is a strong predictor of actual use (Nnaji et al., 2023). In the context of blended learning, it is supported that students' willingness to engage with online components, to engage in online discussions and to complete assignments is affected by individuals' intention to use these tools, which is determined by their view of its usefulness and simplicity (Mantello, et al., 2023).

Briefly, applying TAM to blended learning contributes to the identification and understanding of the factors that drive or inhibit students' acceptance and utilization of technology within the blended learning environment. By addressing issues related to perceived usefulness, ease of use, and attitudes toward technology, educational institutions can have the chance to enhance access to higher education opportunities and better cater for student needs by improving the design and execution of blended learning strategies.

2.3.5 Diffusion of Innovation Theory

The historical roots of the Diffusion of Innovation Theory trace back to Gabriel Tarde, a French sociologist in 1903, who initially outlined the original S-shaped diffusion curve. Later, Ryan and Gross (1943) introduced the adopter categories, a concept integral to the present theory popularized by Everett Rogers. Essentially, this theory describes the process by which individuals embrace new ideas, products, practices, or philosophies. Rogers delineated this progression, highlighting that initially, a select few adopt and advocate for the new concept. As these early adopters propagate its merits, more individuals become receptive, leading to a critical mass. Eventually, the innovative concept permeates the wider population until reaching a saturation point. Moreover, the theory underscores the significance of communication and peer connections in this adoption journey. In other words, the Diffusion of Innovation Theory explores how new ideas and innovations are adopted within a society or group (Yarbrough, 2023).

Applied to blended learning, the Diffusion of Innovation Theory offers valuable insights into how innovations, including educational methodologies like blended learning, are adopted and spread within a society or among groups (Acikgoz, Elwalda, & De Oliveira, 2023). Connected to blended learning, this theory helps to understand how the concept and practice of combining traditional in-person teaching with online learning components are accepted and integrated into educational settings. From the blended learning stand point, the theory can be

understood in terms of what Takahashi et al. (2023) called Innovators and Early Adopters. In their views, these concepts are described as individuals or institutions among educators who first experiment with and embrace blended learning trying new methods and technologies in education, often serving as pioneers in implementing and showcasing the benefits of blended learning.

As per Chauhan et al. (2023), the theory can also be understood in terms of Early Majority and Late Majority. In their understanding, the early and late majorities represent the bulk of educators who gradually integrate blended learning into their teaching practices. In connection to this, since blended learning proves its effectiveness and gains credibility through success stories and evidence of improved learning outcomes, a larger group of educators hence starts adopting these methods (Uzumcu & Acilmis, 2023). Diffusion of Innovation Theory is also believed to emphasizes the role of communication channels in spreading knowledge and information about the innovation. Pertaining to this, success stories, workshops, conferences, and peer discussions are of paramount importance in disseminating information about the benefits and practices of blended learning (Holman & Perreault, 2023).

As commented by Pearson et al. (2023), understanding the Diffusion of Innovation Theory in the context of blended learning helps educational institutions and policymakers develop strategies to enhance the integration and effective adoption of blended learning. It also illuminates the difficulties and obstacles that educators could encounter when introducing this innovation and how to overcome resistance to change, and it can help to clarify the factors that support or hinder the broad embrance of blended learning models across diverse educational settings (Alhammadi et al., 2023).

In summary, the above discussed theories align closely with the blended learning principles and approaches in several ways. As Constructivism theory focuses on student's active learning (Dinata et al., 2023), Connectivism theory on collaborative learning with the

help of technology (Dziubaniuk et al., 2023), Humanism Learning Theory on the satisfaction of human needs (Elfert, 2023), Technology Acceptance Model (TAM) on insights into the adoption and utilization of technology in learning (Mahmood et al., 2023), and the Diffusion of Innovation Theory focuses on the insights into how innovations are adopted and spread within a society or among groups (Yarbrough, 2023), these theories complement blended learning by providing frameworks to understand how learners engage with technology, collaborate, construct knowledge, adapt to new methodologies, and benefit from personalized and networked learning experiences. Hence, incorporating elements from these theories into blended learning design can improve the efficacy and responsiveness of educational practices in diverse learning environments.

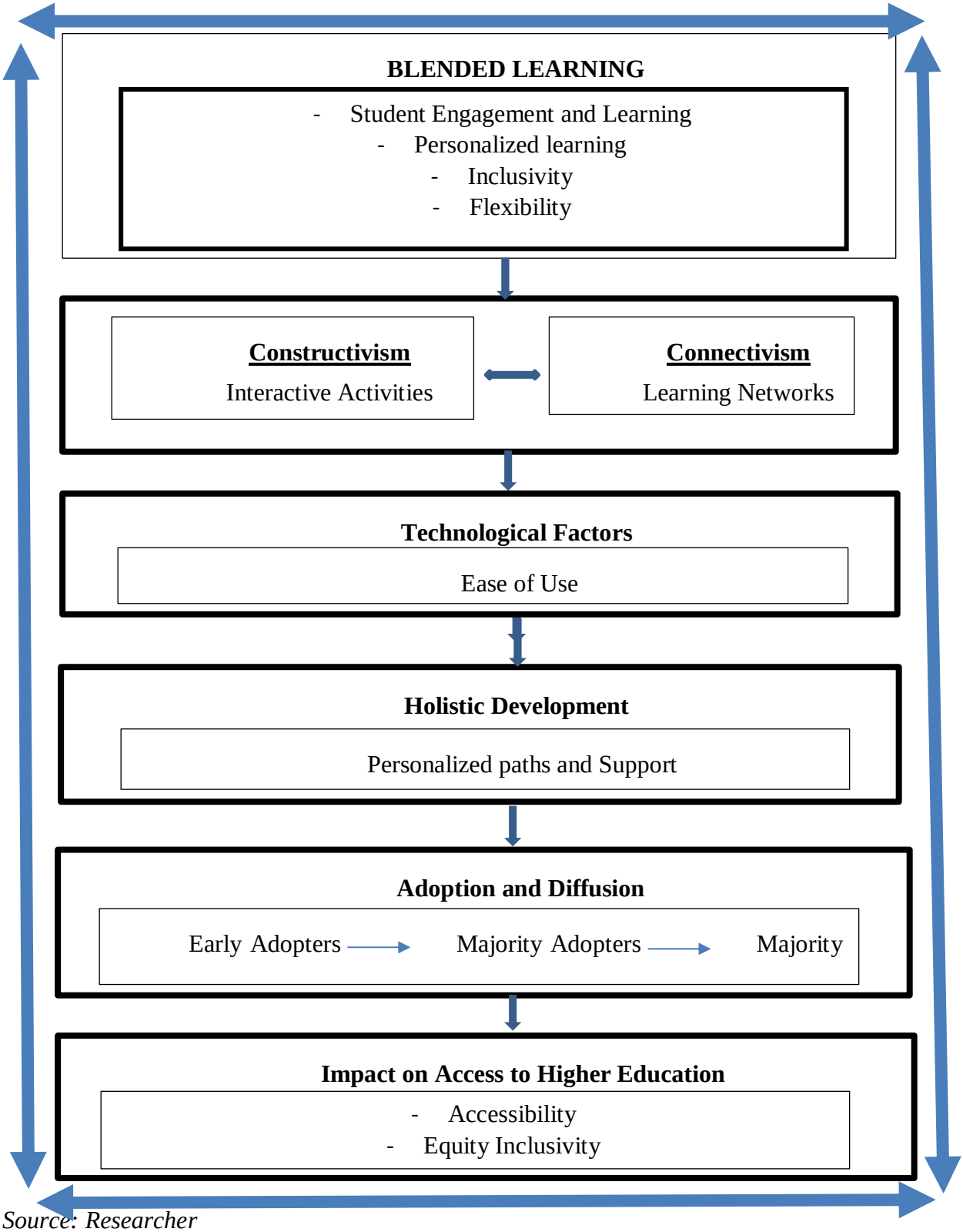
The theories of Constructivism, Connectivism, Technology Acceptance Model (TAM), Humanism, and Diffusion of Innovation collectively provide a robust framework for understanding the impact of blended learning on higher education in Rwanda. These theories are closely connected to the research questions as they offer insights into students' and teachers' perceptions, enrollment trends, institutional advantages, and implementation challenges. Constructivism emphasizes the importance of active, personalized learning, which helps explain positive perceptions of blended learning when it fosters engagement and deeper understanding (Saunders et al., 2019). Connectivism highlights the value of networks and digital resources, offering a perspective on how blended learning increases access and connectivity (Mampota et al., 2023), thereby influencing student engagement and enrollment. TAM illustrates how simplicity and value impact acceptance of blended learning correlates with positive perceptions and improved institutional outcomes (Ohanu et al., 2023). Humanism underscores the role of personalized learning and individual growth (Cherry, 2021), which resonates with perceptions that blended learning models support diverse student needs, thus improving retention and enrollment. Finally, Diffusion of Innovation theory sheds light on the

adoption process, suggesting that early adopters can influence the widespread acceptance of blended learning, despite challenges such as digital access and resistance from educators (Takahashi et al., 2023).

The literature reviewed supports these theoretical connections by highlighting that blended learning offers flexibility, enhances accessibility, and introduces challenges related to technology, infrastructure, and training, all of which are crucial for understanding its implementation and impact on higher education institutions. The consideration of the elements of these theories would significantly contribute to a higher number of students who may be inclined to pursue higher education. In the support of learning motivation, Chen & Yao (2020) stipulate that students prefer to pursue their studies when motivation, collaboration, satisfaction and good relationship are ensured. Hence, from the perspective of the theories discussed in this study, it is implied that any learning and teaching model that gives priority to student's motivation, collaboration, satisfaction connections and flexibility in terms of availability motivate students to develop willingness to pursue their studies; and this would therefore upgrade the enrolment rate in higher educational institutions using the blended learning model in their academic programs. This falls under the blended learning context as it offers flexible and individualized learning opportunities that take into consideration time and location constraints in students' learning process (Kurt, 2021).

Figure 1

Conceptual Framework: Diagram for Blended Learning



Source: Researcher

The diagrammatic representation provides a clear visual structure of the conceptual framework, showing how each theory contributes to understanding the impact of blended learning on access to higher education.

The conceptual framework chart illustrates that blended learning is the core concept that can enhance student's active participation and learning. Active participation and learning are facilitated through Constructivism and Connectivism perspectives, focusing on interactive activities (Qureshi et al., 2023) and building learning networks respectively (Mampota et al., 2023).

Engagement and learning are also influenced by technological factors, which are reflected in the Technology Acceptance Model (TAM). This model evaluates the simplicity and perceived value of blended learning tools (Rejali, et al., 2023). Students' engagement and learning are further influenced by holistic development, inspired by Humanism philosophy. Humanism supports personalized learning paths and provides additional support services within the blended learning model (Huitt, 2021).

Furthermore, the chart demonstrates how the adoption of innovations in society can influence student engagement and learning within the blended learning model. The adoption process involves early adopters, majority adopters, and laggards (Yarbrough, 2023). All these factors together contribute to the accessibility of higher education by ensuring equity and inclusivity for all students; which justifies the impact of blended learning on access to higher education.

2.4. Review of Literature

Access to higher education has experienced significant transformations connected to the adoption of new and innovative teaching and learning approaches (Imran et al., 2023). These changes include blended learning, an instructional technique that combines conventional

face-to-face teaching with online learning components (Castro, 2019). This shift has ignited extensive discussions in educational research about its implications for expanding accessibility to higher learning opportunities. Examining how blended learning impacts accessibility has emerged as a critical research focus, necessitating a comprehensive review of existing literature to unveil its multifaceted impact.

This comprehensive review intends to analyze a broad spectrum of scholarly publications, research articles, and academic inquiries currently published in the domain of blended learning and access to higher education. The investigation will extend across various academic disciplines within higher education, encompassing a range of geographic and socio-economic context. By synthesizing and critically evaluating the available literature, this review seeks to offer perspectives on the varied implications of blended learning on access to higher education, addressing both its promises and challenges.

2.4.1 Rwanda Education System

In Rwanda, the educational structure comprises four primary categories: Pre-primary, Primary, Secondary, and Higher Education (REB, 2022). There is a significant focus on Technical and Vocational Education and Training (TVET) at both secondary and higher education levels (MINEDUC, 2020). Pre-primary education is provided through nursery schools for three years and it is generally reserved for children aged 4 to 6. Primary education lasts six years, and it generally accommodates students between 7 and 12 years old. It focuses on foundational literacy and numeracy skills, and readiness for further studies in secondary education. (MINEDUC, 2020)

Regarding primary education enrolment, Rwanda was recognised as one of the standout nations in sub-Saharan Africa with 98 percent net registration rate (UNICEF, 2021). According to the 2021/22 Education Statistical Yearbook from the Ministry of Education (2022), 282,428

students were enrolled in pre-primary education, and 49.2 percent boys and 50.8 percent girls (MINEDUC, 2022).

Secondary Education also lasts six years, and it caters for students generally aged between 13 and 18. It comprises lower secondary (the initial three years) and upper secondary (the subsequent three years), and each level culminates in national exams that determine eligibility for university education. Public primary and lower secondary education are offered at no cost, with the first nine years being mandatory (REB, 2022).

Tertiary education in Rwanda is offered through public and private institutions spread across the country. These institutions are divided into research-based universities and technical polytechnics. According to Higher Education Council (HEC, 2023), research-based universities are 31 and technical polytechnics are 9. To oversee quality assurance and ensure the preparation of individuals who can contribute to Rwanda's economy and progress, regulatory bodies, like the Higher Education Council (HEC) for universities and WDA for polytechnics were established with a mandate of maintaining the standard of higher education provision in Rwanda (MINEDUC, 2022).

Private higher education institutions hold the majority of enrolments, accounting for 57%, whereas public higher education institutions make up 43% (HEC, 2022). Over the past decade, there has been a doubling in the overall student population, and the rate of enrollment in tertiary education has surged from 3% in 2005 to approximately 9.40% in 2022. Additionally, Rwanda's tertiary education landscape is largely dominated by private institutions totaling 37 out of 40 tertiary institutions in the country (MINEDUC, 2022).

2.4.1.1 Digitalization in Education in Rwanda

In Rwanda, the Government recognizes that the integration of ICT in education can open doors to different educational opportunities that can expand access to different academic

programs. That is why the Government of Rwanda and its stakeholders in education have consistently encouraged all higher education institutions to maximize the benefits of ICT in their academic programs. As ICT is an essential tool in education, Dr Callixte Kabera (2021), the president of the Private Universities' Association, stipulates that the transitioning from traditional in-person teaching to an online or blended model is the only way that can facilitate Rwanda's expansion of access to higher education. When talking to University World News, Dr Callixte Kabera (2021) emphasized on the ICT role in higher education, and stipulated that, in the long run, institutions that would invest in distance learning may survive and thrive, but others that leave technology behind would be adversely impacted.

The integration of technology in education requires interconnected elements that offer opportunities for maximizing the effectiveness of interventions if they are implemented effectively. Education technology encompasses the utilization of technology to create educational content that enhances teaching and learning for everyone, as well as utilizing technology educational services delivery and management (Rwanda ICT Chamber, 2020). According to the Mastercard Foundation (2023), there are key elements for successful educational technology implementation, and these elements consist of underlying enabling factors together with a chain of well-functioning components that interact with each other dynamically as part of a system (Mastercard Foundation, 2023). Both these enabling elements and well-functioning components are vital for the advancement and implementation of education technology. Figuratively speaking, the primary role of enabling elements is to establish an environment conducive to the development of education technology, while the well-functioning components are the ones that bring it into action. In more metaphorical terms, the enabling elements are like the body and its organs, whereas the well-functioning components would be considered as the nervous system (Chuang & Koomar, 2020).

As described in the Mastercard Foundation (2023) report, the enabling factors in education technology encompass governance, funding, human resources, digital literacy and skills, and costs. This implies that they don't only include the existence or accessibility of infrastructure and devices but also an inclusive policy and regulatory framework to unlock financial resources for innovation, alongside the necessary human capital and digital proficiency. Contrasted with these enabling factors, Gray-Lobe et al. (2022) elucidate that the well-operating components facilitate implementers in reaching the end-users. These components comprise infrastructure, hardware, a delivery method tailored to the purpose, high-quality educational material, and support systems assisting educators and learners in utilizing technology effectively in the classroom, particularly within a blended learning framework.

The Mastercard Foundation (2023) report indicates that Rwanda now possesses a more robust infrastructure to support education technology compared to a decade ago. The report highlights the growing enthusiasm among students and teachers to incorporate technology into education, and basic education schools and universities have also become more open to the utilization of technology, particularly in the post COVID-19 pandemic period. Notably, partners like NewGlobe, through the RwandaEQUIP program— The Government of Rwanda's transformative program aiming at making the country's education system globally competitive—offer comprehensive lesson guides to teachers via tablets and other technology-driven tools. This program's implementation demonstrates that educational technology employed for lesson planning can significantly save teachers' time by allowing them to focus more on their students. This case serves as an intriguing example wherein technology doesn't replace individuals in the education domaine but rather to boost their teaching practices and learners to improve their learning experiences.

Various scholars, such as Hennessy et al. (2021), observe that incorporating technology into education offers greater flexibility compared to traditional learning methods by allowing

personalized content for individual users. For instance, technology serves as a means to widely distribute content, reducing expenses on printing and textbooks for educational institutions while extending access to a larger audience at minimal additional cost (Ibukunoluwa, 2022). Additionally, it is suggested by UNICEF (2023) that digital content could potentially serve as a reliable solution to overcome obstacles faced by learners who may be unable to pursue their studies due to diverse reasons.

While Rwanda has made remarkable progress in integrating technology into education, further initiatives and investments are necessary to take it to the next developmental phase. This entails addressing challenges such as enhancing access to electricity and internet connectivity across all educational institutions, establishing a strong network of mobile phone and smartphone users, and strengthening digital literacy and training programs related to educational technology (Kimenyi et al., 2020). Despite previous funding from entities like the Ministry of ICT and Innovation (MINICT), Ministry of Education (MINEDUC), and development partners to support digital infrastructure and devices, a shortage of accessible devices persists for teachers, lecturers, or trainers.

However, the collaboration with UNICEF under the Giga Project marks a significant step forward. This initiative aims to expand digital infrastructure and device availability throughout Rwanda's national education system, with a substantial investment of USD 330 million set to achieve its goals by 2030, including a dedicated USD 70 million by 2024. This underscores the Rwandan government's dedication to advancing the integration of technology in education. The project's overarching objective is to connect every school to the internet and ensure every young individual has access to information, learning opportunities and choices as a strategy of expanding educational access for a wider population (UNICEF, 2022).

In fact, it has to be noted that the integration of ICT requires new investments in capacity building and ICT tools and technologies as well as in pre-adapting the curriculum and

methodology (Talbert, 2021); which may not be automatic for many higher education institutions, especially in developing countries like Rwanda. This could be a challenge in some higher education institutions in Rwanda as there has been a closure of many private institutions due to quality issues and insufficient facilities and teaching staff (MINEDUC, 2021). It is also crucial to acknowledge that it is a process that requires a mindset shift of parents and policymakers that can produce quality graduates if the appropriate investment is done, which can take some time to create that change.

Ultimately, some views support that the integration of ICT has the capability of revolutionizing and democratizing higher education by offering students dynamic and inclusive learning environments that prepare them for the challenges of the contemporary world, and it therefore stands as a transformative force which redefines the learning landscape and empowers both educators and students (Opara et al., 2023). Through the incorporation of digital tools, online resources, and interactive platforms, higher education institutions have the capacity to provide learning experiences that are more captivating, personalized, and easily accessible. (Norbutayev, 2023). Furthermore, the benefits brought by the integration of ICT in education collectively contribute to a more captivating, inclusive, and efficient educational environment that prepares students to thrive in a technology-driven society.

While some views support that the incorporation of technology has brought about transformative changes, other views stipulate that it's essential to examine this integration from a critical standpoint as it's equally important to acknowledge the complexities and challenges it poses (Almufarreh & Arshad, 2023). To come up with a balanced perspective, it may require a fair approach that considers both the advantages and limitations of ICT integration in education such as the provision of adequate resources, continuous training for education beneficiaries, equitable access, and the promotion of responsible and effective use of technology in educational settings (Timotheou et al., 2023).

2.4.1.2 ICT Policy Environment in Education

While traditional teaching methods have historically prevailed, the incorporation of ICT into education in Rwanda has been steadily reshaping the teaching and learning landscape (Rwanda Basic Education Board, 2021). Rwanda Vision 2050 highlights ICT as a crucial catalyst for social and economic progress, empowering human resources, and enhancing public service delivery (Government of Rwanda, 2020). In a similar vein, the ICT in Education Policy (2020) acknowledges the important role of the education sector in driving the desired societal and economic changes. This policy emphasizes that leveraging ICT in education will not only revolutionize teaching and learning but also serve as a tool for professional development of educators (Ministry of Education, 2020).

The Rwanda's current advancements in utilizing ICT in education stem from several policy initiatives. As an illustration, the SMART Rwanda 2020 Master Plan was introduced in 2015 with the objective of shifting Rwanda towards an intellectual capital-driven economy. This five-year strategy aimed to accelerate the achievement of Rwanda Vision 2020's objectives, and its primary mandate was to enhance education opportunities and widen access by cultivating ICT skills (Mugiraneza, 2021). Another policy initiative includes the Economic Development and Poverty Reduction Strategy (EDPRS) which was executed in two stages: EDPRS1 from 2008 to 2012, followed by EDPRS 2 spanning from 2013 to 2018. Within both phases, the EDPRS utilized ICT in education by introducing certification programs for ICT professionals, and each phase employed specific approaches to speed up progress made in national development (Nkurunziza, 2021). Additionally, the National Strategy of Transformation (NST1) was established to be implemented from 2017 to 2024. The NST1 acknowledges ICT as a key driver of development in various sectors. Emphasizing increased digitalization and innovation powered by ICT, it is perceived as crucial in bolstering productivity in both primary and non-primary sectors (Munyengabe et al., 2020). The National

Digital Talent Policy which was endorsed in 2018 also came to boost digital literacy, facilitate the acquisition of ICT competencies, and mitigate the gender gap in digital proficiency (Ministry of Youth and ICT, 2020).

Additional policy initiatives aimed at advancing digitalization in education include the ICT in Education Policy, which has been implemented since 2016. This policy was established to build a strong foundation for ICT professionals, increase ICT adoption and utilization, enhance the leadership skills of educators, and utilize ICT to improve teaching, learning, and research in higher education institutions (Twagilimana & Mannikko-Barbutiu, 2021). Other key policies include the Policy on Science, Technology, and Innovation, adopted in 2006, aimed at fostering research and advancing the development of the ICT sector. The Education Sector Strategic Plan (ESSP), which has been implemented from 2018-19 to 2023-24, seeks to promote the integration of ICT in education as a means to enhance the quality of teaching, learning, and research. Additionally, the National Information and Communication Infrastructure (NICI) Plans recognize ICT as a driving force for socio-economic development in Rwanda. Another significant initiative is the "One Laptop per Child and Teacher" program (Ministry of Education, 2020).

2.4.1.3 Initiatives to Promote Digitalization in Education

The ICT policies have fortified existing methodologies while introducing new initiatives in ICT within education (Rwanda Technical and Vocational Education Board, 2021). These include furnishing schools with computers, creating the Competency-Based Curriculum (CBC) alongside digital content, and facilitating teacher training opportunities. For instance, the implementation of the 2016 ICT in Education Policy involves equipping secondary schools with teaching and learning tools like computers, internet access, and digital content via smart classrooms (Nkurunziza, 2021). The launch of Coding Academy in Rwanda, a form of a specialized secondary school that assists high performing students to develop coding skills,

also came in for the same purpose of promoting digitalization in education (Ministry of ICT and Innovation, 2021).

Studies of the Rwanda education system have found that Rwanda has made commendable progress in advancing digital skills and the integration of technology in the education system. This can be evidenced by the government initiative programs like the "One Laptop per Child" program aiming to provide access to technology for school children (Nkurunziza, 2021). The One Laptop per Child (OLPC) initiative was born from Professor Nicholas Negroponte's idea who proposed to develop and distribute durable and affordable laptops to kids in developing countries. The goal was to enhance knowledge accessibility and encourage young minds to explore and experiment with cutting-edge technology (Ufitiwabo, 2021). This vision materialized with the launch of the OLPC program in Rwanda in October 2008. The aim was to supply Xo laptops, small and cost-effective to primary school students in order to preparing them for tech utilization in their primary education and extending its benefits throughout their academic journey up to tertiary studies (MINEDUC, 2020).

The program's primary aims involve improving education by fostering experiential learning through visually engaging, interactive digital lessons and gaming. It seeks to redefine the teacher's role, shifting from a knowledge provider to a facilitator who assists learners in accessing various information available on laptops, servers, and the internet (REB, 2020). Additionally, it aims to introduce young learners to computers early on, which enables them to acquire computer skills, including programming, through dedicated computer science courses. Furthermore, it aims to broaden students' knowledge in subjects like science, math, languages, and social sciences by facilitating online research and providing digital content stored on individual school servers, maintained by the Government (REB, 2020).

Operating as the key implementation body under the Ministry of Education, the ICT in Education Department of Rwanda Basic Education Board' (REB) oversees the OLPC

program's implementation. (Ministry of Education, 2020). This implementation encompasses multiple functions such as distributing Xo laptops, creating and disseminating digital educational material, offering training to school leaders and educators, fixing and servicing the Xo laptops, and actively contributing to the expansion of ICT all levels of education (REB, 2020). To ensure effective implementation of this program across the country, significant investments have also been made in improving the country's ICT infrastructure like expanding internet connectivity and coverage, including rural areas, to ensure broader access to digital resources (Bishumba,2020).

The improvement of ICT infrastructure has been worked on through collaborations between the government, private sector, and NGOs in different programs like the Africa Digital Skills Excellence Awards and partnerships with organizations like the African Institute for Mathematical Sciences aim to enhance skills and innovation (Ufitiwabo, 2021). For the effective implementation, the Government of Rwanda also entered into the new partnerships with different partners such as Andela, World Economic Forum (WEF), Digital Opportunity Trust (DOT), KOICA and NewGlobe. Andela is a company focusing on training software developers, and, in partnership with KOICA, it intends to create a Pan-African technology hub in Rwanda, which would contribute to the promotion of skills development and job creation opportunities for young Rwandans (Ministry of ICT and Innovation, 2020). The Government of Rwanda partnered with the World Economic Forum (WEF) and Digital Opportunity Trust (DOT) to provide fundamental digital skills training to the wider population, with a particular focus on rural areas with limited or absent internet connection. The partnership between the Government of Rwanda and NewGlobe is centered on the RwandaEQUIP program, a transformative program aiming to make the country's basic education system globally competitive by fostering a technologically empowered teaching and learning environment (Ministry of Education, 2020).

Additionally, the Building Learning Foundations (BLF) program of the Education Development Trust stands as a significant participant within the national education framework. Collaborating with the Rwandan Government via the Ministry of Education, it has enabled online training for mathematics teachers through the use of digital and interactive teaching tools. Furthermore, it aids teachers and head teachers in accessing digitized educational materials through mobile devices (Rwanda Ministry of Education, 2020). Alongside this effort, the private sector's involvement in education has grown, particularly evident during the COVID-19 pandemic. The government partnered with telecommunication companies operating in Rwanda like Airtel and MTN to enable unrestricted access to educational resources on electronic learning platforms (Mugiraneza, 2021).

With regard to digital skills training and development for teachers, the Rwandan Government acknowledges the crucial role of digital skills in contemporary teaching and learning. Hence, there is a need for educators to be proficient in utilizing digital technologies effectively. As noted by the European Commission (2020), to achieve this, teachers need the capacity to incorporate, maximize, and innovate digital resources within their teaching methodologies. Ulferts (2021) supports this notion by highlighting the necessity for educators to possess Technological Pedagogical and Content Knowledge (TPACK) and utilize it to create relevant teaching approaches.

Research, such as that by the OECD (2021), confirms that teachers who are confident in using digital tools are better positioned to help students thrive in a digital-centered world. Consequently, the Rwandan Government, in collaboration with various partners, has conducted training programs to provide teachers with basic ICT skills that can make them able to incorporate technology into their teaching practices (REB, 2020). Moreover, head teachers, sector education inspectors, and district education officers received the same training to help them offer pedagogical support. As of 2021, all sector education inspectors and district

education officers were trained and provided with basic ICT skills (REB, 2021). The initial training sessions covered the introduction to Xo laptops distributed in schools and their physical components, interfaces, and basic technical skills, along with methods for integrating ICT into teaching and learning. The continuous training is designed to equip educators with advanced skills, including using the Management Information System (MIS) to monitor laptop usage and manage attendance records (Ministry of Education, 2020).

In addition to education sector, Rwanda has also prioritized digital government services to increase efficiency and accessibility. Platforms like 'Irembo' serve as a centralized hub for various government services to facilitate citizens to access and interact with public services online (Rwanda Ministry of ICT and Innovation, 2021). All these remarkable achievements have been supported by the policies and frameworks developed to support the growth of the digital literacy in all sectors (Government of Rwanda, 2020).

2.4.1.4 Challenges to Digitalization in Education

Despite these advancements in education sector and other sectors, other studies found out that there are still significant gaps in teachers and students' digital skills. The 2020 ICT profile published by the Rwandan Ministry of ICT and Innovation indicated that 84 per cent of schools had computers installed and utilized, and the student-to-computer ratio was reduced from 23 in 2016 to 8 in 2018 (Government of Rwanda 2021). The United Nations Educational, Scientific and Cultural Organization (UNESCO) 2019 report on enhancing quality education and significance via mobile learning in Rwanda states that while data are unclear on the proportions of teachers currently meeting required ICT competencies, 2020 data show that 17,791 teachers have been trained on basic ICT skills, while 5,584 have had training on ICT-enhanced pedagogy, representing approximately 26 per cent and 8 per cent of all primary and secondary teachers, respectively (REB, 2021). Data on proportions of teachers meeting required ICT competencies remain unclear. The report also indicates that more than 692 smart

classrooms have been set up in schools across the country to upgrade the quality of ICT-enhanced teaching and learning (Wallet et al., 2019).

In Rwandan, different reports indicated that many teachers do not have appropriate digital content to use with students. For example, the 2019 midterm review and evaluation of ICT in education policy found 56.4 per cent of the 40 sampled schools, both primary and secondary, had access to digital content, while another 42.3 per cent said that they did not know about it (MINEDUC, 2020). This also applies to higher education institutions. To understand the extent to which ICT devices were available in schools, the midterm evaluation assessed availability through sample questions on the presence of given tools (MINEDUC, 2020). However, the evaluation solely relied on the responses provided by school head teachers and ICT teachers, without physical verification or factual checks. Of these sampled, 44.2 per cent said that they were aware that different ICT devices were available in their respective schools, while 51.4 per cent reported that they were not aware of their presence (REB, 2021).

Although the Rwandan government has significantly invested in distributing ICT devices in schools, some challenges persist in integrating ICT, such as the steep cost of internet access, insufficient infrastructure, and limited digital literacy, particularly in rural areas. Regarding the access to electricity, one of the main requirements of technology usage, Kropff et al. (2020) reported that only 18 percent of people in rural areas have access to electricity. In the education sector, the effective use of digital content depends on schools having access to computers and internet connectivity; resources that many schools currently lack (Nkurunziza, 2021). Moreover, it necessitates proficient teachers trained in using digital technology for educational purposes (Houser, 2020). However, it was reported that a number of educators still lack digital and ICT skills, and some remain hesitant to integrate ICT into their teaching methods (REB, 2020).

Furthermore, the readiness of school communities is identified as a significant challenge, potentially leading to frustration among users who might find these systems too complex and beyond their capabilities, which can eventually contribute to resistance toward ICT adoption. Various studies, including one conducted by Di Pietro (2020), reaffirmed the deficiency in digital and ICT skills among several teachers and their readiness to integrate ICT into education. Other studies highlighted the link between the absence of ICT skills and the shortage of fundamental ICT infrastructure, such as dedicated ICT rooms, devices, internet access, and electricity. Additionally, the shortage of teacher training in effectively using ICT equipment is cited as a contributing factor (Buningwire, 2021). On this note, some teachers suggest that it should equally invest in trainings to equip teachers and students with the required skills to use them (Mugiraneza,2021). Research has shown that online CPD courses can help teachers to master ICT content and integrate it into their teaching, and it can help both teachers and students develop openness to the embrance of technological innovations and approaches in instruction and learning (Ndayambaje and Ngendahayo 2014). Increased investment in planning and delivery of continuous professional development on digital skills and increased availability of digital materials in education can be one of the best strategies to increase digital for teachers and students.

Briefly, Rwanda's education system promotes the integration of ICT into teaching and learning across all educational levels. The integration of ICT across different levels of education, alongside the implementation of ICT-related policies across various sectors, has revolutionized the teaching and learning landscape in Rwanda (Mugiraneza, 2021). To guarantee that learners take full advantage of various government initiatives aimed at advancing digitalization in education, it is imperative for the Government to support ICT facilities provision, access, and utilization both in schools and at home. This involves ongoing investment in teacher training to familiarize educators with technology's instructional use

(Digital Opportunity Trust, 2020). Additionally, accelerating electricity provision in schools and communities, ensuring adequate spaces for ICT learning, securing internet access and safe storage for ICT devices, and procuring sufficient computers for students and teachers are essential measures to ensure equitable learning opportunities for children in Rwanda.. Furthermore, considering the presence of IT personnel within the school setting to impart ICT skills, perform equipment maintenance, and address technical issues is essential. Collaboration with various stakeholders in the education sector can significantly enhance efforts toward digitalization (Government of Rwanda, 2020).

Moreover, integrating ICT effectively into education contributes to better academic performance while also fostering essential 21st-century skills, including problem-solving, critical thinking, digital literacy, and teamwork; the skills that are increasingly demanded in both local and global job markets. As Rwanda aspires to become a knowledge-based economy by 2050, the role of ICT in transforming education is indispensable. Digital learning tools and platforms enable students to explore content beyond textbooks and allow teachers to personalize instruction based on learners' needs. When properly integrated, ICT also broadens educational access for students in rural and underprivileged regions through e-learning platforms, educational television and radio programs, and mobile learning technologies. These interventions contribute to narrowing the urban-rural education gap, a key concern in Rwanda's education development agenda.

Furthermore, Rwanda's commitment to ICT in education is demonstrated by initiatives such as the Smart Classroom Program, the One Laptop per Child (OLPC) project, and the establishment of the Rwanda Education Board's ICT in Education Unit. These initiatives are designed to integrate digital tools into the school environment and curriculum, providing students and teachers with real-time access to resources and learning communities. However, sustainability remains a challenge. Continuous monitoring, evaluation, and adaptation of ICT

programs are necessary to ensure they are meeting intended goals and responding to the evolving educational context. Partnerships with the private sector, international donors, and NGOs play a pivotal role in providing financial, technical, and capacity-building support to strengthen ICT integration in education. A comprehensive, inclusive, and forward-thinking approach is essential to build a resilient digital education ecosystem that leaves no learner behind.

2.4.2 Twenty-First Century Teaching and Learning in Higher Education

One of the obstacles to the development process in various areas is connected to the human adage that the way things were done before is the way to be done in the future (O'Grady, 2023). For higher education to effectively respond to the current students' learning needs such as literacy, oral expression, numeracy, and problem solving, it is of paramount importance to embrace changes that can help students cope with the society changes. To make it possible, there must be some review in the curriculum and teaching practices (Qianqian and Sang-Bing, 2021). To meet the 21st century requirements, today the society imposes universities to develop transformative approaches that can enhance their learning experience in order to become engaged and competitive citizens on global market who can solve the current society problems (Irvine, Code & Richards, 2019). This imposes a change in teaching and learning practices in tertiary education with much emphasis on student-centered teaching and learning approaches (Schmitt, 2021).

The transformation of instruction and learning in higher education has been a dynamic journey shaped by various factors and pedagogical shifts across time. The journey has marked a shift towards more inclusive, adaptive, and student-focused approaches. This ongoing transformation seeks to prepare students not just with knowledge but with the skills and mindset necessary to succeed in a rapidly changing world (Dangi, Saat, & Saad, 2023). Historically, higher education relied heavily on a lecture-based teaching model. Professors

delivered content in a one-way format, and students were passive recipients of information (Karaca-Atik et al., 2023). Over time, there has been a notable shift towards teacher as the sole knowledge transmitter to student-centered learning approaches emphasizing on active student engagement, critical thinking, problem-solving, and collaborative learning facilitated by a teacher in the role of a facilitator (Bahtiar et al., 2023).

Many researchers in education sector including Bastedo et al. (2023) have discussed the key issues to be considered in the 21st century education. In the above-mentioned century, education should be considered as a universal aspiration which promotes differentiation in teaching and learning (Thahir, 2021). This means that universities should not only consider the classroom of students from a diversity of backgrounds but also a differentiation in learning abilities and styles that can help students develop a competitive ability to work in diverse cultural environments after graduation (Qianqian and Sang-Bing, 2021). As a point of support, today's universities are supposed to educate students not only for academic qualification but also to develop a sense of responsibility of global citizenship (Valverde-Berrocoso et al., 2021). In this regard, higher education now should embrace diversity and globalization where educational institutions must offer diverse courses, that foster multicultural environments and promote global perspectives by helping students to engage with peers worldwide in order to allow cross-cultural interactions and learning experiences (Elias & Mansouri, 2023). Similarly, Formenti & Hoggan-Kloubert (2023) argue that higher education should now be a source of a culture of lifelong learning, as, with the rapid evolution of technology and knowledge, fitting in current society requires continual skill development and the pursuit of knowledge beyond formal degree programs.

As a requirement to achieve the current educational goal and respond to the society needs, transformative teaching approached that enhances civic engagement should be adopted. This allows the institutions of higher education to educate students who don't only think about

their personal advancement for their own benefits, but also the benefits of the society. This would help students develop the sense of responsibility and servant leadership that can help them develop the willingness to give back to the society for change creation (Ndebu et al., 2023).

The integration of technology into teaching and learning also constitutes one of the main developments in 21st century higher education across the globe (Qianqian and Sang-Bing, 2021), and it has been proved to be a powerful way to learn as it enhances individualized and collaborative learning. The technology incorporation in education has enhanced a change in teaching and learning practices to more effectively address the evolving needs of learners in higher education.. Further, the internet revolution has enabled different kinds of exciting and flexible learning and teaching experiences that can help many students have access to education through online or blended learning model. It has massively contributed to the increase of access to tertiary education, and this has facilitated a big number of students with different learning styles and needs to pursue university studies (Fuller, 2021).

2.4.2.1 The 21st Century Teacher

As it is recognised that the 21st century education is a dynamic fusion of innovation, technology, and timeless pedagogy, the educators should be the pioneers of modern learning, navigating a landscape shaped by rapid technological advancements and societal changes. The 21st century teacher differs from their 20th-century counterpart due to evolving learner expectations. Today's educators are expected to stay alongside technological advancements, remain updated about new knowledge, and actively engage students in the learning process. Almazroa & Alotaibi (2023) have outlined characteristics essential for a 21st century teacher. They emphasize the need for adaptability and flexibility in educators within the area of 21st century education. This entails teachers being open to changes within the educational system and employing teaching methods that prepare students for the future rather than relying on past

approaches. Consequently, the dynamic nature of education in this era requires teachers to continuously adapt to ever-changing tools, innovations, and evolving educational needs.

Another expected characteristic of a 21st century educator involves being a collaborator (Yurt, 2023). It's noted that both teachers and students should collaborate effectively to ensure access to the most comprehensive information within the learning environment. Encouraging teamwork among educators involves collaborative efforts for successful curriculum implementation and leveraging shared experiences (Soghomonyan & Karapetyan, 2023). Furthermore, due to the increasing demand for technology integration in modern education, teachers are required to technologically proficient (Cahya et al., 2023). This proficiency extends to understanding that technology used in education for different purposes, can significantly enhance students' learning experiences (Hennigh, 2023). Additionally, educators should recognize that technology can optimize their time management and display a willingness to independently explore and learn about various technologies (Viinikka & Ubani, 2019).

Apart from being adaptive and flexible, collaborators and technologically proficient, they must also be student-centered, forward-thinking and life-long learner. As per Cahya et al. (2023), being student-centered requires teachers to transition into the role of facilitators in learning by encouraging students to assume responsibility for their education. Correspondingly, educators should possess the capacity to steer students toward formulating their questions, conducting research, reaching out to experts, and crafting effective presentations (Karaca-Atik et al., 2023). Essentially, in the 21st century, teachers are tasked to help students become seekers of knowledge and enhance student agency in their learning journey. Being a forward-thinking teacher implies their proactive stance in anticipating new learning opportunities and persistently seeking innovative methods to engage students in order to their readiness for future success (Yurt, 2023). Moreover, it is proposed that a 21st-century

teacher must be a life-long learner. Chu et al. (2021) elaborate that such educators must possess the motivation to stay abreast of new educational tools while taking pride in expanding their knowledge base. They should also demonstrate the ability to update lessons, ensuring they remain current and pertinent to the daily realities that students face (Joynes et al., 2019).

Generally speaking, the 21st century teachers must be adaptable, tech-savvy educators who go beyond traditional teaching methods (Almazroa & Alotaibi, 2023). They must be equipped with digital literacy, and they must embrace technology to enhance learning experiences (Hennigh, 2023). These teachers must prioritize critical thinking, creativity, collaboration, and communication skills in their teaching practices by equipping students to meet the challenges of a fast-changing world (Karaca-Atik, et al., 2023). They must be facilitators of knowledge, encouraging curiosity, problem-solving, and lifelong learning while valuing cultural diversity and fostering inclusive environments. These educators have to continuously evolve by embracing innovation and incorporating modern tools to develop dynamic, engaging, and meaningful educational experiences for their students (Viinikka & Ubani, 2019).

2.4.2.2 The 21st Century Student

As there are some requirements for teachers to meet the 21st century education requirements, there are also some qualities that can make students fit in the world of the 21st-century where curiosity drives exploration and innovation shapes learning methods (Karaca-Atik et al., 2023). In the context of the 21st century, students are urged to recognize the distinct nature of the world and anticipate a different educational experience (Gallagher & Savage, 2023). Given their immersion in a tech-centric environment, students are encouraged to leverage technology advantages in their educational journey by expecting to engage creatively and actively in learning anytime, anywhere through technological means (Baidoo-Anu & Ansah, 2023).

One key characteristic of a 21st century student involves being technologically proficient. According to Loução & Pedro (2023), students are anticipated to possess the capability of using technology for learning. The ability to using technology for learning would help students to open doors to boundless resources, interactive experiences, and personalized learning journeys (Almasco, 2023). Similarly, using technology for learning would grant students access to a wide range of information, which can make learning more engaging, dynamic, and adaptable to individual needs (Sukmanasa et al., 2023). According to Öztürk (2023), students who are able to use online platforms and educational apps would get opportunities for self-paced learning, immediate feedback, and collaborative projects that transcend physical boundaries.

The 21st century also requires students to be global citizens (Tarozzi, 2021). Global citizenship represents a transformative shift in education which emphasizes the development of knowledge, skills, and attitudes that transcend borders and cultures (Teodoro,2020). As global citizens, students must be equipped with a profound awareness of interconnectedness, empathy, and a sense of responsibility towards the world (Tarozzi, 2023). Stated differently, the dynamism of 21st century education necessitates that students take an interest in global matters encompassing environmental issues, healthcare, economic advancement, and the exploration of diverse cultures (Bourn, 2021). In addition to being global citizens, students should also possess the abilities of critical thinking and problem-solving, engaging in learning by questioning concepts and autonomously seeking information that captures their interest (Liang, 2023). This means that it is a requirement for students to possess invaluable skills for looking for relevant information engaging with it, analyzing it, and applying it in innovative ways to come up with new knowledge or understanding (Cherkasova,2022). In other words, students who are critical thinkers and problem-solvers become empowered individuals capable

of navigating complexities, making informed choices, and contributing positively to their communities and the world at large (Glover, 2023).

Additionally, Miller et al. (2023) commented that students in the 21st century must be collaborators and communicators. They emphasized the necessity for students to exhibit strong social skills that can help them confidently express their ideas and thoughts without hesitation. In their view, Jeet & Pant (2023) articulated that when students embody the roles of collaborators and communicators, they step into dynamic roles that transcend individual learning. Collaboration implies teamwork, where students are able to combine their strengths, ideas, and perspectives to achieve shared goals (Tubagus et al., 2023). As commented by Van Laar et al. (2020), through collaboration, students learn to respect diverse viewpoints, compromise, and leverage collective strengths to solve complex problems. The same scholars consider collaboration and communication as the key skills that enable students to thrive in diverse settings, build strong relationships, and work cohesively in teams. These skills help students to become not just independent learners but active contributors in a collaborative global society (Saastamoinen et al., 2023).

Finally, the 21st century education requires students to be creative, innovative and open to change. By being creative and innovative, students no longer believe in rote learning and memorization; instead, they seek avenues for exploration, analysis, and innovation, as highlighted by González-Pérez & Ramírez-Montoya (2022). According to Grey & Morris (2022), education in the 21st century requires students to embrace creativity and innovation in their learning in order to become explorers of new possibilities. Creative learners approach challenges with curiosity, imagination, and a willingness to think outside the box. In other words, innovation, coupled with creativity, involves applying creative ideas to address real-world issues, and it makes students embrace innovation are proactive, adaptable, and resourceful (Dariyono & Rusman, 2023). Creativity and innovation may not be possible if

students are not open to change (Almazroa & Alotaibi, 2023). In this context, Eslit (2023) explains that being open to change means having a mindset that welcomes new ideas, perspectives, and experiences with curiosity and adaptability. The 21st century requires students to be willing to venture beyond their comfort zones, explore new methods of learning, and embrace innovation. This openness allows them to adjust to different environments, learn from diverse viewpoints, and grow personally and academically (Almasco, 2023).

Briefly, students in the 21st century should have an understanding that they are the architects of tomorrow who can navigate a landscape shaped by technological wonders and global connectivity (Bahtiar et al., 2023). Education in the 21st century does not train students to become just receivers of knowledge but engaged participants in their own learning pathway, equipped with a thirst for discovery and a hunger for new perspectives. In this regard, education transcends the confines of the classroom, embracing collaboration, critical thinking, adaptability, and digital fluency in order to make a meaningful impact in an ever-evolving world (Yurt, 2023).

The landscape of higher education in the modern era is dynamic and continually evolving. As it was commented by Formenti & Hoggan-Kloubert (2023), it is characterized by a shift towards student-centric, technology-integrated, and globally interconnected learning environments aiming to prepare students not just for careers but for active participation in an ever-changing world. Hence, in the 21st educational landscape, universities have to rethink the teaching model in many different ways at the same time to embrace diversity and speed of change. So, teaching in 21st Century intends to find a way to adopt different teaching and learning approaches that can help create differentiated learning settings so as to embrace the universal aspiration of learning. To embrace the 21st century education requirements, there must be a move toward student-centered learning methodologies which emphasize on personalized learning experiences, active student engagement, collaborative projects, and

individualized learning paths accompanied by strong critical thinking, problem-solving skills, and creativity rather than traditional lecture-based teaching (Hakim, 2023). This strong initiative requires the society's engagement in education process. So, learning in the 21st century must be considered as a continuous process which requires learner to develop active participation in their learning through individual or collaborative tasks for effective learning (Del Arco et al., 2021). With the technology advancement, the 21st teaching and learning should also consider all the opportunities that technology avails today for stakeholders in higher education. As summarized in the OECD report (2018), institutions of higher education should focus on the knowledge, skills and competences aligned with every individual student's needs in order to cope with the labor market requirements at the end of schooling (OECD, 2018).

2.4.3. Integration of ICT in Higher Education

The integration of Information and Communication Technology (ICT) in higher education has revolutionized the learning landscape by offering numerous benefits to both educators and students (Hunduma & Seyoum, 2023). The importance of ICT in education has been supported by various scholars including Hodges (2020) who stipulated that the ability to use technology and to adapt it is very important in generating and accessing higher education today. Other scholars in the field of education like Tratnik (2019) consider the integration of ICT in education as a mandatory key competency for all universities in the 21st century as it facilitates leaning and teaching practices.

The benefits that ICT brings into education include enhanced learning experiences as it offers diverse learning materials, interactive content, simulations, and virtual labs that accommodate various learning styles and foster more engaging and effective learning experiences (Timotheou et al., 2023). In addition, ICT facilitates access to educational resources like online libraries, digital textbooks, and open educational resources (OERs) and it provides students with access to a broader range of academic resources, irrespective of

geographical location or institutional resources (Cheung, 2023). Hence, this facilitation contributes to flexibility in Learning by creating flexible learning environments that allow students to study at their own pace, accessing materials at any time, and engage in collaborative projects, regardless of their physical presence on campus (Mansurjonovich, 2023). ICT also leads to global connectivity by exposing students to global connections through online collaborations, virtual classrooms, and video conferencing, which in the end allows students to engage with diverse perspectives and cultures helping them to enrich their educational experiences (Peng et al., 2023).

On teaching side, many views support that ICT contributes to the improved teaching methods. On this note, it has been supported that teachers can use ICT to create dynamic lesson plans, integrate multimedia elements into their teaching, and use various educational apps and software to enhance their teaching methods (Fang & Abdullah, 2024). This idea is also complemented by the view that ICT can facilitate continuous learning opportunities for both teachers and students. In his view, ICT can help education institutions to offer opportunities for lifelong learning that can allow individuals to update their skills and knowledge continuously through online courses, webinars, and educational platforms (Bahtiar et al., 2023).

While some views support that ICT brings various advantages to education, its integration isn't without challenges and criticisms. Some arguments in this line of thinking are due to disparities in access to technology and internet connectivity which still exist in different educational institutions. For example, it is commented that students in underserved areas or low-income families might lack access to the required devices or stable internet connections, which leads to a digital divide (Almufarreh & Arshad, 2023). Another critique is on the violation of educational purpose due to distractions and Misuse of ICT. In this regard, some scholars like argue that managing and monitoring students' use of technology can be a

challenging as students can use technological devices for non-educational purposes (Timotheou et al., 2023). Other worries about the integration of ICT in education are connected to costs and Sustainability. Implementing and maintaining ICT infrastructure can be expensive for in such a way that educational institutions might face budget constraints when trying to keep up with rapidly evolving technology, and, consequently, the cost of education can get higher, which can disadvantage some students who may not afford that cost. In their capacities (Adtani et al., 2023).

2.4.4 Artificial Intelligence (AI) in Higher Education

The term Artificial Intelligence (AI) was first introduced by McCarthy in 1956 (Cristianini, 2016). Since then, the definition of Artificial Intelligence has evolved significantly due to considerable advancements in its capabilities. Various scholars have described Artificial Intelligence differently, capturing its multifaceted nature. Chen et al. (2020) describe Artificial Intelligence as computing systems that can execute human-like processes such as learning, adaptation, synthesis, self-correction, and complex data processing. Similarly, Friedman et al. (2021) define Artificial Intelligence as the domain focused on developing computer systems capable of performing tasks usually linked to human intelligence, including visual perception, speech recognition, learning, decision-making, and natural language processing. From an algorithmic stand point, Artificial Intelligence is regarded as any computational method that acts autonomously toward a goal, drawing inferences from theories or data patterns (Celik et al., 2022). Despite the variations in how scholars define Artificial Intelligence, all these definitions suggest that Artificial Intelligence encompasses the development of computer systems capable of carrying out tasks typically associated with human abilities across various domains. These tasks involve problem-solving, learning, perception, decision-making, language comprehension, and more. Essentially, Artificial Intelligence enables machines to

simulate cognitive functions such as reasoning, learning, adaptation, and problem-solving, often using algorithms and data (Cox, 2021).

Historically, the term Artificial Intelligence gained popularity within the domains of physics, technology, computer science, engineering, and mathematics (Zawacki-Richter et al., 2019), yet it remained relatively unfamiliar within the domain of educational pedagogy (Kabudi et al., 2021). Since then, scientists have advanced the field of Artificial Intelligence, continuously incorporating its principles into computer modeling, machine learning, and probability statistics to develop practical applications of these scientific methods in academic institutions, especially within the education sector (Celik et al., 2022). The recent creation of 'OpenAI,' a non-profit AI research organization, underscores the strong commitment to integrating Artificial Intelligence tools in educational pedagogy. The company has invested around 1 billion dollars to accelerate the development of AI and machine learning (ML) tools, with a particular focus on improving Artificial Intelligence in education (Okagbue et al., 2023). Additionally, educational technology (EDTECH) enterprises have advanced the creation robotic devices assisting learning like humanoid robots, and AIDAN, increase human-robot interactions (Webb et al., 2020). Since its inception, AI's influence, functionalities, and applications have evolved from basic Artificial Intelligence to applied artificial intelligence, then to machine learning, and subsequently to deep learning.

In recent times, Artificial Intelligence has achieved remarkable progress across various domains, including education (Arogundade 2023; George and Paul 2020). Within the sector of higher education, Artificial Intelligence is continuously acknowledged as an essential element for competitive advantage (Hannan and Liu 2021). Over the years, the incorporation of Artificial Intelligence in higher education has experienced a gradual evolution since the beginning the 20th century and gained substantial momentum in recent years (Rodríguez-Abitia and Bribiesca-Correa 2021; Kroshilin 2022; Teker et al. 2022; Maltese 2018). Starting

with the initial use of computers and the internet to streamline administrative tasks, universities have consistently utilized digital technologies, progressing towards today's era of AI-driven personalized learning. This evolution aims to improve the quality of education by ensuring greater accessibility and cost-effectiveness for students (Okagbue et al., 2023).

Artificial Intelligence incorporation in education signifies the integration of Artificial Intelligence tools and technologies within educational environments with the aim to enrich learning experiences (Sen, 2022). This integration manifests in diverse forms such as personalized learning platforms, AI-based tutoring systems, smart content creation, automated grading and assessment, adaptive learning systems, and educational data analysis for insights into student performance (Smith & Melissa, 2022). According to Rodr & Shirvanizadeh (2021), the use of Artificial Intelligence in educational pedagogy promises significant transformative shifts in academic teaching engagements. Notably, Ozdinç (2021) asserts its potential to revolutionize traditional instructional methods, transitioning them into prime and digitized experiences for enhanced and efficient education. Moreover, Artificial Intelligence adoption in education aspires to cater for individual learning needs by furnishing tailored learning pathways and adaptable content delivery. It aims to furnish immediate feedback, identify knowledge gaps, and support educators in creating more customized and effective teaching methodologies (Udupa, 2022).

The underlying belief is that by integrating Artificial Intelligence, higher education institutions can attain personalized learning pathways, enhanced accessibility, cost-effectiveness, and an overall enhancement in operational efficiency (Seskir et al., 2023). Similarly, scholars such as Zhang & Xu (2022) and Crompton et al. (2021) highlight the advantages of AI for educators and students in higher education. These advantages involve adapting instruction to cater for diverse categories of learners (Verdú et al., 2019), offering customized and immediate feedback (Dever et al., 2020), creating assessments (Baykasoğlu et

al., 2019), and predicting academic achievements (Çağataylı & Çelebi, 2022). Regarding assessment practices, Rutner & Scott (2022) noted that Artificial Intelligence facilitates automated grading, which is utilized to assist various learners in higher education. Furthermore, it was also highlighted that utilizing Artificial Intelligence in assessments reduces the time instructors spend grading student work, and giving timely feedback (Mousavi et al., 2020).

In the 21st century, Artificial Intelligence has become an essential educational tool within the global academic arena (Poquet et al., 2021). This technological approach to teaching and learning represents an innovative wonder that significantly affects the educational paradigm from traditional methods towards a technologically-driven learning approach (Ahmad et al., 2021). Consequently, it contributes to transitioning from unidimensional learning patterns to multifaceted learning concepts, meaning the shift from physical classroom settings to digital education (Hsu et al., 2021). As various scholars like Webb et al. (2020) have pointed out, the significance of this intelligent tool lies in its substantial transformation of educational pedagogy by enhancing the effective teaching and learning processes and streamlining them (Webb et al., 2020).

A primary advantage of Artificial Intelligence lies in its ability to lower costs while simultaneously enhancing efficiency and accessibility (Schiff 2021). Artificial Intelligence systems have the capability to handle admissions, enrollment, and course timetabling, which therefore lowers administrative assignments. This decrease in variable costs, coupled with the potential for customized curriculum offerings, enhances accessibility. Additionally, Artificial Intelligence has the capacity to create and conduct lessons, evaluate learners' progress, and offer customized feedback, which enables educators to allocate more focus on other academic and scientific duties such as research (Heilinger et al., 2023). additional benefit offered by Artificial Intelligence lies in its capacity to personalize the educational experience for each individual student (Siirtola and Röning 2019). By analyzing data regarding the progress of

students, Artificial Intelligence systems can customize lessons to accommodate the specific needs of every student, a capability exemplified by the effective implementation of AI-based tutoring in internet-based learning platforms.

Moreover, given that Artificial Intelligence streamlines various aspects of everyday life, its application thus extends to fostering high-quality education (Ouyang & Jiao, 2021). Artificial Intelligence possesses the capacity to support educational objectives by catering for the various learning requirements of each student. Through technological advancements like mobile internet, cloud computing, and big data technologies, Artificial Intelligence emerges as a viable avenue for delivering tailored learning materials that align closely with individual learning needs (Kabudi). The integration of humanoid robots into assisted learning can notably simplify the achievement of learning objectives for students. Additionally, internet-driven chatbots can also contribute ideas development during both independent and structured learning (Chen et al., 2020).

Being supported by Duha (2023) who commented that AI-driven platforms automate administrative duties, grading, and evaluation, which thereby makes it time-saving for teachers to concentrate on teaching. Furthermore, Artificial Intelligence has the potential to expand educational accessibility, reaching a broader audience including individuals with diverse learning styles or special needs. Regarding educational support, Hamal et al. (2022) assert that AI-powered systems can provide continuous 24/7 learning support through chatbots, tutoring platforms, or online resources, which allows students' self-paced learning and schedules. This contributes significantly to higher education efficiency and accessibility, tailoring educational experiences through personalized learning paths, adaptive content, and targeted interventions based on individual strengths and weaknesses (Ergen, 2019).

In spite of many benefits of Artificial Intelligence in education, as observed by scholars such as Kabudi et al. (2020), there's a consensus that its integration necessitates meticulous

attention regarding ethical considerations, data privacy, equitable access, and striking a balance between technological support and the human aspect in education. Achieving this balance is important for the ethical and successful implementation of Artificial Intelligence within educational settings (Duha, 2023). Addressing these challenges calls for a collaborative approach involving educational institutions, policymakers, technology developers, and educators. This cooperation is essential to to ensure that Artificial Intelligence in education optimizes its advantages while alleviating potential risks (Ali, 2020).

Considering the advantages and challenges arising from the Artificial Intelligence integration in education, it can be inferred that Artificial Intelligence presents an exciting opportunity to transform education through individualized learning experiences, efficiency improvement, and the provision of considerable insights (Poquet et al., 2021). As Artificial Intelligence integration undoubtedly prompts transformative shifts in academic engagements, higher education institutions should actively encourage the incorporation of Artificial Intelligence tools to enhance high-caliber educational services. Moreover, education policymakers should advocate for policies that can foster the acceptance and utilization of Artificial Intelligence within academic settings.

However, as highlighted by scholars like Kabudi et al. (2020), integrating Artificial Intelligence may pose challenges including equity, data privacy, ethical considerations, and its potential impact on educators' roles. Hence, finding a middle ground between maximizing advantages of Artificial Intelligence's for improved learning and ensuring inclusivity, ethical practices, and preserving the essential human aspect in education is crucial. This endeavor, as suggested by Gorriz et al. (2020), demands thoughtful deliberation, collaboration, and responsible implementation. It also necessitates empowering educators, engaging learners, and shaping a more adaptive and effective educational landscape (Minn, 2022).

2.4.4.1 Global Perspectives on Artificial Intelligence (AI) Integration and Implementation in Education

Different countries and regions have various perspectives on the incorporation of artificial Intelligence in the educational landscape. Such differences are due to countries and regions' diverse cultural, economic, and infrastructural differences (George & Wooden, 2023). Regarding the integration and implementation of Artificial Intelligence, some countries and regions might be more proactive in integrating Artificial Intelligence tools and components in their educational systems, while others might be more cautious or limited in their approach due to due to different factors (Benvenuti et al., 2023). As highlighted by Bellas et al. (2023), cultural, economic, or infrastructural factors such as technological infrastructure, financial resources, government policies and initiatives, cultural acceptance, curriculum alignment, ethical and privacy concerns, and teacher professional development and support constitute the key elements influencing the integration and implementation of Artificial Intelligence in education systems.

The successful adoption of AI in education heavily relies on a solid technological infrastructure. Integrating AI-powered tools into educational settings requires access to stable internet connectivity, adequate hardware resources, and reliable power supply (Chen et al., 2020). However, the reality often presents challenges, particularly in regions with limited infrastructure. Some areas may have strong internet connectivity and access to devices facilitating easier integration of Artificial Intelligence tools into education, while others might face challenges due to inadequate infrastructure (Nemorin et al., 2023). The absence of essential technological elements negatively affects the effective implementation of Artificial Intelligence in education, which creates disparities in access and opportunities among students (Abulibdeh et al., 2024). In their view, Bahroun et al. (2023) assert that without addressing these infrastructure gaps, the full potential of Artificial Intelligence in transforming learning

experiences for all students remains unrealized. Overcoming these challenges demands concerted efforts to develop and improve infrastructure, ensuring equitable access to the necessary resources that contribute to the effective incorporation and implementation of Artificial Intelligence into educational environments (Nguyen, et al., 2023).

The integration and implementation of Artificial Intelligence in educational system in some countries and regions may depend on their financial resources. On one hand, the ability of Artificial Intelligence to revolutionize teaching methodologies, personalize learning experiences, and improve educational outcomes is immense (Miñan et al., 2023). However, the development, implementation, and maintenance of AI-driven tools demand substantial financial investments. Research findings revealed that educational institutions with limited budgets face challenges in acquiring these technologies, potentially widening the gap between resource-rich and resource-poor institutions (Ouyang et al., 2022). This implies that countries with greater financial resources often embrace and integrate Artificial Intelligence by leveraging funds to procure cutting-edge Artificial Intelligence tools, upgrade infrastructure, and provide comprehensive training for educators (Chiu et al., 2023). Conversely, financially constrained regions may struggle to keep pace due to the lack of the means to afford AI technologies or invest in capacity-building initiatives. Lashayo & Mhina (2023) suggests that all educational institutions should bridge the gaps to ensure that Artificial Intelligence benefits are accessible across all educational settings by emphasizing the need for innovative funding models, public-private partnerships, and strategic allocation of resources to democratize Artificial Intelligence in education. In other words, balanced approach that addresses financial constraints while emphasizing the transformative potential of Artificial Intelligence can lead to more inclusive and impactful educational practices (Maphosa & Maphosa, 2023).

In addition, the integration of Artificial Intelligence in education can substantially be affected by government policies and initiatives. It is recognised that government policies and

initiatives are pivotal in transforming the landscape of technological integration in learning environments (Rane et al., 2023). On this point, Chan (2023) commented that forward-thinking policies that prioritize technology in education, allocate funding, and establish frameworks for Artificial Intelligence implementation create a conducive environment for innovation. As noted by Countries with clear guidelines and supportive policies tend to witness more widespread adoption of Artificial Intelligence in their educational systems (Gellai, 2023). These policies often focus on fostering digital literacy, providing resources, and promoting research and development in Artificial Intelligence technologies tailored for educational purposes (Chen et al., 2023).

It was also revealed that government initiatives that promote collaboration between educational institutions, industry experts, and policymakers promote the exchange of best practices and resources, and they lead to effective Artificial Intelligence integration (Rjab et al., 2023). In this juncture, supportive policies encourage the establishment of pilot programs, experimentation with Artificial Intelligence tools, and the development of evidence-based practices to assess the effect of Artificial Intelligence on educational achievements. Additionally, policies that focus on data privacy, security, and ethical issues surrounding the use of AI in education are essential in building trust among stakeholders and ensuring responsible implementation (Van-Noordt et al., 2023).

However, as commented by Mannuru et al. (2023), challenges may arise in regions where policies lag behind technological advancements or lack a coherent strategy for Artificial Intelligence integration in education. This was supported by Baidoo-Anu & Ansah (2023) who stated that policy frameworks that are overly restrictive or ambiguous can hinder innovation and impede the widespread adoption of Artificial Intelligence in educational settings. Hence, it was suggested that governments need to continually adapt policies, keeping pace with technological advancements and ensuring a balance between innovation and ethical

considerations to boost a conducive landscape for Artificial Intelligence integration in education (Misra et al., 2023).

As cultural attitudes shape the readiness and enthusiasm towards embracing technological advancements in learning, studies revealed that the integration of Artificial Intelligence in education is closely linked to cultural acceptance (Hutson et al., 2023). As commented by George & Wooden (2023), cultures that prioritize traditional teaching methods might be more cautious about adopting Artificial Intelligence, while cultures that prioritize modern educational methods may embrace technological innovation in education more readily. In other words, societies with cultures that prioritize innovation, technological advancement, and modernization often exhibit greater acceptance and integration of Artificial Intelligence in education (Kelly et al., 2023). These societies tend to perceive Artificial Intelligence as a tool that enhances educational experiences, offering opportunities for personalized learning, skill development, and creative exploration within educational settings (Choi et al., 2023).

In contrast, cultures that lean towards traditional teaching methodologies or harbor skepticism towards technology might exhibit resistance to Artificial Intelligence integration in education (Kamalov et al., 2023). This implies that deep-rooted cultural values, attitudes, and concerns about the impact of technology on education can create barriers to widespread acceptance. o address these challenges, Abulibdeh et al. (2023) proposed that efforts should focus on bridging the gap between technological innovation and cultural beliefs. This can be achieved by highlighting how Artificial Intelligence complements, rather than replaces, traditional teaching methods. This can result in the successful integration of Artificial Intelligence in education within culturally diverse societies, which often involves educational strategies that respect cultural norms and values while showcasing the advantages of Artificial Intelligence in strengthening educational experiences. In other words, by emphasizing the alignment of Artificial Intelligence tools with cultural educational goals, acknowledging

cultural diversity, and promoting a balanced approach to technological integration, cultural acceptance towards Artificial Intelligence in education can be fostered (Benvenuti et al., 2023).

Apart from cultural acceptance, the adoption of Artificial Intelligence in education requires careful alignment with existing curricula to ensure its integration enhances learning outcomes (Jia et al., 2023). This alignment requires a reevaluation of traditional curricular structures. Artificial Intelligence's potential to personalize learning experiences, offer adaptive assessments, and facilitate innovative teaching methodologies demands a shift in how educational content is designed and delivered (Rasul et al., 2023). Hence, aligning Artificial Intelligence with the curriculum involves mapping AI-powered tools and technologies to educational objectives and learning standards. Additionally, it requires educators to identify areas where Artificial Intelligence can enhance teaching methods, whether through adaptive learning platforms, AI-assisted grading, or personalized content delivery (Aithal & Maiya, 2023). This alignment often involves revisiting learning goals to incorporate essential AI-related competencies and skills, making students ready for the evolving requirements of the digital age workforce. Studies revealed that challenges arise when attempting to align AI with diverse curricula. This is due to the fact that adapting Artificial Intelligence tools to fit within existing educational structures while maintaining continuity in learning experiences poses complexities (Prather et al., 2023). This means that ensuring that Artificial Intelligence integration amplifies fundamental learning goals necessitates a thoughtful, systematic approach to curriculum alignment to ensure coherence between Artificial Intelligence-enhanced methods and established learning objectives. (Ng et al., 2023).

Ethical and privacy concerns are other influencing elements of the adoption and implementation of Artificial Intelligence in educational settings. The adoption of AI in education is accompanied by ethical and confidentiality considerations that demands careful consideration. Utilizing AI-powered tools often involves collecting and analyzing student data

to personalize learning experiences, assess performance, and provide targeted interventions (Nguyen et al., 2023). However, this raises ethical dilemmas regarding data confidentiality, security and the responsible utilization of sensitive data. Safeguarding student privacy while leveraging the advantages of AI-driven personalization necessities strong ethical frameworks and stringent data protection measures (Akgun & Greenhow, 2022). Ethical considerations involve ensuring transparency in data collection and use by obtaining informed consent, and maintaining the confidentiality of student information (Adams et al., 2023). In this way, educators and policymakers have a task to navigate the ethical complexities of Artificial Intelligence by addressing concerns about biases, potential discrimination, and the fair treatment of all students. Balancing the quest for educational innovation with ethical principles becomes so important in fostering trust among students, parents, and stakeholders in AI-driven educational environments (Guan et al., 2023).

As privacy concerns also intersect with ethical considerations in Artificial Intelligence integration, it is imperative to protect student data from unauthorized access or misuse (Lim et al., 2023). In this regard, Kamila & Jasrotia (2023) commented that regulatory compliance, secure data storage, encryption, and policies that govern data access and sharing are necessary to limit privacy risks. The implication is that finding a middle ground between maximizing the use of data for educational enhancements and safeguarding individual confidentiality rights is critical to guarantee countable and moral adoption of Artificial Intelligence in education (George & Wooden, 2023). In order to foster a responsible and trustworthy AI-powered educational ecosystem, comprehensive ethical guidelines and strong privacy measures have therefore to be established in order to navigate the ethical and privacy challenges that can be caused by the integration of artificial intelligence (Machado et al., 2023).

Finally, the effective integration and implementation of Artificial Intelligence in education is associated with the readiness of comprehensive teacher training and ongoing

support mechanisms in educational institutions. In some educational institutions, some educators may not have the requisite training or professional growth opportunities to appropriately integrate Artificial Intelligence tools into their instructional methods, which can make them be hesitant or unable to use Artificial Intelligence effectively (Ayanwale et al., 2022). As indicated by Kohnke et al. (2023), teachers serve as the catalysts for effective Artificial Intelligence integration, and their readiness to embrace and effectively utilize AI-powered tools significantly impacts students' learning experiences. Hence, adequate training programs are crucial to equip teachers with the relevant competencies, knowledge, and confidence to successfully integrate Artificial Intelligence tools in their instructional methodologies (Celik, 2023).

Teacher training for Artificial Intelligence integration involves familiarizing educators with Artificial Intelligence technologies, understanding their functionalities, and demonstrating how these tools can enhance instructional strategies and personalize learning (Zhang et al., 2023). Moreover, training programs need to emphasize not just the technical aspects but also pedagogical approaches that optimize the advantages of Artificial Intelligence in diverse educational settings. Continuous professional development and support networks enable teachers to stay updated with evolving Artificial Intelligence technologies and innovative educational practices, fostering a culture of lifelong learning among educators (Ali et al., 2024).

As indicated by different scholars like Woodruff et al. (2023), challenges in teacher training for Artificial Intelligence integration include different levels of technological proficiency among educators and the need for ongoing support beyond initial training sessions. As a point of supplement, Arnone et al. (2023) suggested that tailoring training programs to accommodate diverse skill levels, providing hands-on experiences, and offering ongoing mentoring or peer support are of paramount importance to overcome such challenges. Comprehensive teacher training and sustained support systems must be established in

educational institutions for successful Artificial Intelligence adoption in education, empowering educators to leverage the transformative benefits of Artificial Intelligence tools effectively within their instructional practices (Ayanwale et al., 2023).

2.4.5. Pedagogical Approaches in Higher Education

Pedagogical approaches in higher education encompass various methods and strategies employed to facilitate learning and promote student engagement. One of the key problems faced by different institutions of higher education today is the adoption of effective academic teaching approaches to effective learning. Looking at the nature of approaches to teaching in higher education, they can be grouped in two different categories, namely the category of 'learning-focused' and 'content-focused' approaches (Marian et al., 2021). Zhang et al. (2023) use different terms to classify pedagogical approaches in higher education: 'deep learning' and 'surface-learning' methods. Learning-focused approaches (Marian et al., 2021) or Deep-learning approaches (Yun et al., 2023) involve active participation in the learning journey. As opposed to content-focused approach, the adoption of learning-focused approach aims at helping students own their learning. According to Uiboleht (2018), this student-centered approach fits well in higher education as it enables students to develop strategies to solve their own problems through active learning. To meet the educational goal and the society needs, different pedagogical approaches have been adopted and evolved throughout years in different academic institutions.

2.4.5.1 Traditional Teaching Methods

Traditional teaching methods constitute the foundation of education, and they have been used for centuries (Anderson,2023). The concept of traditional teaching methods and Content-focused or surface teaching/learning methods are sometimes used interchangeably. In traditional teaching methods, teachers ask students to recite and memorize the content of study

(Thahir, 2021). Traditional teaching and learning approaches center on imparting knowledge and enhancing the capabilities of students through classroom activities (Deng, 2023). In other words, such a kind of instruction helps both educators and learners to be in the classroom for in-person interactions, which makes the level of self-pace learning low because the face-to-face interaction is presented by the teachers (Guo & Li, 2023).

Traditional teaching methods refer different teaching approaches which generally position the teacher as the expert in charge of imparting knowledge to students (Nurdauletova et al., 2023). In this respect, a variety of views stipulate that traditional teaching methods involve teacher-centered methods such as lecture-based teaching, textbook-based learning, rote learning, exams and assessments, demonstration and practice, homework and assignments, and so on (Børte et al., 2023). In lecture-based teaching method, teachers are involved in speaking and presenting information to a group of students, explaining concepts and theories (Li et al., 2022). Different scholars including (Imran et al., 2023) assert that this method is efficient for conveying large amounts of information in a structured manner, with a criticism that it fosters passive learning where students might become passive listeners without actively engaging with their learning, which eventually leads to lower retention and understanding level of students (Zhang et al., 2023).

Traditional teaching methods also involve textbook-based learning approach. This approach relies on textbooks as the primary source of information, with instructors supplementing lectures by referring to these texts (Zhang, 2023). Scholars like Shahabidinovna et al. (2023) commented that relying solely on textbooks may not encourage active learning as it can encourage passive learning habits where students memorize information without truly understanding the concepts, which can limit critical thinking and application of knowledge in learning process (Mahardika et al., 2023). In addition, this method is criticized to be inflexible because textbooks follow a predefined structure, which might not cater for diverse learning

styles or the individual needs of students (Setiawan & Wardani, 2023). Similarly, other arguments on traditional teaching methods highlight that such methods focus on exams and assessments which typically involve written tests, quizzes, and exams to evaluate students' understanding and retention of information (Nurdauletova et al., 2023) or demonstration and practice which involves teachers demonstrating skills or techniques, followed by students practicing these skills under supervision (Anderson, 2023).

According to Nosirova (2023), such teaching methods are not learner-centered methods that encourage active learning, rather they enhance rote learning which involves memorization of facts, formulas, or procedures without necessarily understanding the underlying concepts. Such methods are considered as traditional approaches that only develop unreflective learning strategies such as memorization and reproduction of knowledge (Alneyadi et al., 2023). As they are not student-centered approaches, the surface learning approaches may not be effective for higher education for they do not help students become the owners of their learning and understanding. Hence, as summarized in the figure 1 below, traditional teaching methods require teachers to present their own knowledge on a particular subject, then the students are asked to memorize and reproduce what they are taught (Thahir, 2021). These methods are said to be undesirable and ineffective for higher education because they contribute to shallow learning practices (Uiboleht et al., 2018).

Figure 2

Traditional Teaching/Learning Methods

Source: Noorul, 2021

While traditional teaching methods remain prevalent methods due to their efficiency in content delivery, there is a need to combine them with more interactive and stimulating methods to encourage active engagement and facilitate deeper understanding in the learning process (Yekta et al., 2023). To address these critiques, it has been recommended that they should be combined with interactive elements like discussions, group activities, multimedia, or hands-on experiences to enhance engagement, critical thinking, and deeper learning (Khan, Ramsey & Khan, 2023). In this regard, enhancing effectiveness of traditional teaching methods may require a flexible and adaptive method focusing on the students' learning needs while utilizing a diverse range of pedagogical tools to establish an immersive and impactful learning environment (Serafini & Reid, 2023).

Other suggestions for enhancing the effectiveness of traditional teaching methods evoke the idea of refining the art of delivering engaging lectures by incorporating more pedagogical ingredients that can help students apply knowledge to real-life and enhance active participation of students in their learning (Garcia & Pintrich, 2023) by encouraging them to ask questions, participate in discussions, and apply their learning through practical exercises or projects (Khan, Ramsey & Khan, 2023). To leverage the impact of traditional teaching approaches, it was also suggested that teachers should continuously be offered professional growth opportunities to refine their teaching techniques and adapt them to the evolving

educational landscape in order to respond adequately to students' learning needs (Shahzad & Khan, 2023).

2.4.5.2 Modern Teaching Methods

The longstanding traditional teaching approach, which has endured for centuries, is currently yielding lesser outcomes in contrast to the modern teaching methods that are accessible for implementation in today's schools (Khamzae, 2023). The modern teaching methods stems from a growing recognition of the limitations of traditional educational approaches and a shift towards more dynamic and student-centered learning experiences (Anderson, 2023). In the same line of thinking, Alessa & Hussein (2023) assert that the background of modern teaching methods is multifaceted, drawing from advancements in educational theory, technology, research findings, and an emphasis on addressing various needs of learners in today's society. According to Murodullayevna, (2023) modern teaching methods represent a continuous evolution driven by a quest for more effective, engaging, and inclusive educational practices, and they highlight the diverse approaches, technologies, and strategies that aim to improve quality education, boost learning achievements and adapt to the changing educational landscape.

Several aspects have been attributed to modern teaching methods. In this regard, Toyirovna, (2023) commented that modern teaching involves teaching methods that encourage active learning by shifting from passive reception to engaging students in critical thinking, problem-solving, and collaboration. This involves strategies like flipped classrooms, peer instruction, problem-based learning, and experiential learning, which have gained prominence for their effectiveness in fostering deeper understanding and retention of knowledge. In addition, technology integration in education has also revolutionized teaching methods. Technology not only supplements traditional teaching but also facilitates personalized learning experiences and provides access to a wealth of resources and interactive content (Xu et al.,

2023). With regard to this, the incorporation of technology in education makes the teaching methods involve educational software, learning management systems, virtual reality, gamification, and adaptive learning platforms in teaching and learning practices (Chowdhury & Singha, 2023).

With regard to the personalized and adaptive learning, modern teaching is said to acknowledge the diversity of learners and advocates for personalized learning experiences (Dumont & Ready, 2023). In their view, Li and Wong (2021) comment that adaptive learning systems use customized strategies to adjust instruction according to each student's unique needs, pace, and learning preferences, thereby maximizing learning efficiency and catering for different proficiency levels. In other words, modern teaching involves methods that acknowledge that students learn at different speeds with varied learning styles. This enables students to advance through learning material at their own pace by ensuring mastery before moving forward (Nurjanah, Muthoharoh & Nurbatra, 2023). As a suggestion for effective implementation of personalized learning within modern teaching methods, there should be a consideration of a balance between technology integration, pedagogical innovation, and a focus on

the specific requirements of each student with a goal to create a learning environment that maximizes student engagement, motivation, and academic achievement (Lahiassi, Aammou & Warraki, 2023).

Furthermore, the integration of in-person and online instruction has become increasingly prevalent in modern teaching. Amaniampong and Hartmann (2023) assert that incorporating technologies into contemporary teaching has reshaped educational methods, aiming to improve student engagement, broaden accessibility, and strengthen learning results. In other words, this mixture of in-person and online approaches offers flexibility, promotes self-paced learning, and accommodates various learning preferences (Criollo et al., 2023). This

blended approach thus requires the involvement of learning platforms, video lectures, and interactive content to complement in-person instruction so as to provide a more comprehensive learning experience. From the advantage standpoint, Almufarreh and Arshad (2023) argue that the integration of these technologies in modern teaching does not only promote a more engaging and interactive learning environment but also equip students for a technology-driven world by cultivating skills such as critical thinking, problem-solving, and digital literacy.

The key aspects of modern teaching reveal that any methods that can motivate students to actively take part in their learning and explore learning topics independently to discover knowledge through investigation and experimentation are in line with modern teaching methods (Hojiyeva, 2023). These are the approaches such as Project-Based, Collaborative Learning and Inquiry-Based Instruction which aim to promote problem-solving and critical thinking skills in order to promote a more profound comprehension of concepts and their practical applications in learning process (Martinez, 2022). In simple terms, modern teaching methods aim to establish a dynamic and learner-centered educational environment that boosts critical thinking, collaboration, adaptability, and lifelong learning competencies, vital skills for success in the 21st century (Perdana, Saptasari & Susanto, 2023).

To bring it all together, modern teaching methods represent a transformative shift in education which emphasizes on dynamic and student-centered approaches that leverage technology, pedagogical innovation, and personalized learning experiences (Anderson, 2023). These methods prioritize engagement, adaptability, and inclusivity by acknowledging diverse learning styles and individual needs (Murodullayevna, 2023). By integrating technology, encouraging active participation, fostering critical thinking, and promoting lifelong learning skills, modern teaching methods prepare students to be successful in a constantly evolving world, and, as education continues to evolve, these methodologies stand as pillars of a progressive and inclusive learning environment aiming to equip students with the competencies

and resilience required for success in the 21st century (Qamar, Soomro& Syed, 2023). By understanding the merits and limitations of each approach, one can deduce that traditional and modern teaching methods are both effective and useful in today's education. As with most things, it's all about balance. The most important thing is to understand when a traditional method works best and when it's right to try new and innovative approaches, or when to blend them depending on the targeted teaching and learning purpose.

2.4.5.3 Online vs Blended Learning Modes

The development of technology worldwide has sped up the integration of online and blended learning methods (Ulkhaq, 2023). The incorporation of technology in education has encouraged many higher education institutions to to adopt a combination of in-person and online teaching models, enhancing and expanding the learning experience through the implementation of ICT strategies that might attract improved learning outcomes and student retention mechanisms (Du et al., 2023).

Both online and blended learning are two distinct modes of education that incorporate technology but differ in their delivery and structure. Online learning, also known as distance education, occurs entirely through digital platforms and it allows students to engage with educational content from anywhere with internet access (Tim & Sheng, 2021). For blended learning, it is described as an educational approach that combines traditional face-to-face instruction with elements of online learning (Khamzaev, 2023). In other words, it combines in-person classroom sessions with online activities, resources, or assessments. In terms of differences. Imran (2023) differentiates online from blended learning in terms of mode of delivery, interaction and flexibility. In this regard, online learning is described as entirely remote, it tends to be more asynchronous, and it provides more flexibility in terms of scheduling. On the other hand, the blended learning mode does not only rely on online modalities, rather it combines both in-person and online components, allows for a mix of

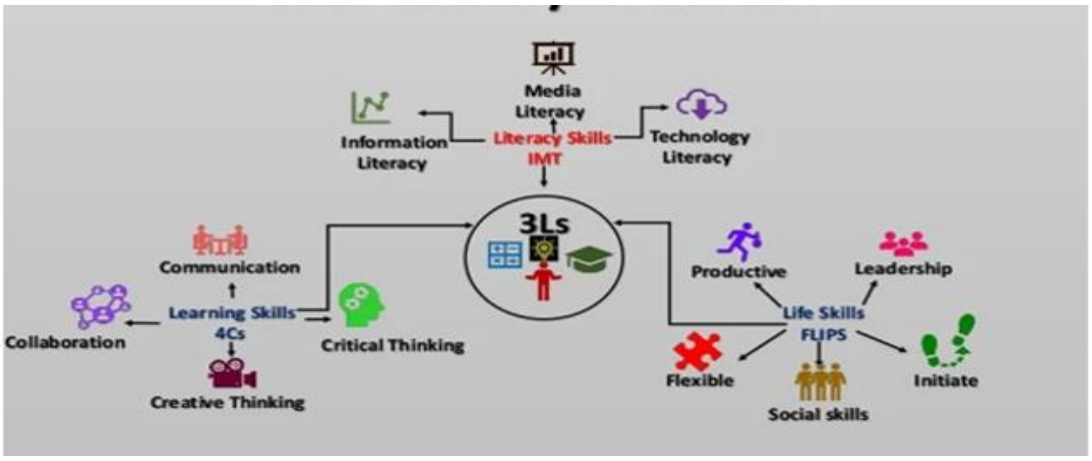
synchronous and asynchronous interactions, and it offers a balance between structure and flexibility.

As higher education is generally for adult learners, they need any kind of pedagogy that help them make a choice in their education in terms of what to learn, when and how to learn it (Trahir, 2021). In other words, they want their education to be relevant to the real world they live in. The online and blended modes are said to be effective for today's higher education as they help the education system respond to the current society issues and develop the targeted 21st century skills.

According to Chu (2021), the 21st century targeted skills are summarized in three Ls: Leaning, Literacy and Life skills. As summarized in the figure 2 below, learning skills include communication skills, collaboration, creative thinking/adaptability, critical thinking/problem-solving (Thahir, 2021). While Literacy skills include but not limited to information literacy (Karakoyun & Lindberg, 2020), it also includes media and technology literacy, life skills target Leadership/ self-regulation/ resilience/ grit, Social Skills/empathy/global stewardship, Initiative/ entrepreneurialism and Productivity.

Figure 3

The Targeted 21st Century Skills



Source: Thahir, 2021

However, while the integration of technology is seen as an opportunity, it can also be a challenge in various higher education institutions due to its strong requirements that may not be affordable by all institutions. As it teachers and students a standard level of digital literacy, and educational institutions to have standard infrastructure, this may have a remarkable effect on the quality desired in education in one way or another (Stauffer, 2022).

As supported by Santosa (2019), an effective pedagogy in higher education is the pedagogy that focuses on the 21st century competencies and skills. In addition, as higher education is open to adult and students from different backgrounds, higher education institutions are encouraged to adopt any pedagogical approaches that can help adult students to expand the capabilities to create their personal insights through active engagement in their learning (Mathew et al., 2019). Views on active learning in higher education generally place importance on important role that students play in their learning process (Ribeiro et al., 2022) to becoming co-creators in their learning (Mercer-Mapstone, et al., 2018). On the side of teachers, Dogani (2023) argues that any pedagogical approach that helps educators play the role of critical and reflective practitioners, facilitators of learning, assurers of education quality diversity and standards, then such a pedagogical approach fits well in higher education.

Based on their views above, it is of paramount importance that the initial role of a teacher, as one who imparts knowledge, is expanded to help students develop their individual capacity to learn through active participation, collaboration and negotiation (Dogani, 2023). So, to promote active learning for students, there is a dire need to find modern methods to teaching and learning which meaningfully involve students in more productive learning environments which cater for various learning styles for students to learn best (Chan & Lee, 2021).

Ultimately, the choice between online and blended learning depends on a careful consideration of educational objectives, student needs, and the desired balance between

flexibility and traditional structure. Online learning offers unparalleled flexibility, enabling students to access educational materials from any location and progress at individual speed (Imran, 2023). On the other hand, blended learning amalgamates the strengths of in-person instruction with the benefits of online resources by offering a more equitable educational experience (Truss & Anderson, 2023). The decision rests on identifying the most effective mode that corresponds with the desired educational outcomes, fosters engagement, and accommodate different learning styles. As education continues to evolve, a thoughtful combination or selective use of both online and blended learning modes may offer the most comprehensive and effective approach for modern learners (Kabarungi et al., 2023).

2.4.6 Blended Learning in Higher Education

Due to the technology global expansion, education is one of the main areas in which internet has massively contributed to the change in teaching and learning process. On account of remarkable evolution of technological innovations in education, since 2002, there has been a prediction that roughly 80-90% of courses in higher education may move to blended model in the future (Menon, 2019). Some arguments affirm that the learning would happen and be more enjoyable only if technology is incorporated in all aspects of education system (Eisha & Widodo, 2019). The advancement of internet has encouraged different higher education institutions to adopt blended learning as a new and innovative internet-based teaching and learning model which allows students to have access to learning from different corners of the world (Fuller, 2021). In the 21st century, rapid technological developments have made it possible that learning can take place everywhere not necessarily in the classroom. In this regard, blended learning is described as an educational model which can provide education through the combination of traditional in-personal and internet-based education methods (Rao, 2019).

The notion of blended learning is derived from the assumption that learning is not an event that can only happen on an occasional or particular time; rather an on-going process (Hebebci & Nilay, 2023). The implementation of the blended learning model has developed over time, and it has become a “new traditional model” or a “new normal” in higher education (Graham, 2018). Blended learning has been described in multiple ways by various scholars.

The blended learning has been described in various ways, but many definitions in educational context share the view that it is an educational framework that merges traditional and internet-based education approaches with the help of technology. According to Bryan & Volchenkova (2019), blended learning is perceived as a type of education which allows students to learn via a mixture of online and in-person educational methods with the flexibility over management of time, location and pace of learning. Similarly, Hrastinski (2019) defines blended learning as a pedagogical concept that consists of the mix of online and physical classroom instruction to support learning. For Bryan & Volchenkova (2019), blended learning is perceived as the collection of alternatives of combining e-learning together with in-classroom instruction modalities that call for physical teachers and students’ presence. Additionally, blended learning enhances students’ active learning as it reserves the limited in-class time only for constructive discussions and clarification for students (Dziuban et al., 2018).

Imran (2023) stipulates that llended learning refers to an educational approach that combines traditional face-to-face teaching methods with digital or online tools and resources.. Essa (2023) describes blended learning as the hybrid model which integrates face-to-face interactions in a physical classroom setting with online activities, digital content, and technology-mediated learning experiences.

In the same line of thinking, blended learning is regarded as a structured educational program where students engage in online learning to some extent, with a degree of autonomy over when and where they learn, and also participate in supervised in-person sessions at a

physical location away from home (Garrison et al., 2023). In his point of view, Hung (2022) characterizes blended learning within the framework of computer-mediated instruction. According to him, it is perceived as systems integrating face-to-face instruction with computer-based instruction. Other scholars describe blended learning based where learning takes place. In this respect, it is described as a structured educational program in which students engage partially in online content delivery and instruction, with some flexibility regarding when, where, and how they learn, while also taking part in supervised sessions at a physical location away from home (Kömür et al., 2023).

The above-mentioned definitions share a common thread that blended learning is an educational model which consists of the combination of in-person and online learning components in various proportions, along with the flexibility for students to have some influence over the speed, location, or direction of their learning. The implication is that the precise balance and implementation of the model can vary significantly based on educational goals, resources, and instructional design strategies. In other words, blended learning is a model which generally blends both face-to-face and online teaching and learning through the application of student-centered instructional strategies (Ayoo and Lubega, 2020). As many students in higher education have various obligations outside of school that may make it difficult for them to commute to campus every day, scholars like Award (2019) and White (2019) stipulates that the blended learning model may create flexibility for students to use their time effectively to actively engage in their learning at individual pace, which eventually promotes heutagogy or a self-determined learning.

Henderson et al. (2021) assert that blended learning model involves flipped classroom strategies where students are first exposed to and engaged with content materials through indicated readings, recorded lecturers study guides and videos prior to attending class. According to the same authors, the flipped classroom strategies are in line with the blended

learning model philosophy since they help students come for face-to-face sessions being ready to engage in activities that can enhance higher cognitive levels of learning with their peers being creatively guided by the teacher. As stipulated by Ascencio (2023), the blended learning model helps to maximize time for students to be engaged in classroom discussions and other learner-centred learning activities. Ascensio's point is also in accordance with the idea that blended learning helps students of all abilities to learn and excel as they learn at their own pace, and it increases student-teacher and student-student interaction in learning process (Divjak et al., 2022).

In the contemporary educational setting, the bended learning model can be understood as an educational approach that consists of the use of electronic learning and teaching tools to supplement face-to-face learning (Staff, 2020). Due to its flexibility, the blended learning model provides a safer learning environment and creates a flexible learning opportunity that can facilitate different types of students, including working and regular students, to have easy access to education from various locations without necessarily being at college premises every day (Fuller, 2021). According to the above-presented definitions, it can be noted that blended learning consists of the incorporation of educational technology in the existing classroom-based instruction. It also consists of effective mix of various teaching and learning styles and modes of delivery. It has constantly been supported by different researchers that the combination of the 2 teaching and learning modalities strengthens learning experience with the help of technology (Graham, 2018). It has also been asserted that this combination may provide more flexible learning opportunities that it can enable students to interact with content at their own speed using internet (Fuller, 2021).

The strengths of the blended learning mode have also been highlighted by some studies, especially where it is stipulated that the quality and learning outcome can be affected particularly when students are only exposed to online methods. This may create a gap in

learning due to the lack of physical learning interaction among students and direct support from teachers (Chan & Lee, 2021). Hence, the blended learning mode has broken such a gap as it considers both modalities in the learning process. By putting together online and traditional in-person instruction methodologies, blended learning would create more opportunities for students to access education with efficient use of their time, especially for those who have other obligations outside of school (Weitzel, 2021).

2.4.6.1 Components of Blended Learning

Looking at different definitions of blended learning, one can deduce that it is an educational approach that involves different learning modalities such as in-person instruction, online learning, self-paced learning, synchronous and asynchronous learning Activities. In-person instruction consists of traditional classroom teaching facilitated by educators where students physically attend classes. It involves learning that occurs within a physical classroom or educational setting where students and teachers interact face-to-face (Oehrli et al., 2023). Bogucka (2023) argues that it allows for real-time communication, immediate feedback, and interpersonal connections that may boost the educational experience, and it often facilitates more dynamic discussions, hands-on activities, and personalized attention compared to remote or internet-driven learning formats.

In the blended learning model, in-person instruction is assisted by online approach. As stipulated by Darmuh & Kadar (2023), online learning refers to the utilization of digital platforms, software, or educational technology for delivering content, assessments, or interactive learning experiences over the internet. Online learning denotes education provided and facilitated primarily via the internet or digital technologies. As stipulated by Guo & Li (2023), online learning offers flexibility, allowing students to access educational materials and and attend classes from any location with an internet connection.. It can be self-paced or

structured and often employs various multimedia tools to facilitate engagement and interaction between students and instructors (Gurcan & Cagiltay, 2023).

In addition to hybrid instructional approaches, blended learning encourages self-paced Learning. It refers to an educational approach where individuals have the flexibility to control their own learning pace and progress through the material according to their own schedule (Schüll, & Brocksieper, 2022). In this mode of learning, Jung & Kim (2022) assert that students have the autonomy to decide when and how they interact with the content, and they can take more time on challenging topics or move quickly through familiar ones, customizing their learning in line with their individual learning needs and styles. Similarly, self-paced learning is often facilitated through online courses, modules, or educational materials that allow learners to proceed at their own pace without strict time constraints (Yan et al., 2021). In the same line of thinking, Abad (2023) indicates that self-paced learning gives students chances to interact with educational materials autonomously, and it allows flexibility in the pace and timing of their learning.

To make it full blended learning, it requires synchronous and asynchronous learning activities. Synchronous learning refers to a method of learning where instructors and students engage in learning at the same time but not necessarily in the same location (Moorhouse & Wong, 2022). Synchronous activities involve real-time interactions between students and instructors through live video lectures, for example, while asynchronous activities occur without real-time interaction where students can refer to pre-recorded lectures or discussion forums (Huang, et al., 2023). Asynchronous learning, on the other hand, Kimura (2023) affirms that it is a learning mode that helps students to access educational materials and participate in learning activities at their own pace and convenience without a requirement for real-time interaction. In other words, in this mode students can engage with pre-recorded lectures, discussion boards, or assignments at a time that suits their schedule (Belt & Lowenthal, 2023).

Looking at benefits, both synchronous and asynchronous learning methods have their benefits. Synchronous learning allows for immediate interaction, live discussions, and quick feedback, while asynchronous learning provides flexibility for students to manage their time and pace of learning (Martin, Kumar, Ritzhaupt & Polly, 2023). In other words, a blended approach that combines both synchronous and asynchronous learning modes is used to establish a well-rounded learning experience which offers the benefits of real-time interaction along with the flexibility of self-paced learning (Aryal & Balan, 2023).

Briefly speaking, the combination of all the above-discussed elements helps the blended learning model to leverage the strengths of both traditional teaching methods and digital tools by offering a more flexible, individualized, and adaptive educational experience for students. The effectiveness of this approach may depend on the effective mutual complement of the face-to-face and internet-based components and how they are effectively integrated to create cohesion and coherence in educational experience for students.

2.4.6.2 Factors Influencing Blended Learning in Higher Education

The adoption of the blended learning model in higher education has been influenced by multiple factors including education current trends and society needs, globalization, technology, class size, etc. (Cassidy& Ahmad, 2019). It was also stipulated that the conception of academic program could be the first factor that influences the adoption of appropriate teaching and learning approach. In this regard, there has been a move or a complementarity of various educational delivery methods such as traditional teaching methods, online teaching and blended learning methods. That is why some methods are no longer considered effective, and thus, they may not help higher education institutions to respond to the current higher educational goal. For example, a range of traditional teaching methods have been criticized to promote rote learning instead of promoting critical thinking, problem-solving, metacognitive and social skills, which are the key skills of a university student today (Lee, 2021).

Education serves as the backbone of a society, adapting to its evolving needs while shaping the future (Smolentseva, 2023). Education which is needed today is the education that prepares individuals not just for jobs but for life in a rapidly changing world by offering them with the skills, knowledge, and resilience required to thrive and create a positive impact to the society (Irwanto et al., 2023). This education model allows students to access course materials and lectures remotely, offering flexibility in learning schedules to accommodate various learning styles and the needs of students who may have jobs or family obligations alongside their academic responsibilities (Boveda et al., 2023).In their argument, Martins & Gresse (2023) assert that such a kind of education facilitates educators to customize learning experiences, offer a range of resources and activities to cater for individual student needs and learning paces.

On the same point, Ridgway & Langinier (2023) associate the needed type of education with the current human mobility factors. According to the same authors, social mobility can determine the quality of education a person receives. In their view, an approach to education that reduces costs and enhances inclusive economic and social development can allow institutions to reach a broader audience without physical space limitations. As the professional world becomes more digital, Zawacki-Richter & Bozkurt (2023) share the same view that there is a need of education that equips students with essential skills in digital literacy and the competence to navigate through online environments effectively in order to prepare them for modern workplaces.

2.4.6.3 Blended Learning Models

Various models are used in educational settings to create effective blended learning experiences. On this point, the findings of different studies suggest can be implemented using diverse models, including the models based on class instruction. Therefore, when developing

a blended learning activity, course, or program, it is useful to consider all available models (Kömür et al., 2023). Different blended learning model include

a) Rotation Model

As stated by Kömür et al. (2023), this model consists of station and lab rotation approaches. In station rotation, students rotate through different learning stations, including an online learning station where they engage with digital content or activities. This rotation through different learning stations is also supplemented by lab rotation where Students rotate between traditional classroom settings and a computer lab for online learning activities (Hua & Yanjun, 2023). On the same note, Becher (2023) argues that the rotation model in blended learning is very important in enhancing the educational experience by considering the advantages of conventional in-person teaching with online learning. In other words, by blending traditional teaching methods with technology-based learning opportunities, the rotation model in blended learning maximizes the benefits of both approaches by providing a more holistic and tailored educational experience for students (Yonchai et al., 2023).

b) Flex Model

The Flex Model is a blended learning approach that allows for a high degree of flexibility in how students engage with their learning (Hidayat, 2023). In this model, students primarily learn online, with control over time, pace, and path. They receive support and guidance from teachers in small-group settings or one-on-one interactions (Haftador et al., 2023). According to Levina (2023), in the Flex Model, students are empowered to assume responsibility for their learning while still providing the guidance and support of teachers. Additionally, it offers a personalized approach that caters for individual learning needs and preferences. However, its success often depends on the accessibility of resources, technology

infrastructure, and the readiness of students to embrace self-directed learning (Kabarungi et al., 2023).

c) Flipped Classroom Model

The Flipped Classroom Model is a blended learning approach that inverts traditional teaching methods. As stipulated by Babintseva (2023), In this model, instructional content is provided online outside the classroom, often through videos or other digital materials, while face-to-face class sessions are used for activities, discussions, and application of the learned concepts. In the same line of thinking, this model allows students to learn content online through pre-recorded lectures or materials before class, and classroom time is then utilized for discussions, collaborative activities, or problem-solving, with the teacher available for guidance (Ashraf et al., 2023). The Flipped Classroom Model allows to optimize class time by shifting the focus from delivering content to engaging students in active learning and applying knowledge (Kardipah & Wibawa, 2020). As a point of supplement, Tonbuloğlu (2023) argues that it encourages a more interactive and engaging classroom environment while offering students chances for individualized learning and a clear understanding of the subject matter.

d) HyFlex Model

The HyFlex also known as Hybrid-Flexible Model is a versatile approach to education that blends in-person instruction with online learning, giving students the option to choose how they participate (Means et al., 2023). In other words, it combines face-to-face instruction with online learning by enabling students to choose between attending in-person or participating remotely in real-time. Described as a place-based approach, Korson, (2023) also states that the HyFlex model strives to offer a balanced approach that merges the advantages of in-person teaching with the flexibility of online learning. Snezhana (2023) indicates that its aim is to cater for diverse student needs while providing a seamless and adaptable learning experience.

Looking at its nature, successful implementation of the model generally requires careful planning, technological support, and considerations for Sustaining a learning environment that is inclusive for all students irrespective of their selected mode of participation (Ates-Cobanoglu & Ermis, 2023).

The above-discussed models and other existing blended learning models offer a versatile approach that merges the strengths of traditional in-person instruction with the benefits of internet-based learning with the purpose of creating a more active, personalized, and conducive learning environment for students. As supported by Castro (2019), blended learning models vary in their approach to support students with different learning styles, pace, and preferences while maximizing the advantages of both internet-based and face-to-face learning modalities. In other words, by taking advantage of the flexibility offered by blended learning, a more inclusive and engaging learning environment can be created that caters to diverse learning styles by improving the overall learning experience for students.. To ensure effective support to students with different learning styles, Almusaed (2023) recommends that there must always be a combination of strategies, including continuous training for teachers, ensuring fair access to technology, developing diverse resources, fostering a supportive learning environment, and engaging students actively in their learning process to accommodate their individual preferences and needs.

2.4.6.4 Attitudes toward Blended Learning in Higher Education

Attitudes toward blended learning are dynamic and can change based on personal experiences and the context in which it's implemented. Several studies investigated the effectiveness of blended learning and people’s perceptions towards it. On one hand, it has generally been noted that blended learning is an educational approach that can provide educational beneficiaries with satisfaction as it helps to achieve the educational goals and to address the current needs of the students. In his study, Ahmad (2021) has revealed that students

have good perceptions of blended learning. In addition, the findings of the study conducted by Fakhouri (2018) also showed that a big number of students perceive well blended learning as they take it as a useful model. They stipulate that it provides them with an opportunity to decide when and how to deal with their learning. As opposed to traditional face-to-face model, the same study results revealed that students consider blended learning as a more effective model as it helps them become responsible for their education.

On the side of faculty members, Li & Billy (2020) investigated the perceptions of the faculty members teaching blended learning courses, and the findings revealed that the majority of the faculty members who participated in the study perceive the model positively. It was stated that the approach offers great learning and teaching experiences to both university students and teachers. This view was also supplemented by Coynea (2018) who stipulated that blended learning does not only enhance students' knowledge, competences and skills, but also it provides flexibility and responsibility in learning. Lee & Hong (2023) carried out a study to assess the students' attitudes towards both online and in-person education.. The results revealed that the students preferred more internet-based than face-to-face instruction as it promotes self-paced and collaborative learning experiences. Nazara (2018) asserts that the application of blended learning approaches helps create opportunities for interaction and reflection in learning, both at the individual and classroom levels. With the help of technology, this approach also helps teachers move from traditional roles to the role of a facilitator (Kwok-Wing Lai, 2021).

Generally, blended learning model has gained traction for its ability to combine traditional classroom teaching with online resources and tools. Many people appreciate blended learning model due to its flexibility which enables students to learn at their preferred speed and convenience. Additionally, it is appreciated as it customizes learning experiences to individual needs to cater for different learning styles and speeds. This goes hand in hand with easy access

to a variety of resources it offers, which enhances learning from a wide array of information beyond traditional textbooks. This makes learning more interactive and enjoyable.

On the other hand, not all people share positive attitudes toward the blended learning model. Negative attitudes toward the blended learning model often stem from concerns and obstacles related to its implementation. In this regard, some other studies reported that the blended learning model may not help students to achieve great learning outcomes due to various factors including time constraints, digital divide, quality of education, lack of motivation, weak student's agency (Stenalt & Lassesen, 2022). It has been revealed that students who are not responsible for their own learning or who are not equipped with adequate independent learning skills prefer face-to-face instruction as they rely on teachers' intervention in their learning process (Shorey, 2018). Furthermore, studies have also indicated that not all teachers have positive attitudes towards blended learning. As blended learning model requires high level of technology literacy, teachers and students who are not digitally literate find it difficult to conduct their teaching and learning using web-based approaches (Kavan, Zameni, & Enayati, 2023). The issue of digital literacy is also connected to the issue of digital divide which raises the concerns regarding unequal access to technology that can make some students and teachers at a disadvantage (Neves & Stephenson, 2023). Other people are not of the positive view of the blended learning due to its reliability on internet. Technical issues or poor internet connectivity might disrupt learning experiences, which can cause frustration and poor learning progress (Al-Obaydi, 2023).

On the side of parents, there are worries about effective monitoring of their children's progress and the provision of support in a blended learning environment. Parents' attitudes often evolve in light of their child's experiences and the effectiveness of blended learning in meeting their educational needs. Clear communication, support systems, and addressing concerns about quality and social development play key roles in shaping parental perspectives

toward this educational approach (Freer, 2023). Other concerns can be connected to some parents' adaptation to the changing educational landscape, especially when it differs significantly from their own schooling experiences (Newman, 2023). In this regard, Wong (2023) states that the concerns arise especially when parents or their children lack access to necessary technology or if they feel inadequate in supporting their child's learning due to technological limitations.

Other scholars affirm that these negative attitudes do not discount the potential benefits of blended learning but highlight the challenges and potential drawbacks that must be resolved for its effective implementation and acceptance by all stakeholders (Newman, 2023). Addressing issues related to access, quality, social interaction, and pedagogical strategies is crucial in making blended learning a more universally accepted approach in education (Petty et al., 2023).

2.4.6.5. Advantages of Blended Learning in Higher Education

Since blended learning is a contemporary method of instruction and learning which considers face-to-face with online modalities, it has been given value and implemented in tertiary education for a number of reasons. It is said to be more flexible than face-to-face instruction (Mukhtaramkhon & Jakhongirovich, 2022), catering diversity in learning using various differentiated methods in teaching (Boelens et al., 2018), or enhancing learners' active interaction with educational materials (Mestan, 2019). It is perceived as an effective approach that can lead to solutions of many educational problems that may hinder the effective learning of students.

Some of the advantages of blended learning mode are associated with its flexibility and accessibility compared to the traditional mode of instruction (Menon & Sujatha, 2019). Its advantages lead to the open and flexible access to education for many students. On this note,

Calamlam (2020) asserts that the blended learning mode increases learning opportunities and facilitates the students to access educational opportunities even when they are in their places of residence. In other words, it offers flexibility in learning schedules, which facilitate students to access resources and materials at their convenience. Truss & Anderson (2023) assert that online components of blended learning can improve access for remote or geographically isolated learners who might not have easy access to traditional educational institutions. It also enables access for individuals with physical disabilities that may hinder their ability to attend physical classes. This flexibility is particularly advantageous for non-traditional students, working professionals, or individuals with other responsibilities (Mukhtaramkhon & Jakhongirovich, 2022).

As highlighted by Rao (2019), blended methods can more contribute to student's learning achievements than merely face-to-face or solely online methods. In blended instruction, students can learn on their own using online and face-to-face instructional strategies together. This creates a room to concurrently develop independent and collaborative learning experience. In addition, blended learning methods enable students to utilize educational technology to advance their learning, digital and critical thinking skills (Kwok-Wing, 2021). In other words, it allows personalized education which caters for individual learning pace.

Another advantage attributed to blended learning is associated with engagement enhancement. As blended learning integrates various teaching methods, including multimedia resources, interactive content, and in-person instruction, this variety keeps students engaged and caters for different learning styles, strengthening a more dynamic educational experience (Almusaed et al., 2023). Additionally, Li (2023) argues that the strength of blended learning lies in its ability to put together the best components of traditional face-to-face instruction with the flexibility and interactivity of online learning. According to the same author, this creates

an environment an environment that fosters greater engagement, and when implemented properly, it can significantly boost students' motivation and dedication to learning.

Cost-effectiveness and efficiency are other motivating factors for the implementation of blended learning in institutions of higher education. On this point, Brenya (2023) commented that blended learning can reduce costs associated with traditional classroom settings by utilizing online resources and reducing the need for physical infrastructure, which allows institutions to reach a broader audience without geographical limitations. On the side of students, it has been revealed that blended learning can offer cost-effectiveness and efficiency in several ways. As the blended learning model allows students to work part-time or full-time while pursuing their education, it can potentially offset educational costs and reducing reliance on student loans (Muhria et al., 2023). Additionally, since the blended learning model offers access to online resources and materials, this implies that students can save on expenses related to textbooks, commuting, and sometimes even accommodation, especially for courses that offer remote learning options (Mendoza & Venables, 2023). Hence, there can be an assumption that the blended learning advantages related to the cost effectiveness and efficiency can make education more affordable and accessible for even individuals from lower-income backgrounds. This may attract a big number of students and extend learning opportunities especially for those who may not be able to attend colleges because of different reasons such as distance or time.

2.4.6.6 Challenges in the Implementation of Blended Learning in Higher Education

Although the blended learning model offers various advantages, its implementation imposes some barriers. As blended learning heavily relies on technology, limited availability of high-speed internet, devices, or digital literacy skills can create barriers, particularly for individuals in underserved or rural areas (Muhria et al., 2023). On the same point of disadvantages, it has also been evoked that if the model can create the feelings of isolation in

students, especially when it is not supplemented with adequate support mechanisms. In this regard, it is argued that students may miss out on the social interaction and immediate support from teachers that traditional classrooms offer (Gibson, 2023).

Another raised barrier is in line with resistance to change. It was commented that some stakeholders, including students and faculty, might resist the move from face-to-face teaching approaches to blended learning due to familiarity or preference for traditional classroom settings (Antunes et al., 2023). This resistance might arise from Several factors, including limited familiarity or confidence in using technology, doubts about the quality and effectiveness of online components in delivering educational content or meeting learning objectives compared to traditional face-to-face instruction (Gupta & Garg, 2021). At the organizational level, the integration of blended learning can be challenged by poor or insufficient infrastructure. The initial investment in technology, infrastructure, and faculty training is usually substantial. For some institutions, maintaining and updating these resources may add to the long-term costs of implementing blended learning, which might not be easily affordable to all institutions (Hill & Smith, 2023).

Other concerns that people have about the blended learning model are associated with quality of content and instruction, equity issues and overemphasis on self-directed Learning. With the perspective that the quality of online content and instruction can vary widely, without proper oversight and regulation, the educational value of online resources may not always meet the standards required for effective learning (Ascencio, 2023). For the equity issue, studies have revealed that blended learning models might exacerbate existing educational disparities. In this regard, it is reported that students from underprivileged backgrounds may not have the same access to technology or supportive environments, which may widen the equity gap (Tonbuloğlu & Tonbuloğlu, 2023). Mendoza and Venables (2023) look at the disadvantages of blended learning in terms of overemphasis on self-directed learning. According to them,

some learners might struggle with self-directed learning and require more guidance and structure, which can be challenging in models that heavily rely on individual initiative and motivation (Mendoza & Venables, 2023).

Brief, although every approach to teaching and learning may have both advantages and disadvantages, various studies have demonstrated that the advantages attributed to blended learning outweigh the disadvantages. Blended learning is an educational method that enables instruction and learning to use information technology to supplement face-to-face instruction, and it favors new strategies to achieve educational goals (Tonbuloğlu & Tonbuloğlu, 2023). It provides a flexible and conducive educational environment that reinforces the student's independence, reflection and research skills in their learning process with the help of technology. This helps students to review and control their learning. It improves and expands learning and teaching through web-based instruction. It has many advantages that can attract a big number of beneficiaries as it is flexible and reduces educational cost for learning. It provides students with busy schedules with opportunities to independently manage their learning and other responsibilities that can be assigned to them (Ascencio, 2023).

Blended learning, while advantageous in many ways, also has its drawbacks in higher education due to low digital literacy among students and teachers, lack of appropriate internet infrastructure, quality of content and instruction, equity gaps and reliance on self-directed learning (Kabarungi et al., 2023). To implement the blended learning model effectively, institutions of higher education must address these disadvantages by providing adequate support, training, and resources, facilitating equal access to technology, and continuously evaluating and improving the blended learning experience to mitigate these challenges (Katal et al., 2023).

2.4.7 Access to Higher Education

As education is a lifelong learning process, many people may not be able to enjoy the existing education opportunities due to various factors that constrain access to education such as age, employment, distance, and cost (Jarvis, 2018). Access to education is described as the ability to provide all people with safe learning conditions and opportunities that are equitably distributed to facilitate learning to happen (Lewin, 2019). Building on Lewin's description, Staff (2020) revealed some weaknesses in the face-to-face educational mode. According to him, it does not fully allow all categories of people to have an easy access to education as it requires regular presence at college premises every day. Hence, there is a need to ensure that the adopted leaning and teaching modes could increase learning opportunities for all people by considering various factors that can constrain access to education (UNESCO, 2020).

As a stipulative definition, access to education may be understood as equal and equitable opportunities that educational institutions offer to help students to explore and benefit from their education (UNESCO, 2020). The blended learning model is one of those opportunities as it facilitates a big number of students with obligations outside of school to access education opportunities using technology-assisted learning tools (Bozkurtm & Zawacki-Richter, 2021). This would accelerate the enrolment rate of of individuals pursuing higher education for their continued personal or professional development.

Aligned with the Education 2030 agenda, the United Nations Educational, Scientific and Cultural Organization (UNESCO), the specialized agency for education within the United Nations, is always preoccupied by the outlook for higher education across the globe. UNESCO views the right to education as extending beyond basic schooling for minors, advocating it as a lifelong pursuit, catering to the educational needs of individuals across all age groups (UNESCO, 2022). Emphasizing the evolving societal landscape, UNESCO perceives higher education as integral to the right to education and a public good.

This alignment with the fundamental mission of Higher Education Institutions (HEIs) aims at producing pertinent knowledge, cultivate well-rounded professionals, and instill a sense of social responsibility. Makoe (2022) contends that higher education institutions should evolve into unified systems leveraging their diversity to generate varied and adaptable routes for both young individuals and adults, thereby avoiding the reinforcement of exclusive pockets that perpetuate unequal opportunities. To achieve this, HEIs need to broaden their approaches to enhance educational possibilities, promote exceptional professional standards across all domains, and nurture individuals who are well-rounded, dedicated to social justice, and environmentally sustainable (Koulidiati, 2022).

With regard to the betterment of higher education, UNESCO has outlined a set of fundamental principles that can be used to shape the future landscape of higher education. These principles prioritize inclusivity, championing the provision of fair access to top-notch education for everyone, irrespective of their economic background or social standing, gender, ethnicity, or geographical location so as to enable the promotion of continuous lifelong learning, which can empower individuals to consistently learn new skills and adjust to the evolving demands of society. Furthermore, UNESCO advocates for the integration of technology and innovation into educational methods, in order to foster digital proficiency and innovative teaching approaches. Based on the UNESCO report, close collaboration among diverse stakeholders, governments, academia, private sectors, and communities, is emphasized as crucial for crafting adaptable and sustainable higher education systems. Finally, UNESCO underscores the importance of safeguarding cultural diversity and instilling values of global citizenship and sustainability within higher education curricula, as a way of preparing graduates to be ready to address complex global challenges (UNESCO Report, 2022).

UNESCO urgently urges the implementation of significant transformations aligning with the established core principles aiming to reshape our trajectories and establish distinct

routes to enhance educational experiences and achievements for all. These pathways necessitate the involvement of different stakeholders staring with students and educators, higher education institutions, policymakers, international organizations, development partners, private sector, civil society entities, youth groups, social initiatives, local communities, and beyond (UNESCO Report, 2022).

In Africa, various UNESCO reports provide significant perspectives on the state of higher education by focusing on matters concerning access, fairness, quality, and the efficacy of interventions. These perspectives stand as valuable reservoirs of information for policymakers, educators, and stakeholders dedicated to enhancing educational opportunities across the continent, where there's an ongoing blame that the right to higher education has not been a reality yet.

In the recent report entitled "The Right to Higher Education in Africa: Briefing note compendium," UNESCO highlighted a significant increase in higher education enrolment rates across the globe over the past twenty years. Despite this growth, it was also stated that Africa maintains the lowest university enrolment rates globally (Kigotho, 2023). Consequently, UNESCO has urged African nations to enhance access to higher education by putting in place some mechanisms that can help the cost of education, ensuring educational excellence, and addressing gender disparities (UNESCO report, 2022).

Information provided by higher education specialists across nine African nations underscored the imperative for collaborative efforts among countries to boost enrolment rates. These experts emphasized a significant global surge in tertiary education enrolment, rising from 19% in 2000 to 40% in 2020. However, they pointed out that Africa uniquely maintains a ratio consistently below 20%. Specifically, within Sub-Saharan Africa, these specialists disclosed an average enrolment rate of 9.4%, a typical example of the disparities and challenges that the region faces (Kigotho, 2023).

As per the same UNESCO report, only Algeria, Botswana, Egypt, Mauritius, Morocco, Namibia, South Africa, and Tunisia have a higher education gross enrolment rate of more than 20%. However, the situation in Sub-Saharan Africa depicts a worse picture regarding the right to education, with only four nations in this sub-region surpassing the 20% threshold for tertiary education enrolment. Additionally, gender disparity remains notable, with a ratio of only 36 female students for every 100 male students (UNESCO report, 2022).

2.4.7.1. Limiting Factors for Access to Higher Education

Access to higher education stands as a cornerstone for personal growth, career advancement, and societal progress. However, despite its transformative potential, a number of different barriers hinder individuals who aspire to pursue further education. Various studies highlighted that the key obstacles are associated with financial constraints, geographical barriers, family and personal obligations, and Personal Health or Disability (Sullivan et al., 2023).

On the point of financial constraint, it is reported that the cost of higher education, including tuition fees, textbooks, accommodation, and other related expenses, can be prohibitive for many individuals (Fia et al., 2023). As reported by Wanti et al. (2022), financial constraints wield a profound impact on access to education, erecting formidable barriers that limit individuals' ability to pursue higher studies. At its core, the rising costs of tuition fees, textbooks, accommodation, and associated expenses create an insurmountable hurdle for many aspiring students (Yende & Mthombeni, 2023). In this juncture, it is also argued that these expenses often exceed the financial means of individuals from lower-income backgrounds by deterring them from even considering higher education or forcing them to take on substantial debt burdens. Hence, it is in this perspective that Nyashanu (2023) stipulates that this financial strain often forces students to make difficult choices, leading them to compromise on the quality of education they can access, opt for less prestigious institutions, or even abandon their

educational pursuits entirely. As a consequence, financial constraints perpetuate a cycle of limited opportunities, hindering social mobility and perpetuating socio-economic disparities (Bastedo et al., 2023).

Concerning geographical barriers, many scholars including Vabø and Schmidt, 2023) state that limited access to higher education institutions in remote or rural areas can hinder individuals from pursuing further studies due to travel constraints or lack of nearby educational facilities. Limited proximity to institutions is highlighted as one of the geographical barriers that can negatively affect access to education. In this regard, it is explained that individuals living in remote areas might have limited access to higher education institutions due to their geographical isolation; and this geographical isolation implies extensive travel, which can be logistically challenging, time-consuming, and costly (Coke et al., 2023).

In addition, family and personal obligations are also said to constitute a barrier to access to education. In this way, Shreffler et al. (2023) indicate that family responsibilities such as caregiving, work obligations, or family responsibilities can limit individuals' ability to pursue higher education, especially for non-traditional students because it may sometimes be impossible to balance these responsibilities alongside academic pursuits without adequate facilitation. Addressing these challenges, there is a need to establish more flexible educational programs that can provide options for online or a mixture of online and in-person learning modalities in order to help people accommodate individuals or family responsibilities and academic commitments (Imran et al., 2023).

Another limiting factor for access to higher education was evaluated in terms of individuals with health issues or disabilities. People with disabilities might face additional challenges in accessing higher education due to the need for specialized support or accommodations, inflexible programs with fixed schedule; which may not always at their disposal (Dollinger et al., 2023). Health issues calls for an academic program with accessible

facilities, flexible scheduling and a supportive and understanding environment that promotes inclusivity and accommodates diverse health needs (Duggan, 2023).

In her assessment, Chiyaba (2023) highlighted the prevalent insufficiency of facilities within higher education, comprising inadequate student accommodation, lecture halls, libraries, internet connectivity, and online resources. Despite the increase of universities in Africa, the same scholar observed a deficit in the necessary infrastructure to support high-quality learning environments. Addressing the challenge of accessing higher education, Sanga (2023) proposed that African nations should consider internationalizing their universities, promoting the cross-regional movement of students and researchers, and establishing virtual universities by enhancing internet accessibility and digital education. Additionally, it was suggested embracing adaptable educational methods to grant wider access to higher education for everyone (Baloyi, 2023).

In addressing the multifaceted barriers to higher education, it can be evident that the challenges are not insurmountable but require concerted efforts and systemic changes. By recognizing and actively mitigating financial, geographical, familial, and health-related obstacles, we contribute to creating a more inclusive and equitable educational landscape (Shreffler et al., 2023). Whenever there are planned targeted interventions, policy reforms, and a commitment to establish educational programs that embrace diversity and support individual needs, there will be an opportunity to unlock the transformative power of education, ensuring that every aspiring mind has a fair and unobstructed path to higher studies (Duggan, 2023).

2.4.7.2. Access to Higher Education in Rwandan

In Rwanda like many other countries, education has been among the priorities of Government. The Rwandan government believes that improving the quality of education contribute to the economic development (MINEDUC 2019). The Government of Rwanda

(GoR) is committed to strengthening higher education sector in order to make it more relevant, flexible and accessible. This would help universities to deliver, develop and produce highly qualified graduates who are competitive at local, national, and global level. Rwanda has made significant strides in improving access to higher education in recent times. The government has prioritized education as a key component of national development with the goal to boost the enrollment of students in higher education (MINEDUC, 2022).

Higher education in Rwanda is delivered in both public and private institutions of higher education that are categorized as either research-based universities or technical polytechnics. Today, Rwanda counts 31 research-based universities and nine polytechnics (HEC, 2020). The majority of Rwandan Higher education Institutions (92.5%) are private and their funding is mainly from private sources. Generally, these institutions are relatively new, smaller, specialized universities, or transnational institutions like the Unicaf University, Mount Kenya University, and Carnegie Mellon University Africa. Universities and Polytechnics were established as regulatory agencies responsible for the provision of higher quality education so as to train graduates who are able to play their role in building a society with a strong economy and development (HEC, 2020).

Before 1994 genocide against Tutsi, National University of Rwanda was the only one institution delivering higher education in Rwanda (MINEDUC, 2022). While the university graduated only 2,000 students from 1963 to 1994, now Rwanda counts 40 higher educational institutions with a total enrolment of 86,140 students (MINEDUC, 2022). Private higher education institutions dominate the enrolment with 50,421 of which public higher education institutions enrolment are 35,719 (HEC, 2020). Together, private institutions count 57% of all university students in 2019 (MINEDUC, 2020). The overall number of students has doubled within the last ten years while the number of higher educational institutions jumped from 3% in 2005 to around 7.40% in 2019 (MINEDUC, 2022).

As Rwanda is committed to expand access to higher education, one of the best strategies adopted to raise the number of students is to constantly establish both full and part-time programs with the help of ICT to enable open and distance modes of learning (MINEDUC, 2020). Other government initiatives include the offering of scholarships and financial assistance to deserving students, especially those from economically disadvantaged backgrounds to make sure that talented students can access higher education irrespective of their financial situation (Uwizeyimana, 2022). The Government of Rwanda has also initiated new and enhanced existing partnerships with international organizations and foreign universities to enhance quality education and expand learning opportunities for students. (Amutuhaire, 2023). This includes partnerships for curriculum development, faculty training, and student exchange programs. In addition, Rwanda has also invested in online and distance learning programs to reach students in remote areas and provide flexible learning options for individuals who might not have the ability to enroll in traditional universities (Tangwe et al., 2023).

Despite these good initiatives of expanding access to higher education and improving the quality of educational opportunities for its citizens, challenges remain including the need for further infrastructure development, ensuring quality education across institutions, and addressing issues related to affordability and access in more remote regions. As revealed by Hodges (2020), the expansion of full access to learning opportunities requires academic staff to review and harmonize the teaching and learning methods and approaches to be consistent with a more student-centred and practically-orientated philosophy. These learning models, including, blended learning model, as one of online models, requires effective infrastructure and tools that can help educational institutions create a sustainable blended learning environment. As disclosed in the study carried out by Moshtari and Safarpour (2023), in many developing countries including Rwanda, these resources are not fully ready yet though they

recognize the importance of the blended learning model in increasing access to higher education. Although infrastructure and tools are not well established in different developing countries like Rwanda, the ICT integration in education approaches was adopted as one of the responses to COVID-19 pandemic to avoid any disruption in teaching and learning (Uwizeyimana, 2021). The study results disclosed that the main constraints faced by different educational institutions in implementing online teaching and learning strategies include limited access to appropriate and infrastructure and tools, the technical support and training shortage, and the digital gap among learners (Uwizeyimana, 2021).

2.4.8 Impact of the Blended Learning Model on the Access to Education

The current development in technological advancements in education has led to a possibility of adopting new teaching methods. In this regard, many educational institutions have integrated a blended learning approach in their academic programs for students to have easy and flexible access to higher education. The consideration of technology in education sector has significantly contributed to a valuable and conducive learning environment which can result in students' successful academic achievements (John, 2021). Effective application of blended learning requires educational institutions to invest in the correct technological tools for e-learning methods. Once the system is well established, it provides a lot of benefits to both educational institutions and students (Park & Jo, 2018). Looking at the benefits, blended learning approach helps students to increase their engagement and involvement in academic programs, save their time as students' progress at their individual speed, and it enhances student experience as it helps them to access professional resources, and to create connections with other professionals in their domains of study through the application of technology (Alsalhi et al., 2021). In the same view, Biasutti et al. (2021) argues that, as opposed to in-person instructional approach, blended learning approach has various advantages in terms of cost, flexibility and efficient time management.

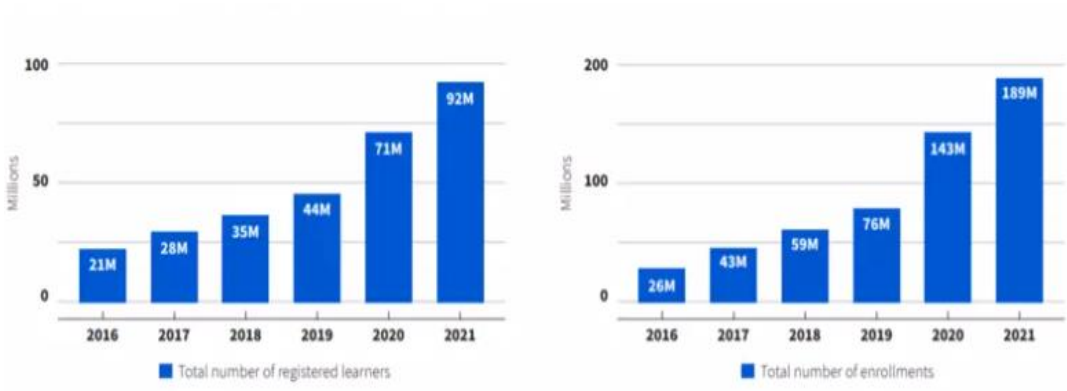
It has been reported that blended learning contributes to the increased accessibility by allowing students to access courses and educational resources remotely and reducing geographical barriers (Buck & Tyrrell, 2022). As a result, this accessibility can attract students who may not have the means or with Inability to participate in conventional on-campus classes because of location constraints or other commitments (Sghir et al., 2023). Additionally, it was disclosed that blended learning provides students with diverse learning options. This offer of a mix of in-person and online learning appeals to students with different learning preferences, as it incorporates multimedia, interactive tools, and self-paced learning, making education more engaging and adaptable to individual needs (Topping et al., 2022). Building on Topping et al.'s point, this would be another motivation for students to register for academic programs in the blended learning model. Another motivating factor is that blended learning is cost-effective. From this point of view, there is a belief that blended learning might be a more affordable alternative for some students, especially those facing financial constraints. In this regard, it can potentially reduce costs associated with commuting, housing, and other expenses related to on-campus education (Abusalim et al., 2020).

One of the core obstacles that many institutions of higher education have faced is the ability to create an effective condition that can facilitate all people to have open access to educational programs regardless their particular learning abilities, lifestyle and location (Oweis, 2018). The integration of blended learning emerged as a resolution to this issue as it provides students with access to educational opportunities from anywhere without necessary being on campus all the time. Because of the utilization of technology in the blended learning approach, online resources can be accessed from anywhere in the world (Harrell and Wendt, 2019). So, blended learning has improved accessibility and inclusion in many academic institutions.

The study results by Bruck (2021) on the perceptions of students toward blended and face-to face instruction revealed that more 70% of students showed their satisfaction with blended instruction and willingness to enroll in more blended courses. The satisfaction with blended learning approach contributes to higher enrolment of students in different forms of online academic programs in contrast to the face-to-face method. It was reported that since 2016, the percentage of students registered for online courses has gone higher annually by around 7 million, but due to the escalation of COVID-19 pandemic, the new registration and enrolment figures moved from 71 million at the beginning of 2020 to 92 million at the end of 2021 (World Economic Forum, 2021). Statistics show that the number of new enrolments in different forms of online educational program has increased by 32% since 2020 (Selvanathan, Hussin & Azazi, 2023). This remarkable increase of student registered and enrolled for online higher education courses implies a global acceptance of online teaching and learning, and it helps universities to have more students in different academic programs. The figure three below shows the global growth of registration and enrolment in online higher education programs.

Figure 4

Global Growth in the Online Education 2016-2021



Source: *World Economic Forum, 2021*

Ultimately, by offering flexibility, accessibility, diverse learning opportunities, and cost-effectiveness, blended learning has played a role in increasing enrolment rates in higher

education. Blended learning enables institutions to provide a broader array of courses and programs, including specialized subjects that may not be offered locally. This expanded variety can draw students who are interested in particular fields of study (Guo et al., 2023). However, the efficiency and effectiveness of blended learning in boosting enrolment depends on various factors, including the quality of online content, technological infrastructure, and the capacity of institutions to respond to the required needs of varied student population (Purnama & Sriliasta, 2023).

2.4.9 Institutional Challenges in the Implementation of Blended Learning

Although the integration of blended learning within educational institutions represents a promising evolution in pedagogy, offering a dynamic fusion of conventional classroom teaching with online learning aspects (Mosha & Luhanga, 2023), different views assert that this transition is not without its complexities and hurdles. As institutions endeavor to implement blended learning models, they encounter a myriad of challenges that span technological, pedagogical, and logistical domains (Hill & Smith, 2023). As pointed out by Brenya (2023), from establishing robust technological infrastructures to fostering faculty readiness and ensuring equitable student access, the path to seamless integration of blended learning poses significant institutional challenges. Hence, navigating these complexities demands a strategic approach, concerted efforts in faculty training, resource allocation, and an unwavering commitment to enhancing the educational experience for all stakeholders involved (Graham et al., 2023).

As various institutions of higher education have integrated blended learning into their existing programs to facilitate the learning of students from various backgrounds (Vanslambrouck et al., 2018), many of them still face institutional challenges in implementing this pedagogical mode. According to Han and Ellis (2019), institutions face contextual difficulties in the integration of blended learning connected to complexity in strategy, structure,

or support. The separate role played by educators and learners in the integration process of blended learning has also not been understood yet as it is still new approach. As the integration of blended learning requires both teachers and students to be digitally-literate stakeholders in the learning process, it has therefore been revealed, especially in developing countries, that digital literacy is still at lower lever (Han and Ellis, 2019). In his empirical literature, Radha (2020) identified both internal and external institutional aspects that affect blended learning successful implementation in educational institutions. Internal factors include teachers' level of digital literacy, attitude towards the utilization of technology in instructional practices and the poor quality of trainings given to teachers for professional growth (Brown, 2019). External influences involve academic workload or interactions with students.

On the other hand, Lai et al. (2018), investigated lecturers' views about the integration and implementation of blended learning model in academic programs. The study results showed that teachers face many obstacles in the implementation process. The highlighted obstacles include lack of new teaching and technological skills, resistance to change, and unwillingness to jarpodize their normal teaching practices by changing their courses into a newly blended format (Vaughan, 2020). All the above-stated factors affect teachers' professional devotion to the application process of the blended model.

As blended learning depends on the technical resources or equipment, its implementation may be disadvantaged by some technical aspects. This challenge is connected to poor and insufficient infrastructures. In numerous developing nations, the number of IT infrastructure is still limited, and it may not allow the smooth implementation of blended instruction. In this regard, access to network infrastructure is still a serious issue for teachers and students (Cassidy & Ahmad, 2019). Depending on the institution and its location, the IT infrastructures are not always accessible in many educational institutions. In addition to poor or insufficiency of IT infrastructures, IT literacy is also another significant obstacle for both

students and teachers when trying to access the course resources needed for blended instruction (Menon & Sujatha, 2019). This implies that basic technology knowledge or willingness to learn is the requirement for both students and teachers in order to have effective integration of blended learning in academic programs of higher educational institutions. This requires the institutions to provide continuous technical and professional support for both students and educators in order to ensure the smooth integration of blended instruction in their academic programs. The smooth implementation of blended instruction requires high technology set up and maintenance costs, which may not easily be affordable for many higher educational institutions.

For Rwanda, different studies in the past reported that Rwanda is among countries that are not at advanced level in terms of digital infrastructure, and yet this is one of the requirements for any educational models that involve online learning modalities. According to the National Institute of Statistics of Rwanda (2018), a small number of the Rwandan total households had access to electricity (27.1%), and 17.2% accessed the internet. For the possession of the electronic and technological devices, it was reported that 3.3% of the households possess a computer, 10.4% have a TV set, 66.9% own cell phones, and 73.8% own a radio post or can access it through their cell phones (NISR, 2018). At a personal level, it was reported that that 36.7% of the Rwandans have a mobile phone, and 10.5% of the youth are computer literate (NISR, 2018). The University of Rwanda (2018), the biggest university in the country, reported that 63% of students have laptops (Uwizeyimana, 2018). This small number of computer literacy and ownership may constitute an obstacle to effectively implementing blended learning in the institutions of higher education in Rwanda, and it may lead to demotivation on the side of teachers and students regarding active participation in the integration of blended learning in their respective institutions.

Through the national digital transformation programs, the current Rwanda's intention is to upgrade digital technologies to boost innovation and creativity in various social and economic areas including education (MINEDUC, 2023). The latest data from the Ministry of Youth and ICT in Rwanda indicate that, at the start of 2023, internet users in Rwanda were 4.25 million (30.5%) of the population. For the mobile phone ownership, the report estimates a total of 10.57 million mobile phones with active connection in Rwanda (Ministry of Youth and ICT, 2023). This quick move of digital transformation in different sectors in Rwanda would facilitate the implementation of any programs that involve online modalities like the blended learning model in education sector.

For successful implementation of blended learning, institutions need to remain committed to addressing the expected challenges. As suggested by Halder (2023) overcoming technological barriers, empowering faculty through comprehensive training, and ensuring equitable access for all students are crucial steps toward a successful integration of this innovative educational model. Additionally, cultivating a culture of adaptability, continuous improvement, and collaboration within educational communities will be pivotal in surmounting these obstacles (Barroso et al., 2023). As institutions persist in their efforts to refine strategies, allocate resources judiciously, and prioritize student-centered learning experiences, Hlazunova (2023) assumes that the promise of blended learning as a transformative force in education would remain achievable. As recommended by Tonbuloğlu & Tonbuloğlu (2023), embracing these challenges as chances for development and transformation, institutions can lay the foundation for a more inclusive, dynamic, and impactful education system in the digital age.

2.5.Summary

The purpose of this chapter was to conduct a comprehensive review of existing literature related to blended learning and access to higher education, with the aim of laying a

strong theoretical and conceptual foundation for the present study. The chapter explored diverse scholarly contributions, theoretical models, and practical perspectives that have been developed in response to the integration of blended learning approaches within higher education systems, particularly in the context of increasing equitable access for diverse student populations.

To provide a structured foundation for the study, the chapter began with an in-depth discussion of the most relevant theoretical and conceptual frameworks. These included Constructivist Learning Theory, Connectivism Learning Theory, Humanism Learning Theory, Technology Acceptance Model (TAM), and Diffusion of Innovation Theory. Each of these theories contributes to understanding how students interact with knowledge, how technology is adopted in educational contexts, and how innovations such as blended learning diffuse within higher education institutions. Their inclusion helped to ground the research in well-established academic thought and offered a framework for analyzing the impact of blended learning from pedagogical, psychological, and technological perspectives.

Following the theoretical grounding, the chapter turned to a critical synthesis of 21st-century educational approaches in higher education. This section examined the shifts in teaching and learning paradigms prompted by digital transformation, globalization, and the demand for flexible learning pathways. Emphasis was placed on student-centered pedagogies, competency-based learning, and the integration of digital tools, all of which align closely with the principles of blended learning. Blended learning was positioned not just as a technical solution but as a pedagogical evolution that aligns with broader trends in educational innovation and inclusivity.

The chapter also provided a detailed overview of the current state of access to higher education in Rwanda, highlighting both progress and persistent challenges. Key barriers such as geographical disparities, socioeconomic inequalities, infrastructural limitations, and limited

institutional capacities were examined. This contextual analysis was crucial for understanding how blended learning can serve as a potential driver of positive change for access in the Rwandan higher education system. The literature pointed to the need for scalable, cost-effective, and flexible learning models to meet the educational needs of a growing and diverse student population.

Attention was also given to pedagogical practices in higher education, especially in environments transitioning toward digital and blended models. The chapter reviewed the strengths and limitations of traditional face-to-face instruction, fully online learning, and the hybrid model that blends both. Blended learning was discussed as a strategic middle ground that enables institutions to maintain interaction and engagement while expanding reach and reducing physical infrastructure constraints. Evidence from previous studies underscored the importance of pedagogical adaptation, including redesigning curricula, training instructors, and rethinking assessment methods to suit blended formats.

One of the core areas of focus was the implementation and practice of blended learning in higher education. Drawing on both global and regional literature, the chapter examined how institutions have adopted blended learning, the types of technologies used, and the instructional models that have emerged. Studies from similar educational contexts emphasized the importance of strategic planning, technological infrastructure, staff development, and student support services in ensuring successful implementation. In Rwanda, a growing number of institutions have begun to embrace blended learning, particularly as a response to the challenges posed by the COVID-19 pandemic, which forced a rapid digital transformation across the education sector.

The chapter then turned to evaluating the impact of the blended learning model on access to higher education. Several benefits were identified, including increased flexibility for learners, reduced costs of attendance, expanded geographical reach, and the ability to cater to

non-traditional learners such as working adults and rural students. Blended learning was found to support inclusive education by offering alternative learning pathways that accommodate varied learning styles, life circumstances, and commitments. Furthermore, when implemented effectively, holds the potential to lower dropout rates, enhance student engagement, and support academic achievement.

However, the review also acknowledged the barriers Encountered by higher education institutions in adopting blended learning models. Key challenges include technological limitations such as poor internet connectivity, insufficient digital infrastructure, restricted availability of digital devices, and low levels of digital competence among students and staff. Pedagogical challenges such as unwillingness to embrace change, lack of training, and difficulties in monitoring student progress in blended environments were also highlighted. Institutional challenges, including inadequate policy support, budget constraints, and weak quality assurance mechanisms, were found to affect the successful scaling of blended learning initiatives.

The literature emphasized the importance of addressing these challenges systematically through targeted interventions, policy reforms, and capacity-building initiatives. Ensuring equitable access to devices and the internet, training educators in digital pedagogy, investing in learning management systems, and establishing national standards for blended learning were recommended as strategies for enhancing the effectiveness and sustainability of blended learning programs.

Throughout the chapter, a wide range of current and credible sources were consulted, including peer-reviewed journal articles, academic books, institutional reports, government policy documents, and relevant online databases. This diverse literature base provided a robust foundation for understanding both the opportunities and limitations of blended learning in expanding access to higher education. The critical analysis and synthesis of these sources not

only identified gaps in the existing knowledge but also helped to frame the current study in a meaningful and evidence-based context.

In conclusion, this literature review has shown that while blended learning offers promising pathways to enhance access to higher education, particularly in resource-constrained settings like Rwanda, its success depends heavily on strategic implementation, stakeholder engagement, and continuous improvement. The insights gathered in this chapter will inform the data collection and analysis processes in subsequent chapters, guiding the exploration of how blended learning is perceived and practiced in Rwandan higher education institutions. As higher education progressively adapts to ongoing technological developments and changing learner needs, blended learning stands out as a transformative approach capable of bridging access gaps and creating more inclusive educational systems.

CHAPTER 3: RESEARCH METHOD

3.1. Introduction

Rwanda is dedicated to building relevant, flexible and accessible higher education that can contribute to the sustainable development of human society at local, national, and international level (HEC, 2020). To achieve this, different higher educational institutions in Rwanda have adopted various online education forms as one of the strategies to facilitate and expand access to education. This decision to adopt various online education forms has motivated a need of research to investigate if these online models really extends learning opportunities in those institutions in Rwanda.

In Rwanda, students' enrolment in higher education institutions was proved to be limited between 1963 and 1994. In three decades of that period, higher education system only graduated about 2,000 students (MINEDUC, 2020). This limited number of graduates is caused by the evidence that higher education in that period was dominated by one public institution which only consisted of in-person and in-classroom learning system (HEC, 2020). With the Rwandan Government's commitment of expanding access to higher education, Rwanda counts now 40 higher education institutions with 179,866 graduates in both public and private higher education institutions (MINEDUC, 2022). Based on these statistics, Higher Education Council (HEC), confirms that since 1994 the enrolment percentage has moved from 3 to 10.4% in higher educational institutions in Rwanda (HEC, 2020).

Face-to-face education has long been said to have some limitations in providing easy access to education, especially to people with busy schedule in terms of personal, social or business responsibilities assigned to them (Staff, 2020). Thanks to the technology advancement, internet has provided an easy access to education that can accelerate learning opportunities from anywhere at any time (Carstens et al., 2021). Although some institutions of higher education in Rwanda have adopted the blended learning mode, as one of the online

education forms, not many studies have been carried out to investigate if this model really extends learning opportunities in Rwanda for students who may prevented from attending colleges due to different reasons such as distance or time. Hence, the goal of this study is was investigate the impact that the blended learning model can have on the access to higher education in Rwanda. Due to its nature, the study consists of mixed-research methods in order to achieve its overall objective and respond to the research questions.

Research methods and data collection are fundamental components of any research, and they are crucial in shaping the validity and reliability the findings. The main aim of this chapter is to examine the research methods and tools employed in data collection and analysis to fulfill the study's objectives and address the research questions. This chapter delves into detailed procedures and methodologies used to uncover insights and draw significant conclusions. By outlining the chosen approach, data collection strategies, and the rationale behind the choice, this chapter establishes the groundwork for understanding the study's complexities. From selecting research paradigms to the specifics of data collection methods, this chapter clarifies the systematic framework used to investigate, analyze, and derive meaningful interpretations from the data collected. This exploration will unveil the methodology and data collection techniques utilized in this study, shedding light on the path taken to acquire invaluable insights and contribute to scholarly discussions. The discussion in this chapter mainly focuses on the approaches and design of this study, study population and Sample, research instruments, Procedures and Ethical Assurances of the study, and data collection and analysis methods.

3.2. Research Approach and Design

The research approach and design constitute the blueprint guiding the investigation's trajectory and shaping the validity of its outcomes (Salter et al., 2023). This section serves as the gateway into understanding the strategic framework and methodological architecture employed in this study. It also reveals the philosophical underpinnings that steer the research

direction, outlining the rationale behind selecting a particular approach. Moreover, it delineates the design elements guiding data collection, analysis, and interpretation. From the overarching research philosophy to the specific methodological choices made, this section illuminates the systematic structure crafted to navigate the complexities of the research landscape. By unravelling the essence of the chosen approach and design, this section lays the groundwork for understanding the study's philosophies and methodologies, how they align with research goals, and their role in facilitating meaningful discoveries.

3.2.1 Research Philosophies and Paradigms

The term ‘Research philosophy’ refers to assumptions about the development of knowledge (Saunders et al., 2019). As outlined by the same author, in the course of research, researchers, whether they are aware of them or not, inevitably need to make various assumptions. These assumptions play a key role in influencing researcher’s understanding of the research questions, methods used and how the findings are interpreted in order to help them create a cohesive research project where all research components align together. As stated by Helskog (2020), research can be carried out in line with various underlying philosophical assumptions which are considered as fundamental beliefs and perspectives that underlie the researcher's approach to studying phenomena. These assumptions guide how researchers perceive the nature of reality, knowledge, and the process of research, and they include but not limited to epistemological assumptions, ontological assumptions, and axiological assumptions (Molina-Azorin & Fetters, 2021)

Epistemological assumptions are the foundational beliefs that guide how researchers perceive knowledge and its acquisition. These assumptions delve into questions about the nature of knowledge, how it is constructed, and the methods used to obtain it ((Saunders et al., 2019). They shape the researcher's stance on what constitutes valid knowledge, whether it's derived from empirical evidence, subjective experiences, or a combination of both (Akotia et

al., 2023). Handema et al. (2023) indicated that epistemological positions vary, with some researchers embracing positivism, emphasizing empirical evidence and the objective pursuit of truth, while others lean towards interpretivism which values subjective experiences and understanding the diverse ways individuals create and interpret knowledge.

Regarding ontological assumptions, they form the bedrock of a researcher's beliefs regarding the nature of reality and existence (Kaukko et al., 2023). In other words, these assumptions revolve around fundamental questions concerning what exists and the nature of that existence. Researchers' ontological perspectives range from realism, positing an objective reality that exists independently of human perception, to constructivism, suggesting that reality is constructed through human experiences and interactions (Bibi et al., 2022). Ontological assumptions profoundly shape how researchers conceptualize the phenomena they study, influencing the methods chosen to investigate them and the interpretations derived from collected data (Valencia-Mazzanti et al., 2023). Acknowledging and understanding these ontological assumptions is crucial as they underpin the researcher's entire approach to studying the world, defining the boundaries within which research inquiries are formulated, conducted, and understood (Akkerman et al., 2021).

For Axiological assumptions in research, they pertain to the values, ethics, and the role of personal beliefs in the research process (Timmermans & Blok, 2021). According to Liu & Tseng (2021), these assumptions explore the researcher's stance on the influence of values, biases, and ethical considerations on the study. In this regard, researchers may navigate between objectivity, by striving for neutrality and minimizing personal biases in their investigations, and subjectivity, by acknowledging and embracing the impact of their values and perspectives on the research process (Kumatongo & Muzata, 2021). In other words, axiological considerations shape decisions about research design, participant engagement, data interpretation, and ethical considerations throughout the study. As stated by Reed et al. (2021),

understanding and being transparent about these axiological underpinnings are crucial as they influence the researcher's approach, the ethical conduct of research, and the interpretation of findings.

As philosophical assumptions profoundly influence the selection of research methods, the interpretation of data, and the overall approach to generating new knowledge within the research, they also lead to the selection of appropriate research paradigms (Coates, 2021). Research paradigms include the fundamental philosophical frameworks that guide the entire research process, and they constitute the researcher's beliefs about the nature of reality, knowledge, and the methods used to acquire knowledge (Hammersley, 2023). Common research paradigms include positivism, interpretivism, and pragmatism (Sanabria et al., 2023).

As a research paradigm, Positivism is rooted in the belief that there is an objective reality existing independently of human perception (Egede & Mahamed, 2023). Tracing its origin, it originates from the contributions of Francis Bacon, Auguste Comte, and the early 20th-century philosophers and scientists collectively referred to as the Vienna Circle (Masuku, 2023). Assuring clear and precise knowledge, positivism is associated with the philosophical position of natural scientists, and it involves observable social reality to formulate generalizations (Saunders et al., 2019). Emphasizing empirical observation and the scientific method, positivism seeks to uncover general laws and regularities governing phenomena. In the positivist framework, knowledge is derived from observable and measurable phenomena, and researchers aim for objectivity, seeking to eliminate biases and subjective interpretations (Fulton et al., 2023). Quantitative methods, such as experiments, surveys, or statistical analysis, are commonly employed in positivist research to gather data and establish causal relationships (Sanchez et al., 2023). Positivism values the replication of findings and aims for generalizability, striving to uncover universal truths. In other words, the foundation of this

paradigm lies in the pursuit of verifiable, objective knowledge through systematic and rigorous scientific inquiry (Treagust, & Won, 2023).

For researchers following the positivist approach, they may utilize established theories to formulate hypotheses, and these hypotheses serve as speculative explanations that can be subjected to testing, confirmation, partial confirmation, or rejection (Matusov, 2023). This process contributes to the ongoing development of theory, which, in turn, may undergo further testing in subsequent research. It's important to note that being a positivist doesn't necessarily require starting with existing theories (Šubrt, 2023). The evolution of natural sciences often involves the collection of data and observations from the world before formulating and testing hypotheses. Interestingly, the original positivists stressed the significance of inductive research, emphasizing empirical data, even though contemporary positivist research tends to be more deductive in nature (Sanchez, et al., 2023). Hence, positivists would aim to maintain objectivity and distance themselves from their research and data to prevent any bias that can impact the research findings (Saunders et al., 2019). This involves conducting research in a manner that is as free as possible from personal values, and positivists find this approach credible due to the measurable and quantifiable nature of the data they gather. In other words, they assert their external stance in the data collection process contending that there is limited opportunity to influence the essence of the collected data Lim, 2023).

As far as Interpretivism is concerned, it diverges from positivism by emphasizing the subjective nature of reality and the importance of understanding human experiences within their social contexts (Lim, 2023). Interpretivism was developed during the early and mid-twentieth century in Europe, and it originates from the contributions of German, French, and occasionally English intellectuals. The purpose of interpretivist research is to create new, richer understandings and interpretations of social worlds and contexts. It encompasses various branches such as hermeneutics, phenomenology, and symbolic interactionism (Crotty 1998).

At the core of interpretivism lies the belief that reality is constructed through human perceptions, interactions, and interpretations (Sanchez et al., 2023). The implication is that researchers operating within this paradigm focus on exploring meanings, intentions, and the complexities of individuals' lived experiences. In interpretivism perspective, researcher use qualitative methods such as interviews, observations, or content analysis to delve into the nuances of human behavior and social phenomena. Rather than aiming for objectivity, interpretivist researchers embrace subjectivity, recognizing that knowledge is context-specific and influenced by the perspectives of both the researcher and the participants (Lucarelli et al., 2023). This paradigm underscores the importance of understanding the diverse ways in which individuals create and interpret their realities within their social and cultural contexts (McChesney & Aldridge, 2019).

Interpretivism, similar to critical realism, emerged as a critique of positivism but from a subjectivist viewpoint. It asserts that humans, distinct from physical phenomena, actively construct meanings, and interpretivists delve into the evaluation of these meanings (Trangbæk & Cecchini, 2023). As indicated by Lucarelli et al. (2023), the central argument of interpretivism is that the study of human beings and their social worlds should differ from the approach taken in natural sciences research, as opposed to attempting to replicate the latter. Similarly, it is indicated that interpretivists contest the positivist endeavor to uncover fixed, universal 'laws' applicable to everyone, instead the underscore that individuals from diverse cultural backgrounds, under different circumstances and at various times, ascribe different meanings, thereby shaping and experiencing different social realities (Friedner-Parrat,2023).

In addition to positivism and interpretivism, pragmatism research paradigm comes to integrate elements from both positivism and interpretivism, with an emphasis on the practical application of knowledge to solve real-world problems (Heinonen & Strandvik, 2022). Originating in the late-nineteenth to early-twentieth century in the work of philosophers

Charles Pierce, William James, and John Dewey, pragmatism aims to reconcile opposing elements such as objectivism and subjectivism, facts and values, as well as accurate and rigorous knowledge with different contextualized experiences (Saunders et al., 2019). As indicated by Kaushik & Walsh (2019), central to pragmatism is the belief that the value of knowledge lies in its usefulness and practicality. Researchers operating within this paradigm prioritize the exploration of multiple perspectives and approaches to understand phenomena. From its standpoint, pragmatism encourages flexibility in research methods, advocating for the use of quantitative and qualitative approaches based on their appropriateness to address specific research questions (Ormerod, 2023). This paradigm values the dynamic nature of knowledge focusing on adapting theories and methods to suit the context and aiming to provide practical solutions applicable to real-life situations. In other words, pragmatism emphasizes the importance of both theoretical understanding and practical implications, seeking to connect theoretical knowledge with its practical application in solving societal problems (Guraya et al., 2023).

Pragmatism, as asserted by Ormerod (2023), contends that concepts hold relevance only where they support practical action. This reconciliation is achieved by evaluating theories, concepts, ideas, hypotheses, and research findings not in abstract terms, but in relation to the roles they play as tools for thought and action by considering their practical consequences in specific contexts (Sanches de Oliveira, 2023). Pragmatists regard reality as significant in terms of the practical effects of ideas, and they value knowledge for its ability to facilitate successful actions. For a pragmatist, Horvath et al. (2023) indicate that the research process commences with identifying a problem and aims to provide practical solutions that can inform future practices. The values of the researcher play a crucial role in steering the reflexive inquiry process, which is initiated by doubt and a perception that something is not correct, and it concludes by reinforcing belief once the problem is resolved (Heinonen & Strandvik, 2022).

Given that pragmatists prioritize practical outcomes over abstract distinctions, their research may exhibit considerable variability in terms of leaning towards 'objectivist' or 'subjectivist' perspectives (Sanches de Oliveira, 2023). The implication from this is that if one were to engage in pragmatist research, the primary determinant for the research design and strategy would be the identified research problem and the associated research question (Ormerod, 2023). The research question, in this context, would likely incorporate the pragmatic emphasis on practical outcomes (Guraya et al., 2023).

Putting all together, the paradigms of positivism, interpretivism, and pragmatism offer distinct lenses through which researchers approach the study of phenomena (Saunders et al., 2019). Positivism, rooted in empirical observation and quantifiable data, seeks objective truths and generalizability ((Egede & Mahamed, 2023). Interpretivism, on the other hand, emphasizes understanding the subjective meanings and social context surrounding human experiences, acknowledging the complexity of reality (Lim, 2023). Pragmatism, as a more flexible approach, prioritizes practical outcomes and aims to reconcile opposing perspectives, valuing the instrumental role of concepts and theories in guiding action ((Heinonen & Strandvik, 2022). Researchers' choices among these paradigms profoundly shape their methodologies, guiding how they frame research questions, collect data, and draw conclusions, and the choice of paradigm depends on the nature of the research question, the context of the study, and the researcher's philosophical stance on the nature of reality and knowledge (Saunders et al., 2019).

In accordance with the research questions and types of data, the research philosophy adopted in this study consisted of the pragmatism research paradigm which involves the elements of the two contrasting research paradigms, namely positivism and interpretivism. This research paradigm was selected in line with the mixed-methods research approach which allows the collection and analysis of both quantitative and qualitative data in the same study (Fulton et al., 2023). The choice of pragmatism, as research paradigm, influenced the research

procedure from the development of research questions to the collection, analysis, and interpretation of data (König et al., 2023). As each paradigm offers distinct perspectives and methodologies for understanding and exploring phenomena (Egede & Mahamed, 2023), the choice of this research paradigm helped the researcher to use surveys for statistical analysis, and interviews together with content analysis for data collection and analysis.

3.2.2 Research Approaches and Design

Research is about gathering data that can lead to informed-decisions (Ziafati-Bafarasat, 2021). In research, there are various approaches to use to design and conduct research. A research approach is described as the series of steps adopted in the research to gather, examine, and decipher data collected (Hoadley & Campos, 2022).The selection of an adequate research approach may be dependent on the nature, the type of data and the philosophy of the study underlying data collection, analysis and interpretation procedures (Myers, 2020). As supported by different scholars such as Easterday (2018), there are three primary research approaches that can be resorted to when conducting studies, namely quantitative, qualitative and mixed approach.

Quantitative research consists of collecting quantifiable data to systematically analyze a research phenomenon (Ahmad et al., 2019). In the same line of thinking, quantitative research approach consists of the methods of collecting numerical data to answer a research question or to verify a research hypothesis using statistical or computational data (Sürücü & Maslakci, 2020). In other words, quantitative research approach uses techniques to collect data that can produce quantified conclusions (Maarouf, 2019). As it relies on positivist paradigm, it uses deductive reasoning, and it depends on more reliable and objective results (Mohajan, 2021). In other words, the validity, reliability and generalizability are the key aspects of this approach. Although quantitative approach can facilitate the straightforward analysis of data and the replication of the test and results, it is also criticized not to facilitate further arguments, and to

only rely on statistical data, which can lead to the broader overlook of relationships (Devault, 2020). It is also argued that quantitative approach may not help to collect in-depth data as it only looks at measurable and numerical data (Saldaña & Omasta, 2018).

As opposed to quantitative approach, qualitative research approach aims at investigating the implication of the individuals' experiences, culture, and how they perceive a particular issue or case (Sutton and Austin, 2022). A qualitative approach explores views rather than statistical perceptions of the world (Borgstede and Scholz, 2021), and this often implies smaller sampling in comparison. Qualitative approach relies on the interpretivist paradigm which favors research methods that focus on individuals' beliefs, motivations, and reasoning to investigate, analyze and interpret a phenomenon using inductive reasoning (Eakin and Gladstone, 2020). While qualitative approach is concerned with interpretive openness, it can contribute to the researcher's subjectivity in data analysis and interpretation process; and it therefore requires approaches to counter-act these to ensure dependability, trustworthiness and transferability (Guenther and Falk, 2021).

As stated by Wilkinson & Staley (2019), researchers should use methods aligning with their research paradigms in order to maximize the chance of collecting data that can lead to a meaningful analysis and interpretation. Building on the pros and cons of qualitative and quantitative methods, researchers and methodologists have adopted the mixed-methods study approach; which is considered as a study approach on its own with its own particular philosophical beliefs and research methods that consider both qualitative and quantitative viewpoints (Poth & Munce, 2020). A mixed-methods research approach integrates qualitative and quantitative methods within a single study by offering a thorough and detailed understanding of the research topic (Hendren et al., 2023). This approach combines the strengths of both qualitative and quantitative methodologies, utilizing their distinctive attributes to provide a richer exploration of complex phenomena (Hirose & Creswell, 2023).

In other words, it involves collecting and analyzing both numerical data (quantitative) and textual or visual data (qualitative) to gain a more holistic understanding of the research question or problem. In this perspective, a mixed-methods approach has many advantages as it combines post-positivist and interpretivist philosophical perspectives, which is often referred to as a pragmatist paradigm (Dawadi, 2021). Mixed- methods research approach puts together quantitative and qualitative approaches by using both types of data in one study (Tzagkarakis & Kritas, 2022). It is also described as an additional major research approach which calls for the collection and analysis of both qualitative and quantitative data in one study (Harris, 2021), or a group of related studies (Johnson & Walsh, 2019). In other words, this methodological approach allows researchers to triangulate data by providing multiple perspectives, and it enables researchers to address research questions that may not be fully understood using a single method alone, offering a more comprehensive and strong interpretation of the topic under investigation.

From the researchers' a point of view, mixed-methods study helps researchers to build on the relationship and advantages of both qualitative and quantitative research approaches; which leads to a deeper comprehension of the research issue (Rohr, 2022). So, if research uses numbers, a quantitative approach is used; if it uses words, a qualitative approach is resorted to; and if it is somewhere in between, mixed-research methods is applied (Dawadi et al., 2021). Mixed-methods study is said to be the most advantageous research approach compared to quantitative or qualitative research approaches since it helps reach and produce data that may not be reached and produced in either of the later method alone (Cresswell and Clark, 2018). Mixed-methods research gives an opportunity to rely on multiple sources of data (Poth & Munce, 2020) in order to comprehensively investigate and understand a phenomenon from different perspectives (Dawadi & Giri, 2021). Using a combination of research methods allows to leverage the advantages of each data type while mitigating their individual limitations. This

approach aims to achieve more robust conclusions from the interpretation of findings gathered from diverse sources (O'Cathain et al., 2019). Researchers use the mixed-methods approach for the expansion of their evidence, improvement of the findings' credibility, and the illustration of the findings from both methods (Bazeley, 2018).

Although mixed-research approach is said to be time consuming, it enhances the quality of data from data collection to analysis level (Hauken et al., 2019). Mixed-methods research approach was determined suitable for this research as its overall objective and research questions require data collected through both qualitative and quantitative approaches. This matches well with the view that the approach of mixed-methods facilitates the process of collecting both qualitative and quantitative data to enrich data analysis and interpretation (Saunders et al., 2019).

3.2.2.1 The Mixed-Methods of the Present Research

In the context of this study, mixed-methods research is particularly well-suited for studying the impact of blended learning on access to higher education due to its capacity to integrate the advantages of both quantitative and qualitative research methods. Blended learning, which combines conventional in-person teaching with digital learning elements,is a complex phenomenon that cannot be fully understood through one method alone (Guttesen, K. (2022). On one hand, quantitative methods in this study can help to provide valuable statistical data on access aspects such as enrolment rates. These numerical findings offer a comprehensive overview of trends and patterns that allow to the identification of statistical relationships and trends (Mertler, 2019). On the other hand, the qualitative component of mixed-methods research enables a more in-depth investigation into the experiences and viewpoints of the study participants. In this study, qualitative approach can facilitate the collection of data in relation the perceptions and experiences of students, educators, and administrators involved in blended learning programs (Emary et al., 2023). Data collected through methods like interviews and

open-ended surveys can help gain insights into the nuances of how blended learning impacts access to higher education. By combining quantitative and qualitative findings, mixed-methods research offers a more in-depth understanding and nuanced picture that enables to draw sound conclusions and make informed recommendations (Hammack et al., 202) for improving access to higher education through blended learning initiatives.

Furthermore, mixed-methods research allows for the validation and triangulation of findings, enhancing the overall reliability and validity of the study (Rodríguez-Sabiote, 2019). Hence, combining quantitative results with qualitative insights can strengthen their conclusions and provide a more comprehensive understanding of the complex interaction between blended learning and access to higher education (Hammack et al., 2022). As stated by Siddiqi et al. (2023), this approach does not only add rigor to the research process but also ensures that the study's findings are more reliable and applicable to a wider range of educational contexts. In the context of exploring the impact of blended learning on access to higher education, a mixed-methods approach enhances the research's ability to generate actionable recommendations for educators, policymakers, and organizations that want to take full advantage of the use of blended learning for wider educational access.

Justifying the adoption of mixed-methods in this study, some research questions require quantitative data to give an overview of the respondents' attitude towards the blended learning model while other sets of questions require qualitative data for deep understanding of that attitude. Hence, both qualitative and quantitative data were collected using an open and closed-ended questionnaire along with structured interviews respectively as data collection tools applied to mixed-methods research approaches. The consideration of qualitative and quantitative methods helped to investigate the study problem with greater precision and in-depth data by approaching it from different perspectives (Hendren et al., 2023). So, the use of mixed-methods approach offers a more comprehensive and multifaceted understanding of

research questions. By considering the strengths of both quantitative and qualitative approaches, it allows to navigate the complexities of the study topic, triangulate data, and gain deeper insights that might elude a single-method study. The mixed-methods approach not only strengthens the validity and reliability of the results but also promotes a more refined and comprehensive understanding of the phenomena being studied.

3.2.2.2 The Concurrent Mixed-Methods Design of the Present Research

The classification of mixed methods encompasses various approaches to combining quantitative and qualitative design elements. These approaches can involve the simultaneous use of both types on an equal footing or with one approach taking precedence, and they may be implemented concurrently or sequentially (Mertler, 2019). Looking at the nature and the research questions, this study uses a concurrent mixed-methods design. A concurrent mixed-methods design involves collecting and analyzing both quantitative and qualitative data simultaneously (Deschenes et al., 2021), and it was particularly found well-suited for studying the impact of blended learning on access to higher education. In this design, data were collected using both quantitative and qualitative methods concurrently, which allows for a more comprehensive and integrated understanding of the research question (Norcott et al., 2021).

Within the framework of blended learning and access to higher education, a concurrent mixed-methods design involved administering surveys and analyzing existing institutional data to gather quantitative information on enrolment rates of students in blended learning programs. Simultaneously, qualitative data were gathered through interviews to delve into students' experiences, perceptions, and the challenges encountered by educators and administrators involved in blended learning initiatives. Combining these two types of data collection and analysis in a concurrent manner helped to explore the statistical relationships and trends and delve into the lived experiences and contextual factors that influence the impact of blended learning on access to higher education. As indicated by Emary et al. (2022), the simultaneous

integration of quantitative and qualitative findings allows for a more robust and holistic interpretation of the research results, offering a richer understanding of the complexities involved. Hence, for the interests of this study, the concurrent mixed-methods design found advantageous as it provides a real-time synthesis of both types of data, which helps researchers to compare, contrast, and corroborate findings (Hammad & Bush, 2023). This integrated approach enhances the validity and reliability of the study (Baddianaah et al., 2023) by ensuring that the research outcomes are more comprehensive and meaningful for informing educational practices and policies related to blended learning and higher education access (Weidner et al., 2021).

For this study, 10 higher education institutions in Rwanda were used to collect data in order to investigate the impact of the blended learning model on the access to higher education in Rwanda. To mitigate the concern of some researchers that generalization of the findings from the case study may not always be reliable (Rashid, 2019), various institutions were chosen for this research, and they were therefore selected to enhance credibility and generalizability of data. As blended learning is described as an educational model which generally combines both face-to-face and online instruction through the application of student-centred instructional strategies (Ayoo and Lubega, 2020), the considered institutions were selected as they all have a common feature of having this model in their academic programs.

Briefly, a mixed-methods study approach and concurrent mixed-methods design were adopted in this study in order to collected data that can help to achieve the study general objective and respond to the research questions. The selected approach and design require the methods of gathering both qualitative and quantitative data to respond to all study questions and to investigate the impact of blended learning model on the access to higher education in Rwanda. To strengthen the transferability of the study data, different institutions of higher education were selected, and it would allow to collect data from various institutions of higher

learning in Rwanda that have the blended learning model in their academic programs. This would enhance confidence and certainty in the study findings which will be collected and analyzed using triangulation method (Campbell et al., 2020). In line with the research approach and design, questionnaire and semi-structured interviews were used as data collection tools, and the data were collected concurrently to enhance data triangulation. In this regard, a few questions were predetermined to keep the focus of the study, and follow-up questions were asked wherever necessary during the interviews to get in-depth information about the attitudes and beliefs of the study participants regarding the blended learning model in their respective educational institutions.

3.3. Population and Sample of the Research Study

An important step that researchers take in designing their studies is to identify the population that they want to draw conclusions about (Umair, 2019). All research studies involving human subjects must define the specific population that the research intends to study, and from which the sample is calculated to facilitate data collection and analysis process. In other words, study population can be referred to as the whole group of people that the research findings are applied to (Shukla, 2020).

Understanding the population and sample of a study is fundamental to understand the scope, relevance, and generalizability of its findings (Bhardwaj, 2020). This section focuses on defining the specific demographic, geographic, or other defining characteristics of the population under this study. It clarifies the rationale behind the selection of the population and the sample from the larger population explaining the factors that influenced the selection process. By detailing the criteria that guided the sample selection and its representation of the study population, this part establishes the foundation for interpreting the study's conclusions within the context of the targeted population. Exploring the complexities of defining the population and selecting the sample sheds light on the methodological decisions that shape the

study's credibility by providing a deeper understanding of how the findings relate to or can be applied to the whole study population.

3.3.1. Population of the Research Study

Using online survey and semi-structured interviews, the study was carried out in 10 higher education institutions in Rwanda having the blended learning model in their academic programs. The study was conducted with the aim to investigate the impact of the blended learning model on the access to higher education in Rwanda. Due to the study design, the population in this study includes university students and lecturers from whom data were collected by the use of online survey, and academic registrars together with IT senior staff with whom semi-structured face-to-face interviews were held. The study only targets students who pursue their academic programs in the blended learning model and their lecturers, academic registrars and IT senior staff, who usually play a daily significant role in providing adequate IT support to ensure that everything goes well in teaching and learning inside and outside classroom. This population was selected as the right population for this study as they meet the criteria of assuming different responsibilities in the blended learning model in their respective academic institutions.

The total population in this study consisted of 310 people. This number includes 240 students who are currently doing their academic program in the blended learning model, 50 lecturers who teach different modules in the blended learning program, 10 academic registrars and 10 ICT senior staff from the target higher education institutions. The study only considered pre-final and final year students in each institution of higher education as they have enough experience with the blended learning model.

Table 1

Total Study Population by Higher Education Institution

University	Total Population/ Students (for the survey)	Total Population/ Lecturers (for the survey)	Total Population/Registrars (for interview)	Total Population/IT Senior staff (for interviews)
University A	40	5	1	1
University B	24	5	1	1
University C	22	5	1	1
University D	21	5	1	1
University E	25	5	1	1
University F	24	5	1	1
University G	26	5	1	1
University H	19	5	1	1
University I	19	5	1	1
University J	20	5	1	1
TOTAL	240	50	10	10

Source: Researcher

3.3.2.The Sample of the Study

Researchers are rarely with the ability to investigate the whole target population as it is not always easily accessible (Campbell, 2019). Even when population is relatively small, it is not frequently practical and possible to collect data about everybody from the population. To

make it more practical, researchers usually select a sample, which is described as a manageable subset representing the whole target population (Bhandari, 2022). While study population is described as the whole group that researchers target to make conclusions about (Umair, 2019), a sample is referred to as the specific group that researchers intend to gather data from (Andrade, 2020). Samples play an important role in research as they serve as a representative subset of a larger population under study. They act as a lens through which researchers gather insights, draw conclusions, and make inferences about the broader group from which they are selected. Samples have to selected carefully to reflect the diversity, characteristics, and key attributes of the population to ensure that findings derived from the sample can be generalized or applied to the larger population with a reasonable degree of confidence (Perry, 2023).

The main purpose of the sample is to facilitate the researcher to carry out the research to people from the whole target population so as to apply the study findings to the entire population (Kraemer, 2019). Looking at the main functions of both study population and sample population, they play a complementary role in what Lakens (2021) called a 'give-and-take' process. In this process, the population gives the sample, and, in turn, it draws conclusions from the data collected from the sample (Lakens, 2021).

Generally, a sample in research studies must be large enough to assure a good representation of the entire study population and to facilitate the generalizability of the data (Andrade, 2020). However, it is also stated that if the sample is too large, data may become more monotonous, costly and harder to interpret (Bhandari, 2022). The sample therefore must effectively represent the whole study population, and the principle of 'no more and no less' must be applied for the adequate size (Casteel & Bridier, 2021).

The study sample consists of 220 individuals from whom data were collected by the use of both online survey and semi-structured interviews. For the survey, the study sample comprised 150 students and 50 lectures (cf. Table 3.1). For the semi-structured face-to-face

interviews, the study sample was composed of 10 registrars and 10 IT senior staff from all the selected institutions. The sample of students was calculated with the help of Slovin's formula. For lecturers, the study considered at least 5 lecturers who teach some modules in the blended learning in each institution of higher education. All academic registrars and IT senior staff were purposely considered since each institution has 1 academic registrar and 1 IT senior staff. Slovin's formula considers the total population (N) and a margin of error (e) to obtain a representative sample. In calculating the sample with the formula, a confidence level of 95% was used, which leads to a margin error of 0.05. The formula works as follows:

$n = N / (1+Ne^2)$ whereas:

n = no. of samples

N = total population

e = error margin / margin of error

Hence, the application of the formula to the student population gives: $n= 240 / (1 + 240 * 0.05^2) = 150$ students for the survey.

Table 2

The Sample Student by the Selected Higher Education Institution

Institution	**Total Population (students)**	**Sample Students for the Survey**
University A	40	25
University B	24	15
University C	22	14
University D	21	13
University E	25	16

University F	24	15
University G	26	16
University H	19	12
University I	19	12
University J	20	12
TOTAL	**240**	**150**

Source: Researcher

Table 3

The Total Sample Size of the Study

Students (for the survey)	**Lecturers (for the survey)**	**Academic Registrars (for interviews)**	**IT Senior staff (for interviews)**	**Total**
150	50	10	10	240

Source: Researcher

As this sample was calculated using a scientific formula considering both confidence levels and margins of error, the sample of 220 is judged to accurately represent the whole study population of 310. The consideration of confidence levels and margins of error in sample calculation reflects the assumption that statistics are not always right; and there is always a room for error (Stephen, 2022). Thus, confidence levels and margins of error help researchers know the percentage that their study results may differ from the real population value. This is also in line with the view that the highest error of estimation is an index of the precision of an estimate and is described as part of a confidence interval (Donna et al., 2022).

The choice of an adequate sampling method is an important step to ensure the sample size sufficiency which reflects the characteristics of the target group (Nelson, 2019). In this study, both purposive and census sampling methods were complementary resorted to in the process of sample selection. Purposive sampling method was chosen as all the selected educational institutions for this study must meet the criteria of having the blended learning model in their academic programs. This makes it simple and straightforward to the study objectives (Campbell et al., 2020). For Census method, no sample is needed. Data is collected from each and every element or unit of the population (Van Haute, 2021). This is applicable when the study population is limited. As every item of the population is taken into account, a lot of views support that census sampling method can lead to more accurate and reliable conclusions (Bhardwaj, 2020).

In this study, purposive sampling method was used in choosing only students and lectures who have participated in the blended learning model, while the census method was used in considering every academic registrar and senior IT staff in each higher education institution considered in this research. To collect data, a mixed-methods approach was applied; and questionnaire in the nature of a Google Form was designed for both selected students and lecturers. To complement the data collected from 150 students and 50 lecturers using an online survey, semi-structured face-to-face interviews were also held with 10 academic registrars and 10 IT senior staff from all the selected institutions. In this regard, as each institution has one academic registrar and one IT senior staff, the interview was held with the academic registrar and IT senior staff from each of the selected institution.

3.4. Instrumentation of Research Tools

There are different ways of collecting research data. Data collection tools design depends upon the research approach and design (Zhang, 2021). Research is usually planned in line with a problem that needs to be addressed (Bachman et.al, 2019). Research instruments

are the tools and techniques utilized by researchers to gather data, measure variables, and investigate phenomena within a study (Lazenby et al., 2023). These tools include a diverse array of methods such as surveys, questionnaires, interviews, observations, experiments, and tests. The choice and application of these instruments play a crucial role in shaping the quality and richness of research outcomes, directly affecting the validity and reliability of the conclusions derived from the gathered data (Nguyen & Habók, 2023). This means that research tools are also chiefly designed based on the study objectives and questions. As this study relies on mixed-methods approach, both qualitative and quantitative data were collected. The combination of both types of data contributed to the complementarity and dependability of data (Zohrabi, 2019).

Research instruments are tools used in the process of gathering, measuring, and interpreting findings collected in relation to the research objectives (Buntins et al., 2021). Looking at the study objectives and design, a mix of data collection tools is needed for data triangulation to achieve the study objectives. Hence, data were gathered from multiple sources through the use of an online questionnaire composed of open and closed-ended questions along with faced-to-face semi-interviews as data collection tools applied to mixed-research approaches.

For the purpose of ensuring validity and reliability, a standardized preparation approach was followed. The survey and interview guides were developed in alignment with the study objectives, pilot tests were conducted to assess clarity and relevance, and the tools were subsequently reviewed and finalized based on feedback from the pilot study and the research supervisor. The research tools were eventually approved by the Unicaf Research Ethics Committee (UREC). For the process of data collection, the researcher used the approved documents by UREC (included in the appendices) to ask for an institutional permission and the consent from the participants for ease access to the university premises and the participants.

3.4.1. Questionnaire

A questionnaire is a fundamental tool for primary data collection in mixed-methods studies (Rose et al., 2020). In this study, the questionnaire was carefully designed to collect comprehensive data on the impact of blended learning on access to higher education in Rwanda. It included a variety of question types, such as closed-ended and open-ended questions, Likert scale questions, and questions generating nominal and ordinal data. This diverse combination of question formats ensured a balanced approach to data collection, allowing for both quantitative and qualitative insights.

As Sah (2020) highlights, open-ended questions in surveys contribute significantly to discovery by providing in-depth responses. Unlike interviews, surveys with open-ended questions can be administered to a larger number of respondents while maintaining respondent anonymity. This anonymity encourages honest and thoughtful responses, which enhance the richness of the collected data. On the other hand, closed-ended questions, including Likert-scale items, facilitated structured data collection, making it easier to quantify responses and perform statistical analyses.

To ensure the questionnaire's reliability and validity, a standardization process was undertaken. First, a pilot study was carried out to assess the clarity, relevance, and ease of understanding of the questions.Feedback from the pilot study allowed for refinements in wording and structure to eliminate ambiguities and enhance the questionnaire's effectiveness. Furthermore, expert validation was sought to confirm that the questionnaire adequately captured key variables aligned with the study's theoretical framework, including Constructivism Learning Theory, Connectivism Learning Theory, Humanism Learning Theory, the Technology Acceptance Model, and the Diffusion of Innovation Theory.

The questionnaire targeted both students and lecturers, ensuring a comprehensive understanding of blended learning's impact from multiple perspectives. Given the respondents' availability and the need for efficient data collection, the questionnaire was distributed online via Google Forms. Online administration facilitated timely responses, increased accessibility, and resulted in a higher return rate compared to traditional paper-based surveys. Additionally, digital distribution allowed for automated data collection, reducing errors and improving data management for subsequent analysis.

3.4.2. Interviews

Interviews are also an effective data collection tool in mixed-methods research, providing in-depth qualitative information. De Fina (2019) asserts that interviews are particularly useful for qualitative data collection, especially when the researcher seeks direct and detailed information from study respondents. Individual interviews serve as a vital method for gaining deep insights into how people perceive, understand, and experience a particular phenomenon (Frances & Coughlan, 2019).

In this study, a 10-minute in-person semi-structured interview was conducted with 10 academic registrars and 10 IT senior staff from 10 higher education institutions. Thus, the estimated time of interviews were approximately 200 minutes (20x10), and they were conducted with the help of a tape recorder. The semi-structured format allowed for a balance between structured inquiry and the flexibility to explore emerging themes through probing questions. Conducting in-person interviews facilitated deeper engagement, enabling the researcher to observe body language and facial expressions, which added contextual depth to the responses (Johnson et al., 2020).

To ensure the reliability and validity of the interview process, a standardized preparation approach was also followed. Initially, an interview guide was developed, outlining

key questions based on the research objectives and theoretical framework. The guide included open-ended questions designed to encourage detailed responses while allowing room for follow-up questions and deeper exploration of topics.

A pilot test was performed with a small group of participants to refine the interview questions, ensuring clarity, relevance, and comprehensibility. Feedback from the pilot test helped adjust the wording of questions and improve the overall flow of the interview process. Additionally, the validation from the study supervisor was sought to confirm that the interview questions effectively captured the study's key variables.

3.5. Study Procedures and Ethical Assurances

Study procedures refer to the detailed plans and steps involved in conducting a research study, and these procedures outline how data will be collected, the specific methodologies to be used, and the sequence of activities throughout the research process (Berkovich & Grinshtain, 2023). They encompass various aspects such as participant recruitment, data collection methods, data analysis techniques, and the dissemination of findings. Ethical assurances are described as the principles and guidelines that researchers follow to ensure the ethical conduct of their studies (Kambhampati et al., 2023). As reported by Burr and Leslie (2023), this includes obtaining informed consent from participants, protecting their confidentiality and privacy, minimizing risks, providing potential benefits, and ensuring that the research does not cause harm to individuals or communities involved. Ethical assurances also involve obtaining approval from institutional review boards or ethics committees, adhering to professional codes of conduct, and following established guidelines and regulations to maintain integrity and trustworthiness in research practices and uphold the rights and well-being of participants and maintaining the credibility and validity of the research findings (Schutte et al., 2023).

In essence, solid research procedures and ethical assurances are the twin pillars that uphold the integrity and credibility of any study (Huda et al., 2023). As stated by Kambhampati (2023),

the meticulous design of research procedures, encompassing a detailed roadmap of data collection and analysis, ensures the reliability and validity of the research findings. Simultaneously, ethical assurances serve as the moral compass guiding researchers toward responsible and respectful engagement with participants, safeguarding their rights, well-being, and privacy (Powell, et al., 2023). Based on their complementary role, both research procedures and ethical assurance do not only strengthen the trustworthiness of research findings but also signify a commitment to upholding the highest standards of scientific research, by fostering a foundation of accountability, transparency, and ethical conduct within the realm of research endeavors (Burr & Leslie, 2023).

As study procedures, ethical considerations and the protection of participants are important aspects of conducting a scientific research (Berg, 2019), before the process of data collection in this study began, the Unicaf Research Ethics committee (UREC) approved the research. For validity and reliability purposes, all the research tools were consistently created in conformity with the study aims and objectives, reviewed, and finalized following the comments provided by the research Supervisor prior to his approval. In addition, the researcher also requested for an institutional permission for easy access to the university premises and the participants.

For ethical assurance in data collection and analysis process, the point of informed consent, participants' anonymity and confidentiality must be taken into consideration (Horton & Lucassen, 2022). At the very beginning of that process, the researcher clarified the main goal of the study to the participants and clarified that the role of the researcher in this study is to collect and analyze their personal and professional experience with the blended learning model and its impact on access to higher education. In this regard, an agreement for voluntary participation was requested and obtained from the participants before data collection process started. To keep privacy and anonymity of the participants in data collection and analysis process, an online questionnaire was distributed with a required option for the participants to consent for voluntary participation in the research or not. If they don't consent, they were allowed to leave the questionnaire incomplete.

For the participants' confidentiality during interviews, a signed consent was requested from the interviewees, and detailed explanations of the research purpose were also given to them before the interview commenced. In addition, interviews were conducted in a safe place, and the participants' names were not put anywhere in the study. Only specific codes were resorted to in the place of interviewees' names. The participants were informed that interview is an individual interaction with the researcher, and information from the interview must remain confidential and must only be used for the study purpose.

3.6. Data Collection and Analysis

Data collection and data analysis are interrelated processes (Niraula, 2019). Data analysis is all about making sense out of research data (Harris, 2021). Data collection involves the systematic gathering of information or data for research purposes. As stipulated by Verd (2023) this process can take various forms depending on the nature of the study, including surveys, interviews, observations, experiments, and archival research. The main goal is to gather relevant and accurate data that can be analyzed to answer the research questions or test the hypotheses.

After the data is collected, the analysis phase begins. This involves examining, interpreting, and organizing the gathered information to derive meaningful insights and make conclusions (Nneoma et al., 2023). This can involve statistical techniques, qualitative analysis methods, or a combination of both, depending on the type of data collected and the research objectives (Pitts et al., 2023). The aim of data analysis is to uncover patterns, relationships, and trends within the data, in order to allow researchers to make informed interpretations and enhance the overall understanding of the topic under investigation (Rangineni, 2023). Based on their importance, Nguyen and Habók (2023) highlight that effective data collection and

rigorous analysis are fundamental components of producing credible and reliable research findings.

As stipulated by Hammer (2019), the selection of a data analysis approach usually counts on the questions asked and data obtained in data collection process. Mixed-methods approach is said to be more advantageous than pure quantitative or qualitative approaches as it produces data which cannot be produced in either method alone (Johnson et al., 2019). Hence, the application of mixed- methods to this research helped to gather triangulated data to achieve the study objectives. The triangulation contributes to the complementarity and dependability of data (Zohrabi, 2019), and it facilitates validation of data through cross verification from different sources (Bhandari, 2022). The research data were gathered by the use of an online questionnaire together with face-to-face semi-structured interviews as data collection tools applied to this mixed-methods study.

As a mixed-methods study, data analysis therefore consisted of triangulation analysis method, which is a technique to analyze results of the same study gathered through different methods of data collection (Noble & Heale, 2019). In this regard, quantitative data that were collected in the form of nominal, ordinal and numerical data need to be summarized, described and analyzed using cross tabulations (Borgstede & Scholz, 2021). To display the analysis outcome of quantitative data, tables, bar charts, Pie chart, diagrams, and statistical test were used.

3.6.1 Statistical Tests for Quantitative Data Analysis

Statistical tests are essential in quantitative data analysis, as they offer a structured and objective approach to derive meaningful conclusions from data sets (Han et al., 2023). In the area of quantitative research, where numerical data is collected and analyzed, statistical tests serve as powerful tools for assessing relationships, patterns, and the significance of findings

(Rahnenführer et al., 2023). These tests help to make informed decisions about hypotheses and generalizations based on the sample data, which offers a level of confidence in extending those conclusions to a larger population (Macdonald et al., 2023). The primary objectives of statistical tests include determining whether observed differences or relationships in the data are statistically significant or merely the result of random chance (Ordak, 2023). They also assist in quantifying the intensity and nature of relationships between variables. By applying statistical tests, it is possible to assess the reliability of their findings, identify patterns that may exist within the data, and make informed inferences that contribute to the overall validity of the research outcomes (Burrill & Pfannkuch, 2023).

Selecting the appropriate statistical tests for a study is a critical decision that directly influences the accuracy and consistency of research findings (Han, 2023). The choice of statistical tests depends on several factors, including the study design, research question, nature of the data, and the level of measurement (Ahmed et al., 2023). In the context of a study investigating the impact of blended learning on access to higher education, a range of statistical tests can be applied to analyze and interpret the data. The possible statistical tests for this study include descriptive statistics, inferential statistics, correlation analysis, regression analysis, multivariate analysis, time series analysis, and propensity score matching.

a) Descriptive statistics

Descriptive statistics can be applied to this study as they condense large amounts of data into manageable summaries (Hung, et al., 2023). Measures such as the mean, median, mode, and percentiles offer a quick snapshot of the central tendency and variability within the dataset (Habtegebriel & Valdramidis, 2023). In the context of this study, descriptive statistics can be used to describe the central tendency of variables such as student enrolment rate, attendance, or engagement trough the calculation of Mean, Median, and Mode, and to measure

the dispersion or spread of data around the mean through the calculation of Standard Deviation and Variance (Kaur & Yellapu, 2019).

Descriptive statistics, being useful for summarizing data, exhibit notable weaknesses when applied to intervention studies (Silverman, et al., 2023) like studying the impact of blended learning on access to higher education. One significant limitation is their inability to establish causation; as they lack the capacity to reveal cause-and-effect relationships (Hung et al., 2023). Furthermore, in the context of this study descriptive measures may oversimplify the complex dynamics involved in the impact of blended learning, potentially missing critical nuances and variations in student access. Descriptive statistics are also sample-specific, and without inferential methods, generalizations to the broader population may be unfounded (Wan et al., 2023). Hence, they may not adequately address confounding variables or offer insights into changes over time, which may require the incorporation of more sophisticated statistical techniques and research methodologies (Cheng et al., 2023) to overcome these limitations and derive a thorough understanding of the intricate relationship between blended learning and access to higher education.

Additionally, as descriptive statistics provide basic summaries, such as means, medians, and standard deviations, which offer insights into the central tendency and variability of the data (Kaur & Yellapu, 2019), they may however fall short in uncovering the nuanced relationships and patterns (Idrees et al., 2023) that exist within the dynamics of blended learning environments. Moreover, as access to higher education is shaped by a variety of factors such as socio-economic backgrounds, institutional policies, and individual learning preferences (Wanti et al., 2022), these may not be fully captured by simple summary statistics. Based on its limitations, descriptive statistics alone may not provide the depth of insight

required to unravel the complexities of how blended learning influences access to higher education (Beckmann et al., 2023).

b) Inferential Statistics

Inferential Statistics are also part of tests that can be applied to this study. The main purpose of inferential statistics is to make inferences, predictions, or generalizations about a population based on a sample of data drawn from that population (Hazra, 2023). Inferential statistics involve using sample data to draw conclusions about characteristics, relationships, or trends in a larger population that the sample represents (Amrhein et al., 2019). Inferential statistics can be used through independent t-test to compare means between two groups (Janczyk & Pfister, 2023). In the context of this study, for example, they can be applied to compare students in traditional and blended learning environments for a particular variable, or through the Paired t-test to compare means within the same group before and after the implementation of blended learning.

Additionally, inferential statistics can be applied through Analysis of Variance (ANOVA) to compare means among more than two groups ((Janczyk & Pfister, 2023). This can be helpful in this study only if there are different forms or levels of blended learning. Another possibility of applying inferential statistics is to use Chi-square test to assess the association between categorical variables, such as access rates based on demographic factors (Han et al., 2023). This is what the study used when investigating the impact of blended learning. The impact was investigated by assessing the attitudes of respondents toward blended learning based on demographic factors such as age, sex, types of respondents, etc.

Inferential statistics has been proved to be effective in the intervention studies as they enhance the rigor and depth of the study phenomenon under investigation (Ng'ambi et al.,

2023). Its effectiveness in the study on the impact of blended learning on access to higher education relies in its the capacity to extend findings from a sample to the broader population (Black, 2023). Using inferential statistical tests such as Chi-square test in this study would enable the ability to make informed and generalizable conclusions about the relationship between blended learning participation and access outcomes. It would also facilitate the identification of statistically significant patterns or trends in the data, helping researchers discern whether observed effects are likely to be representative of broader populations (Adetayo et al., 2023). In the context of blended learning and access to higher education, inferential statistics provide a rigorous and systematic framework to examine the significance of the observed relationships, which contributes to a deeper understanding of the factors influencing access in blended learning environments.

c) Correlation Analysis

Correlation analysis is a statistical technique used in research to evaluate the magnitude and orientation of the linear association among two or more variables (Ding & Du, 2023). The goal is to determine if, and how strongly, variations in one variable correspond to changes in another (Talaat & Gamel, 2023). In the context of this study on the impact of blended learning on access to higher education, correlation analysis can be a useful statistical tool to explore relationships between the study variables. As an example, in the study context, correlation analysis can be applied to quantify the degree to which participation in blended learning environments is associated with increased access to higher education. This numerical measure would facilitate a clearer understanding of the impact, and it would assist in comparing the strength of associations across different demographic groups or academic contexts (Akour et al., 2023). Additionally, this method can allow researchers to identify whether there is a consistent and statistically significant relationship between the study variables (Pakkan et al.,

2023). The results can then be used as a guide for educators and policymakers in making informed decisions about the implementation and optimization of blended learning strategies to enhance access to higher education.

Although correlation analysis is a valuable tool for assessing relationships between variables Ding & Du (2023), its limitations may restrict its effectiveness in studying the impact of blended learning on access to higher education comprehensively. As indicated by Schroedler et al. (2023), correlation analysis primarily examines linear associations, assuming a straightforward and proportional relationship between variablesWhen considering blended learning in relation to access to higher education, the relationship is likely to be complicated and influenced by various factors, including student demographics, institutional policies, and technological infrastructure. Hence, correlation analysis might oversimplify these complexities, potentially missing nuanced patterns or non-linear associations that play a role in determining access outcomes (Oakley-Girvan et al., 2023). Moreover, as correlation does not imply causation (Jang & Park, 2023). In the context of this study, even if a positive correlation is identified between blended learning participation and increased access, it cannot be assumed that blended learning directly causes improved access, as other factors may be at play. Consequently, establishing a causal link between blended learning participation and improved access may require more advanced research designs, methods, and additional statistical techniques (Pakkan et al., 2023) to obtain a more understanding of the dynamics between blended learning and access to higher education.

d) Regression Analysis

Regression analysis is a statistical method used in research to explore and model the relationship between one dependent variable and one or more independent variables to understand how changes in the independent variables are associated with changes in the

dependent variable (Sinha-Ray& Goel, 2023). As stated by Olaniyi et al. (2023), regression analysis provides a mathematical equation that represents the relationship that allows predictions and hypothesis testing.

In this study, the dependent variable might be the level of access to higher education, while independent variables could include factors related to blended learning participation, demographic characteristics, and technological readiness. For instance, a multiple linear regression model could be employed to assess the combined influence of various factors on access (Cruz-Sandoval et al., 2023). The coefficients associated with blended learning variables would indicate the strength and direction of their impact, offering insights into how increased engagement with blended learning might contribute to improved access. As part of regression analysis, logistic regression can also be used to identify other significant predictors that can facilitate a more comprehensive understanding of the contributing or hindering factors of the access to higher education in a blended learning setting (Kim et al., 2023). It can enable the development of predictive models which can guide educational institutions and policymakers in optimizing strategies to enhance access for a diverse student population (Supsermpol et al., 2023).

While regression analysis is an important statistical tool, its effectiveness in studying the impact of blended learning on access to higher education may be limited under certain conditions. One significant challenge is the potential for the presence of unobserved or omitted variables that are critical in understanding the complexities of access dynamics in blended learning environments (Howell-Moroney, 2023). If important factors influencing access, such as socioeconomic backgrounds or institutional policies, are not included in the regression model, the estimates of the relationship between the study variables may be biased or incomplete (Zhang et al., 2023). Additionally, the assumption of linearity inherent in regression

models may not accurately reflect the complex and potentially non-linear relationships that characterize the complex nature of blended learning and its impact on access. As commented by (Kim et al. (2023) the method's susceptibility to outliers and the potential for multicollinearity could further undermine the reliability of regression results. Therefore, when applying regression analysis, there must be a consideration of supplementing it with other methods, such as multivariate analyses or qualitative approaches (Silvestri et al., 2023) in order to offer a deeper and broader insight into the factors affecting access to higher education in the context of blended learning.

e) Multivariate Analysis

Multivariate analysis techniques can be applied to obtain a fuller and more detailed insight into the nuanced relationships the nuanced relationships among various factors influencing study variables (Kifor et al., 2023). As stipulated by Muniz & Oliveira-Filho (2023), this method allows for a more sophisticated exploration of complex interactions and patterns within the data, enhancing the depth and accuracy of research findings. Multivariate Analysis can be applied through Multivariate Analysis of Variance (MANOVA) to analyze the differences in multiple dependent variables among groups (Winarni, 2023).), or Principal Component Analysis (PCA) to reduce dimensionality and identify patterns or clusters in the data to explore complex relationships among multiple variables simultaneously (Petrillo et al., 2023).

In the study investigating the impact of blended learning on access to higher education, multivariate analysis can serve as a powerful analytical approach to unravel the complex relationships among multiple variables (Ghosh et al., 2023). For instance, Multivariate Analysis of Variance (MANOVA) can be applied to examine if there are statistically significant differences in access across various demographic groups or levels of blended learning

engagement, considering multiple dependent variables simultaneously. Principal Component Analysis (PCA) or Factor Analysis can help identify underlying patterns among various factors (Messaoud et al., 2023), which can assist in the reduction of dimensionality and pinpointing the most influential components that contribute to variations in higher education access outcomes.

While multivariate analysis offers a solid set of tools for exploring complex relationships among multiple variables, some scholars like Cheek et al. (2023) commented that it may not always be the most effective approach for certain aspects of intervention studies like a study on the impact of blended learning on access to higher education. The application of multivariate methods often demands a considerable amount of data, and if the dataset is limited or lacks diversity, the results may be susceptible to overfitting or inadequate representation of the population under study (Sacre et al., 2023). Moreover, if the underlying assumptions of multivariate techniques are not met, such as normal distribution of variables or linearity, the reliability of findings may be compromised (Chen et al., 2023). Additionally, the complexity of blended learning environments and access to higher education may involve non-linear relationships or contextual factors that are not easily captured by traditional multivariate methods, which may require complementary qualitative approaches or more specialized analyses to provide a comprehensive understanding of the study's objectives (Shin & Enomae, 2023).

f) Time Series Analysis

Time series analysis is a powerful tool in research which is commonly used in different discipline, particularly in fields where data is collected over time (Kahraman & Akay, 2023). It involves studying and modeling the patterns, trends, and behaviors exhibited by a set of observations or measurements taken at successive points in time (Wen et al., 2020). Time series

analysis can highly be suitable for studying the impact of blended learning on access to higher education as it allows for the systematic examination of data collected over time, offering insights into evolving trends and patterns (Li et al., 2029).

In the study context, time series data could involve enrolment figures and student participation rates over successive academic terms or years. By employing time series techniques, it is possible to identify temporal variations in access to higher education as a result of implementing blended learning models. Additionally, time series models can facilitate forecasting future trends, enabling educational institutions and policymakers to anticipate changes in access patterns and implement targeted interventions to enhance inclusivity and educational outcomes (Agarwal et al., 2021). Overall, time series analysis can provide a strong framework for examining the dynamic and evolving nature of the topic (Wen et al., 2020) like impact of blended learning on access to higher education which supports informed decision-making grounded in evidence within the field of educational policy and practice.

While time series analysis is a valuable tool in many research contexts, it may have some limitations in the context of this study. One limitation is that time series analysis assumes a stationary environment, meaning that the statistical properties of the data do not change over time (McIntosh et al., 2021). However, the introduction of blended learning in higher education often represents a dynamic and evolving process with continuous adjustments to instructional methods, technology integration, and educational policies (Tandon et al., 2022). Hence, these dynamic changes may lead to non-stationarity in the data, which makes it challenging to apply traditional time series models effectively. Moreover, the impact of blended learning on access to higher education is influenced by various factors, including socioeconomic conditions, technological advancements, and institutional policies (Wen et al., 2020). Time series analysis

alone may struggle to capture the complexity of these complex influences and may not provide a comprehensive understanding of the causal relationships involved.

g) Propensity Score Matching

Another possible statistical test that can be applied to different types of intervention research is Propensity Score Matching (PSM). This statistical technique is usually used in observational research to reduce bias and mimic the design of a randomized controlled trial by creating comparable groups based on the likelihood (propensity) of receiving a particular treatment or intervention (Boram et al., 2023). It is particularly useful when random assignment is not feasible or ethical in a study (Kadam et al., 2022).

In the context of the study investigating the impact of blended learning on access to higher education, Propensity Score Matching (PSM) can be highly suitable where random assignment of students to blended or traditional learning environments may not be feasible. PSM offers a method to create comparable groups and mitigate potential selection biases (Huang et al., 2021). The propensity score, derived from observed characteristics such as prior academic performance, socioeconomic status, and learning preferences (Kadam et al., 2022), serves as a balancing tool. By matching individuals with similar propensity scores, researchers can construct treatment and control groups that closely resemble each other in terms of pre-treatment characteristics, which helps to control for confounding variables that could influence the access to blended learning (Almedimigh et al., 2023).

This approach may allow for a deep evaluation of the impact of blended learning on access, as it facilitates the isolation of the treatment effect from other factors (Hu et al., 2023). By ensuring balance across relevant covariates, PSM may enhance the internal validity of the study and strengthens the causal inferences that can be drawn regarding the effects of blended

learning on access to higher education. With PSM, it is then possible to analyze outcomes, such as enrolment rates or academic success, with greater confidence in the reliability of their findings (Liu et al., 2020).

Although Propensity Score Matching (PSM) is a useful tool for addressing selection biases in observational studies, its suitability in the study on the impact of blended learning on access to higher education might be limited in certain situations. PSM assumes that all relevant covariates influencing treatment assignment are observed and included in the propensity score estimation (Chen et al., 2021). In the context of blended learning, there could be unobservable factors, such as student motivation, engagement, or teacher quality, that significantly impact both the choice of learning modality and access to higher education. As commented by Berg et al. (2021), if these unobservable variables are not adequately accounted for, PSM may fail to achieve sufficient balance between treatment and control groups, leading to biased estimates of the treatment effect.

Additionally, the success of PSM relies on the assumption of a correctly specified and well-behaved model for the propensity scores (Griffin et al., 2019). If the model is misspecified or if there is a lack of overlap in the propensity score distributions between the treatment and control groups, the matching process may be challenging, and the results may be sensitive to model specifications (Okuzu et al., 2024). In the case of blended learning impact studies, where the intervention's effects may vary across diverse student populations and institutional contexts, which makes the assumptions of PSM may be difficult to meet.

In conclusion, the selection of appropriate statistical tests for a study is an important aspect of the research process as it directly affects the accuracy and credibility of the results (Han, 2023). The decision should be guided by a careful consideration of the study's objectives, research questions, and the characteristics of the data (Ahmed et al., 2023). As different

statistical tests are designed to address specific scenarios, such as comparing means, exploring relationships, or analyzing categorical data, researchers must be conscious of the assumptions associated with each test and choose methods that align with the study's design and the nature of the variables under investigation (Kurniaman & Zufriady, 2019).

Without ignoring the strengths and weaknesses of each statistical test, inferential statistics through the application of Chi-square test was proved to be effective in this study as it extends study findings from a sample to a larger population (Black, 2023). The application of the Chi-square test in this particular study offers the opportunity to draw informed and generalizable conclusions regarding the relationship between participation in blended learning and access outcomes (Han et al., 2023). This tests also assisted in the identification of statistically significant patterns or trends in the data, which helped the researcher determine whether the observed effects are likely to be indicative of broader populations. Within the context of blended learning and access to higher education, the use of inferential statistics can help provide a systematic and strong framework for evaluating the significance of observed relationships, thereby contributing to a more profound understanding of the factors influencing access in blended learning environments (Hazra, 2023).

3.6.2 Qualitative Data Analysis

Qualitative data analysis involves multiple techniques aiming at extracting meaningful insights from non-numerical data sources (Bryda & Costa, 2023). These techniques collectively enable researchers to uncover patterns, meanings, and contextual nuances in qualitative data, which contributes to a comprehensive understanding of complex phenomena in various fields (Hendren et al., 2023). For effective analysis, qualitative data can involve various methods such as thematic analysis, grounded theory, content analysis, narrative analysis, and phenomenological (Paulus, 2023).

a) Thematic Analysis

Thematic analysis is the process of recognizing, examining, and presenting patterns or themes within qualitative data (Naeem et al., 2023). In other words, researchers identify recurring themes or patterns in the data and interpret their meaning. This method is often used in studies with open-ended interviews or focus group discussions (Harkko et al., 2023). Thematic analysis has been proved to be a highly effective technique for analyzing data in intervention studies (Erdem et al., 2023) like a study investigating the impact of blended learning on access to higher education. Blended learning, which combines traditional face-to-face instruction with online components (Hill & Smith, 2023), introduces a complex environment that warrants a detailed understanding of its effects. hematic analysis enables researchers to methodically identify and interpret recurring patterns within qualitative data (Carrasco et al., 2023) by offering a structured framework for exploring the varied viewpoints of students, educators, and administrators. In the context of blended learning, themes may emerge related to the accessibility of online resources, the effectiveness of blended instructional models, and the challenges or benefits experienced by various stakeholders. This method can then facilitate the exploration of both positive and negative aspects of blended learning, which illuminates the intricate factors that affect access to higher education in the contemporary learning landscape (Vo et al., 2023).

Thematic analysis is particularly effective to uncovering insights from diverse qualitative data sources such as interviews, focus groups, or open-ended survey responses (Sheikhan et al., 2023). By applying this approach to the study on blended learning and its impact on access to higher education, Anabalón & Roman (2023) commented that researchers can systematically organize and interpret the rich qualitative data generated in the study. According to the same scholars, this can ultimately contribute to a comprehensive

understanding of how blended learning impacts access to higher education and informing potential improvements in educational practices and policies (Anabalón & Roman, 2023).

Although thematic analysis is an effective method for qualitative data analysis, some researcher, including Braun & Clarke (2023), indicated some limitations. One indicated limitation lies in the potential subjectivity involved in the identification and interpretation of themes (Saunders et al., 2023). As stipulated, with this method different researchers may perceive and categorize themes differently, which leads to a degree of researcher bias (Varagur et al., 2023). Additionally, it is raised that thematic analysis may oversimplify complex phenomena by reducing them to identified themes, by potentially neglecting the complex interplay of factors influencing the impact of blended learning on accessibility (De Paoli, 2023). Furthermore, it is also commented that thematic analysis may not capture the dynamic and evolving nature of the research topic experiences over time as It offers a momentary overview of themes as they appear at a specific point in time but may not fully capture the evolving perspectives and changing dynamics in the long-term implementation of blended learning initiatives (Chavulak et al., 2023).

b) Content Analysis

Content analysis is another analysis method for qualitative data which involves systematically analyzing the content of textual, visual, or audio data (Sheydayi & Dadashpoor, 2023). It consists of categorizing and coding the data to identify specific themes, patterns, or trends, especially when analyzing large volumes of data, such as media content or written documents (Malekahmadi et al., 2023). The process of content analysis begins with clearly defined research objectives, where the researcher outlines the specific questions or goals guiding the analysis. This means that after selecting the relevant content, a unit of analysis is

determined, specifying the segments or elements within the material to be examined, such as words, sentences, or themes (Munro et al., 2022).

As commented by Kreuter & Kreuter (2021), the heart of content analysis lies in the development of a coding scheme, a set of predefined categories that capture the key concepts or characteristics of interest. This coding scheme guides the systematic categorization of content, either by human coders or through automated methods, which enables the extraction of quantitative and qualitative insights (Arnull et al., 2023). The results can then be analyzed to identify recurring patterns, trends, or significant themes, offering valuable insights into the communication dynamics, attitudes, or representations present within the analyzed content (Sheydayi & Dadashpoor, 2023). Content analysis is said to be flexible and it can be applied across various disciplines which require a rigorous methodology for to analyze and interpret large volumes of textual or visual data systematically (Malekahmadi et al., 2023).

In the context of a study investigating the impact of blended learning on access to higher education, content analysis can serve as an effective tool for systematic examination of the diverse range of materials generated by this educational approach (Ban & Mahmud, 2023). This technique can be used to analyze official documents, course materials, online discussions, multimedia presentations, and other resources (Caudill & Slater, 2023). As an example, by defining the research objectives and selecting a relevant sample of content, it is possible to use content analysis to explore how blended learning influences access to higher education in terms of students' enrollment.

However, content analysis is accused of having some limitations. Like thematic analysis method, one significant concern raised lies in the potential oversimplification of complex phenomena (Arnull et al., 2023). As content analysis relies on predefined coding categories, some scholars like Emrouznejad et al. (2023) stipulated that by applying this

method, there can be a risk of overlooking some aspect of the research phenomenon, especially those not anticipated during the coding scheme development. Additionally, it is stated that content analysis may not fully capture all aspects of the research phenomenon comprehensively. As a result, in the context of different studies like the one on the blended learning model and access to higher education some various factors such as the quality of online interactions, individual learning preferences, individuals' perspectives, and the evolving nature of digital resources might be challenging to quantify accurately through content analysis alone as many of them are more observable than the underlying meaning or context (Quevedo et al., 2023).

c) Narrative Analysis

Narrative analysis is a qualitative research method that centers on analyzing and interpreting the stories or narratives embedded in data (Scott et al., 2023). Whether derived from interviews, written accounts, or other forms of qualitative information, narrative analysis delves into the complexities of storytelling (Bateman & Tseng, 2023). As indicated by Hartika et al. (2023), this method does not only scrutinize the surface-level content of narratives but also explores their underlying structure, patterns, and the meanings ascribed by individuals. For Scott et al. (2023), narrative analysis acknowledges the significance of context, cultural influences, and the storyteller's unique voice in shaping the narrative, what makes it a powerful tool for exploring diverse aspects of human experiences in qualitative research.

In a study investigating the impact of blended learning on access to higher education, narrative analysis can be used in capturing the subjective experiences of individuals engaging with this educational model. By collecting narratives through interviews, reflective essays, or other qualitative means, the structure, content, and meanings embedded within these stories can be easily analyzed (Turnbull yet al., 2023). As illustrated by Alshami et al. (2023), narrative

analysis can enable the exploration of how students navigate the blend of online and traditional learning environments by shedding light on the challenges, successes, and personal transformations they undergo. Hence, through this approach, it is possible to uncover rich narratives that articulate the impact of blended learning on access and provide a deeper understanding of the various ways in which students experience and make sense of this educational modality.

Although narrative analysis is a powerful tool for exploring individual experiences and perspectives, it may face some limitations in the study investigating the impact of blended learning on access to higher education. One main constraint can be the potential subjectivity existing in storytelling, which may cause biases or variations in participants' narratives (Enciso et al., 2023). Additionally, narrative analysis often involves a smaller sample size, limiting the generalizability of findings (Sunde et al., 2023). In this regard, the same scholar clarifies that the qualitative nature of narratives might make it challenging to quantify and compare the impact across a larger population systematically. Furthermore, as narratives are influenced by personal interpretations and cultural contexts, it was commented that it might not be accurate to generalize or make assumptions based exclusively on individual stories (Loyola et al., 2023). To address these limitations, Bateman & Tseng (2023) suggest a complementary approach consisting of combining narrative analysis with quantitative methods in order to provide a more comprehensive understanding of the broader trends and implications of blended learning on access to higher education.

d) Case Study Analysis

Case study analysis is a research method for qualitative data that involves an in-depth examination of a specific instance or case, often within its real-life context (Grenier, 2023). The goal is to gain a deep understanding of the case, identify patterns, explore causal

relationships, and derive insights applicable to broader phenomena (Cole, 2023). Case study analysis is particularly suitable in providing a detailed exploration of complex situations and is widely used in fields such as business, social sciences, and education (Meng et al., 2023). As clarified by Grenier (2023), the process of case study method begins with defining clear research questions or objectives, guiding the selection of a relevant and illustrative case. Data is then systematically collected from diverse sources, such as interviews, observations, and documents, providing a comprehensive view of the case.

In the context of this study, case study analysis can serve as an effective method to grasp the various aspects of the blended learning model within real-world contexts. As an example, it is possible to select specific educational institutions, courses, or programs as cases for an in-depth exploration (Dahal, 2023) of the complex interaction between blended learning and elements affecting access to higher education. Data collected through interviews with students and educators can then contribute to a comprehensive understanding of how blended learning impacts access in terms of different aspects such as flexibility, technological proficiency, and inclusivity (). The case study analysis can then help to uncover patterns, challenges, and success factors (Zarestky, 2023) related to the integration of blended learning in higher education.

Given that case studies typically focus on specific instances or contexts, the findings derived from one case may not be readily applicable to a broader population or diverse educational settings due to its potential lack of generalizability (Hendren et al., 2023). The unique characteristics of individual cases may lead to results that are context-specific (Pyo et al., 2023), which makes it challenging to draw universal conclusions about the general impact of blended learning on access across higher education institutions. To ensure a more comprehensive understanding, it is recommended to supplement case study analysis with

quantitative methods or adopt a more extensive research design that involves a broader range of educational contexts and diverse student populations (Hendren et al., 2023).

e) Phenomenological Analysis

As described by Demir (2023), phenomenological analysis is a qualitative research approach that aims to explore and understand individuals' lived experiences of a particular phenomenon. Rooted in phenomenology, a philosophical perspective that emphasizes the examination of conscious experiences, this analysis method seeks to uncover the essence and meaning of those experiences (Englander & Morley, 2023). Researchers conducting phenomenological analysis typically engage in in-depth interviews, observations, or the analysis of written or verbal accounts provided by participants. The analysis focuses bracketing preconceived notions and allowing the emergence of themes and patterns that capture the essence of the lived experiences (Varaei & Karami, 2023).

In the area of blended learning and access to higher education, phenomenological analysis can be an effective analysis technique due to its emphasis on exploring and understanding the lived experiences of individuals (Thomas & Sohn, 2023). As blended learning is a complex educational phenomenon (Asmawi, et al., 2024), phenomenological analysis can allow deep exploration of subjective experiences of students who engage with blended learning focusing on their perceptions, challenges, and successes. As commented by Yan et al. (2023), by using methods such as in-depth interviews or analyzing participant narratives, it is possible to uncover the essence of how blended learning shapes students' access to higher education. In other words, phenomenological analysis is well-suited to capture the diversity of experiences within a study population. Furthermore, as blended learning environments involve a broad range of learners with different technological backgrounds,

learning styles, and accessibility needs, this method can facilitate the exploration of these individual differences (Guin, 2023).

However, when investigating the impact of blended learning on access to higher education, phenomenological analysis may face some challenges especially in situations where a broader, more quantitative understanding is sought (Hammel, 2023). As it tends to focus on the essence and meaning of individual experiences (Pakhotina et al., 2023), it might not capture the broader patterns, trends, or measurable outcomes associated with blended learning across a diverse student population. Additionally, the method heavily relies on participants' self-reported perceptions (Mhatre & Mehta, 2023), which could be subjective and influenced by various biases. To ensure a comprehensive understanding of the impact on access to education, there may be need to combine phenomenological analysis with other research methods, such as surveys or quantitative data analysis, to offer a more comprehensive understanding of the intricate relationships between blended learning and access to higher education. (Englander & Morley).

3.6.3 Qualitative Data Analysis in the Present Study

In this study, thematic analysis was used for qualitative data analysis collected through surveys and interviews. Thematic analysis is referred to as a method used to analyze qualitative data which require exploring a set of data for the identification and analysis of the recurrent patterns (Creswell & Clark, 2019). Thematic analysis is a data driven method for the analysis of qualitative data which involves searching through a data set to find out and interpret recurrent patterns to construct themes (Michelle & Lara, 2020). Different researchers, such as Lakens (2021), argue that thematic analysis is an effective data analysis method to use to understand people’s views, behaviors and experiences about a research topic (Braun and Clarke 2022), and it is designed to search for common or shared meanings from a data set (Nowell et

al., 2020). With thematic analysis method, qualitative data are analyzed by grouping them in categories and themes. In this study, thematic analysis will be applied and data will be examined using deductive approach to identify themes, views and meanings from the recurrent data to ensure they reflect the preconceived themes based on the research questions along with interview questions.

The analysis of the qualitative data in this study went through the existing key stages such of thematic analysis such as familiarization with the data, organization and indexing, coding, refinement of themes and categories (Nowell et al., 2020). The familiarization stage focused on the description of data collected and data reading and re-reading exercise to find out initial ideas (Fàbregues et al., 2021). Organization and indexing stage consisted of a systematic organization of data for easy retrieval and identification (Perez et al., 2022). The process of coding was facilitated by NVivo, a software program for qualitative and mixed-methods research data analysis (Røddesnes et al., 2019), which helped to create theme nodes that represent the main topics found in this study data. The creation of nodes usually contributes to the effective organization of data relevant to each identified theme (Brown & Collins, 2021).

As far as coding exercise is concerned, it consisted of 3 main coding cycles. The first cycle of coding focused on the description of data and process, the second cycle consisted of the creation of patterns from the identified similar coded data; and the third cycle focused on categorizing data based on thematic similarity (Fetters, 2022). The latter cycle led to the discussion and interpretation of the categorized data in conformity with the objectives of the study and the study questions.

Thematic analysis was supplemented by content analysis method where it was used for systematically analyzing the textual data collected from institutional documents. In this study,

this method consisted of reviewing and analyzing documents including institutional reports, or historical records to get relevant information or insights related to the status of students' enrollment. These official documents were checked in order to identify and categorize the content related to blended learning experiences and their impact on access to higher education. In other words, content analysis in this study provided important insights into how blended learning influences access to higher education and inform strategies for improving educational practices and policies to enhance access for diverse student populations.

3.7.Summary

This chapter offered a detailed overview of the research methodology used in the study, describing the organized procedures followed to gather and analyze data that is crucial for understanding the impact of the blended learning model on access to higher education in Rwanda. The methodology was designed to effectively address the research objectives and answer the key research questions in a reliable and thorough manner.

A mixed-methods approach was chosen to ensure a comprehensive and well-rounded investigation, blending both quantitative and qualitative perspectives. This approach allowed for the collection of statistical data that highlighted broad patterns and trends, alongside detailed insights into participants' personal experiences and institutional practices related to blended learning. By merging these two types of data, the study sought to offer a deeper and more complex understanding of the role blended learning plays in shaping access to education.

The case study design allowed for an in-depth exploration within the context of ten selected higher education institutions in Rwanda that have incorporated blended learning into their academic programs. This design enabled the researcher to explore institutional variations, implementation challenges, and outcomes specific to the Rwandan context, thereby enhancing the contextual relevance and applicability of the findings.

The study population comprised a wide range of stakeholders, including students, lecturers, academic registrars, and IT staff involved in the blended learning system. A sample of 220 participants was selected using appropriate sampling techniques, with Slovin's formula guiding the quantitative sample size and purposive sampling used for qualitative participants. This ensured that the sample was representative and that the data collected reflected multiple perspectives across the institutional spectrum.

Online questionnaires and semi-structured interviews served as the primary data collection instruments. These tools were chosen for their ability to reach a broad participant base and to capture detailed insights, respectively. The use of digital platforms for data collection also offered efficiency and convenience, especially in light of technological advancements and the context of blended learning itself.

Ethical considerations were carefully addressed throughout the research process. Prior to data collection, approval was obtained from the Unicaf Research Ethics Committee (UREC). All participants were informed of their rights, the voluntary nature of their participation, and the measures taken to protect their anonymity and privacy. Ethical compliance contributed to the credibility and integrity of the research process and outcomes.

For data analysis, quantitative data were processed using descriptive and inferential statistical techniques to identify patterns and relationships among key variables. Qualitative data, on the other hand, were examined through thematic analysis, which facilitated the identification of emerging themes related to institutional practices, learner experiences, and technological integration.

Overall, this chapter has laid the methodological foundation upon which the research findings are built. The combination of rigorous methodological planning, appropriate data collection tools, and ethical diligence has positioned the study to produce reliable, valid, and

contextually meaningful results. The next chapter presents and discusses the findings derived from the data, providing insight into how the blended learning model is influencing access to higher education in Rwanda.

CHAPTER 4: FINDINGS

4.1. Introduction

In Rwanda, students' enrolment in higher education institutions was proved to be limited in the last few decades. To illustrate, in three decades of the period 1963-1994, the higher education system only graduated about 2,000 students (MINEDUC, 2020). This small number of graduates proves the limited access to higher education due to the fact that the education system in that period only consisted of in-person and in-classroom learning model (HEC, 2020). With the Rwandan Government's commitment of expanding access to higher education, Rwanda counts now 40 higher education institutions with 179,866 graduates in both public and private higher education institutions (MINEDUC, 2022). Based on these statistics, Higher Education Council (HEC) confirms that since 1994 the enrolment percentage has moved from 3 to 10.4% in higher educational institutions in Rwanda (HEC, 2020).

Face-to-face education has long been said to have some limitations in providing easy access to education, especially to people with busy schedules in terms of personal, social or business responsibilities assigned to them (Staff, 2020). Thanks to the technology advancement, the internet has provided an easy access to education that can accelerate learning opportunities from anywhere at any time (Carstens et al., 2021). Although some institutions of higher education in Rwanda have adopted the blended learning model, as one of the online education forms, not many studies have been conducted to investigate if this model really extends learning opportunities in Rwanda for students who may not be able to always be physically on campus to attend classes because of different reasons such as distance or time.

Hence, The aim of this study is to examine the effect of the blended learning model on access to higher education. The study intended to investigate if this inventive educational model addresses many key challenges faced by multiple institutions of higher education including the expansion of access to education. The study was conducted in 10 selected higher

education institutions in Rwanda having the blended learning model in their academic programs. The study population consisted of university students, lecturers, academic registrars, and IT senior staff. The study was conducted with the aim to attain the following objectives:

- Investigating both university students and teachers' perceptions of the blended learning model in their academic activities;
- Analyzing the students' enrolment status in higher education in Rwanda before and after using the blended learning model;
- Analyzing advantages of blended learning model in higher education system in Rwanda;
- Evaluating the challenges faced in the implementation of the blended learning and teaching model in Rwanda

For data collection, the study used online survey, interviews and document checking techniques.

The discussion in this chapter consists of three main sections: the trustworthiness of data, results' reporting, and the evaluation of the results. The section on trustworthiness of data aims at clarifying the means by which the trustworthiness of the data was secured. Then, the results' reporting consists of the presentation of primary data; and the presentation follows a systematic order, and it aligns with the research questions. The section on the result evaluation consists of briefly reporting what the findings mean. The whole chapter is concluded by the section with a summary in which the key points presented in chapter 4 are summarized.

4.2. Trustworthiness of Data

In the landscape of research, the bedrock of credibility lies within the trustworthiness of data (Adler et al., 2023). By comparing trustworthiness with a compass guiding explorer through uncharted territories, Albert (2023) clarifies that trustworthy data forms the

cornerstone upon which reliable conclusions and insights are built. According to the same scholar, trustworthiness embodies the reliability, validity, and integrity of information collected, and it serves as a proof of the strength of the methodologies used. Different scholars including Holloway and Galvin (2023) assert that ensuring the trustworthiness of data does not only validates the findings but also cultivates confidence in the conclusions drawn from the study findings.

According to McSweeney (2021), the trustworthiness of data is a prominent aspect in all types of research. In mixed-methods research, trustworthiness is ensured by considering different strategies used in both qualitative and quantitative research (Stahl & King, 2020). In other words, trustworthiness is very important to justify whether the study information collected is trusted, applicable and not biased (Collingridge & Gantt, 2019). As stipulated by FitzPatrick (2019), the terminology used to measure trustworthiness varies depending on the research paradigm. On the same point, Kyngäs (2020) clarified the terminology applied to both qualitative and quantitative research paradigms, and he stated that in a mixed-research all terminologies are referred to as it considers both paradigms.

Table 4

Difference between Qualitative and Quantitative Research Paradigms

Qualitative	**Quantitative**
Credibility	Validity
Transferability	Reliability
Dependability	Generalizability
Conformability	Objectivity

Source: Author's compilations

In research, trustworthiness is considered as a major element that is used to determine if the research data were collected in a precise, consistent, and exhaustive manner in order to yield meaningful and trusted results (Lorelli et al., 2018). Similarly, trustworthiness is referred to as rigor applied to ensure quality and confidence in the research methods used, research data and their interpretation (Pilot & Beck, 2019). To make the research worthy of consideration, Amankwaa (2018) argues that it is necessary to put in place protocols and procedures that can contribute significantly to the quality of the entire research. So, addressing the trustworthiness concerns requires the consideration of different elements such as confidence in the findings, the applicability and the objectivity of the findings (Adler, 2022).

Researchers generally have different views about the best criteria that can be used to evaluate trustworthiness of the qualitative data in order to ensure rigor and reliability in the findings and interpretations. In this mixed-methods research, the common and relevant aspects used to determine the trustworthiness of qualitative data were considered. Kyngäs et al. (2020) indicated that credibility, transferability, dependability, and confirmability are the key aspects to determine the trustworthiness of qualitative data. For the document checking, only data from various official reports with regard to the status of the students' registration in the blended learning model were considered.

4.2.1. Credibility

One of the most important elements needed to establish research trustworthiness is to guarantee the credibility of the study results. Credibility is all about how qualitative data collected are representative of the phenomenon under study (Kasirye, 2021). For Kyngäs (2020), credibility is referred to as level of certainty of the qualitative findings, and it refers to the believability of the findings. Establishing credibility involves demonstrating that the data collection methods, interpretations, and findings are plausible and trustworthy.

To enhance credibility, this study applied triangulation method throughout data collection and analysis process. Triangulation is a technique that consists of collecting data from various informants using multiple data collection tools that can be used to establish the credibility of data (Pietrzykowski & Smilowska, 2021). In this research, data were gathered from university students, lecturers, IT senior staff and academic registrars through the use of online survey, face-to-face interviews and document checking. Online survey was administered to the university students and lecturers while face-to-face interviews were held with academic registrars and IT senior staff. All the triangulated data were used to make data more truthful and believable (Cypress, 2020); and it helped the researcher to consider viewpoints and experiences from different individuals in order to get a larger picture of the respondents' attitudes and behavior towards the research aim.

4.2.2.Transferability

According to Ferrando (2021), transferability is all about the degree to which the qualitative findings can be transferable in other circumstances. Building on Ferrando's description of transferability, Holloway and Galvin (2023) assert that this criterion evaluates how well the findings can be generalized or applied to different contexts or settings. Providing rich, detailed descriptions and explanations of the research context and participants enhances the transferability of qualitative findings (Hendren et al., 2023). While in qualitative study, the internal validity allows the research findings to be generally applied to a wider population, some researchers including Nyirenda et al. (2020) argue that it may not be possible to apply the findings and conclusions to other situations and populations as qualitative research focuses on a limited number of specific environments and people.

However, other researchers such as Stahl (2020) and King (2020), highlights the elements to consider in order to ensure transferability in research. Those elements include the number of organizations participating in the research and their locations; the number of

participants involved; the methods employed in data collection; and deep contextual description of the research area. According to Korstjens & Moser (2020), transferability of qualitative data can be established through the purposeful sampling for the interviews. To enhance transferability of the interview findings in this research, a detailed contextual description of the study was provided, the research informants for interviews were chosen purposefully from different higher learning institutions selected from various locations of the country.

4.2.3. Dependability

Dependability relates to the consistency and stability of the research data over time and across researchers (Korstjens & Moser, 2020). In this regard, Hendren et al. (2023) points out that consistent and transparent documentation of research procedures, methodologies, and decision-making processes helps ensure dependability in research. Dependability helps to evaluate how the qualitative data are consistent in terms of the informants' experience (Kyngäs et al., 2020). The strategy consists of an in-depth description of the study procedures for measuring the level to which the study findings could be revealed the same (Coleman, 2022) just in case the procedures are repeated by a separate researcher using the same context, methods and population (Adler, 2022).

To ensure dependability of the qualitative findings in this study, the interview processes, procedures and methods were made clear and reported in detail to enable the respondents to have clear understanding of how the interviews are to be conducted. To mitigate response bias and to ensure focused data collection, interview guide was used in the interview sessions. The interview guide consisted of open-ended questions to elicit spontaneous and unbiased answers. The guide also allowed neutral reactions to keep the natural flow of the conversation between the interviewer and the interviewee.

4.2.4. Confirmability

As stated by Yadav (2022), confirmability in qualitative data is like objectivity in quantitative data. Similarly, it refers to the neutrality and objectivity of the data, ensuring that the findings are shaped by the participants' perspectives rather than the researchers' biases (Hatch, 2023). In other words, it is related to the level of data objectivity from the study participants without any researcher's biases (Coleman, 2022). In other words, it reflects the level of impartiality in data collection process to make sure that the data are real, unique, and reliable. In other words, it focuses on the authenticity of the findings based on the extent to which researchers can interpret the data in connection with the realities of the collected data.

Although, some researchers recognize the difficulty of ensuring real objectivity in qualitative data, some strategies must be used to ensure that the results are the genuine outcome of the informants' experiences and ideas (Coleman, 2022). To this end, researchers are advised to recognize values that can support conclusions made and methods used in the study so as to explain the reason why the study approaches, design and methods were chosen and employed over the others, and also to admit their possible weaknesses. It can also be ensured through triangulation and member checking of the data (Rose & Johnson, 2020).

In this research, confirmability was established by the use of an audit trail and member checking techniques. An audit trail technique consists of keeping the records of how the interviews were conducted (Carcary, 2021). During the interviews, the researcher took notes of the respondents' thoughts and any other important reactions or feedback relevant to the interview questions. In this regard, all findings were documented where a clear coding schema was used to identify and clarify the codes and patterns for the analysis of data. In addition to an audit trail technique, member checking technique was also used. It is described as a qualitative data validation technique where researchers and study respondents collaborate to enhance the correctness of the recorded data (Motulsky, 2021).

In this study, this technique was used where the researcher collaborated with every respondent for data validation. Before closing the interview with every respondent, the researcher gave data back to him/her to cross-check if the collected data are real, unique, and trustworthy (Candela, 2020). In addition, Gray (2018) argued that validity can be ensured during the interviews where both the researcher and the respondent have a chance of paraphrasing the interview questions and asking clarifying questions to maximize clear understanding of the questions and to ensure the collection of the accurate answers. In this respect, there was an opportunity for both interviewees and interviewer to paraphrase interview questions and asking clarifying questions wherever necessary to ensure clear understanding of the questions and to confirm that the answers collected are correct.

4.3. Validity and Reliability of Data

Validity and reliability are essential components for ensuring the quality of quantitative data. Peeters and Harpe (2019) commented that the validity and reliability of quantitative research results are contingent upon the strengths of a study design, appropriateness of the selected methods and samples together with the carefulness and consistency used in conducting the research.

Validity and Reliability are nearly related concepts with different meanings. According to Rose and Johnson (2020) validity aims to evaluate how a measure is accurate while reliability generally focuses on how a measure is consistent. On the point of differences, Coleman (2022) argues that reliability of a measurement may not always involve its validity. In other words, the findings may be reproducible without being necessarily accurate (Gray, 2019). In other words, while validity confirms that the data measures what it's supposed to measure, reliability ensures that the measurements or observations are consistent and dependable.

4.3.1. Validity

Validity denotes the degree to which a measurement or assessment tool accurately captures what it is designed to measure (Youssef, 2023). According to Basantes-Andrade et al. (2023), validity ensures that the data collected accurately represents the concepts or variables being studied. Huntington (2023) differentiates different types of validity such as content validity, criterion validity, and construct validity. According to him, content validity ensures that the full scope of the concept is covered. For criterion validity, it relates to the comparison of results established measure while construct validity confirms that the measure accurately reflects the underlying theoretical construct.

Maintaining the validity of quantitative data requires researchers to ensure that the collected data accurately measure their intended variables (Almanasreh et al., 2019). Validity means the degree to which the measurement tools used in a study effectively assess what they are intended to measure (Coleman, 2021). As confirmed by various researchers including Fiona (2022), when research exhibits high validity, it generates results that align with the realities and features of the physical or social environment.

To assess the validity of study findings, internal and external validity must be ensured. Internal validity refers to the degree of confidence in the reliability of the tested causal relationship, without the influence of other factors (Mears, 2017). External validity, on the other hand, involves accurately representing the study population and measuring the generalizability of the findings to other situations, groups, or settings.

There are several methods available to enhance the validity of quantitative data. Fiona (2022) proposed four main types of validity used if the measurement tools used in a study effectively assess what they are intended to measure. The first method is construct validity which is used to ensure that the measurement tool effectively measures the intended concept.

Content validity is another validity method which involves assessing the extent to which the measurement tool encompasses all relevant elements of the concept being measured. Face validity comes as another validity method used to test whether the content of the measurement tool aligns with its objectives, while criterion validity evaluates the correctness of the results and the correlation between variables. In other words, validity evaluates the degree to which the results are in correlation with other justifiable measures of the same concept (Peeters and Harpe, 2019). Hence, to ensure that the survey results accurately represent the variables they aim to measure, various techniques of quantitative data validation were employed in this mixed-methods research.

4.3.1.1. Random Sampling

For university students, the researcher selected a sample that represents the study population, and it was calculated by the use of Slovin's formula: $n = \frac{N}{1+Ne^2}$ where "n" represents the number of samples, "N" represents the total population, and "e" represents the error tolerance or margin of error.

To mitigate the sampling bias, the qualifying respondents were selected randomly, and they were given equal opportunity to voluntarily take part in the study. Various researchers such as Adler (2022), Korstjens (2018) and Moser (2018) support random sampling as a technique that can be used to foster validity of quantitative data as it enhances fair distribution of any unexpected influences within the sample.

4.3.1.2. Survey Quota

Survey Quota is regarded as a quantitative data validation technique which consists of sourcing survey respondents from different groups of people with different backgrounds (Iliyasu & Etikan, 2021). In this study, the online survey was administered to both university students and lecturers (males and females) who may have different perceptions of the blended

learning model in higher education institutions. To avoid selection bias in this study, the respondents for the online survey were selected from different categories of people with varying backgrounds and perspectives of the research topic.

4.3.1.3. Short and Accessible Survey

To avoid non-response bias, the online survey should be short and sent to only relevant respondents (Stantcheva, 2023). For this research, the online survey was only sent to the target respondents, and it contained only relevant questions that can help to get the findings that answer the research questions. The online survey was friendly for the respondents and it was accessible through different electronic devices (computers, smart phones, etc). In addition, the survey was not lengthy in such a way that the respondents with busy schedules may not be prevented from completing it.

4.3.1.4. Voluntary Participation

As stated by Davison et al. (2022), when all research respondents are free to choose to participate without any pressure, they usually provide genuine and accurate data. In the same way of enhancing validity of data collected through online survey, the respondents were asked to consent to the voluntary participation to make sure that the data are from the authentic participants who are ready and willing to provide data freely. The request for voluntary participation was preceded by detailed explanation of the goal of the research and contextual meaning of the phenomenon under investigation.

4.3.2. Reliability

Reliability in research pertains to the consistency, stability, and trustworthiness of measurements or observations over time (Savin-Baden & Major, 2023). As commented by Sabnis & Wolgemuth (2023), a reliable research method or instrument produces consistent results when applied repeatedly under similar conditions. Additionally, Riazi et al.(2023) said

that reliability ensures that the data collected or obtained through a particular method is trustworthy and free from random error. Still on its importance in research, it is summarized that reliability is essential because it establishes the consistency and stability of research measurements, and it ensures that any variations observed in the data are due to actual differences in the phenomenon being studied, rather than inconsistencies or errors in the measurement process (Atenas et al., 2023). Reliability in quantitative research is about the level to which the findings are reproducible just in case the research is replicated under the same circumstances (Duckett, 2021). Similarly, it focuses on the consistency of the methods and how they are consistently used (Surucu & Maslakci, 2020). This implies that if the same results can be reproduced when the same methods are used under the same situation, the measurement is therefore proved to be reliable (Rubio & Berg-Weger, 2023).

As there are different methods that can be used to ensure reliability in research, internal consistency was ensured in all measures used in this study. Internal consistency intends to evaluate the connection between different items in a measurement tool that are expected to assess the same construct (Drost, 2021). In this juncture, the online survey questions were conscientiously formulated and divided into different categories to investigate how the blended learning model affects access to higher education. The results collected from different questions were consistent with the research topic.

Other strategies used to enhance reliability of measurement instruments in this study include consistent application of the same steps in the same way throughout the procedures of collecting and analyzing data for each measurement. As supported by Middleton (2023), once the method is applied consistently in research, the level of reliability is high; and it therefore produces precise, stable and reproducible results. In addition, the conditions of data collection were standardized in order to keep consistency and mitigate possible influence of external factors that may have an impact on the study findings. In this research, all respondents were

given the same information regarding the study, and they were tested in a properly randomized setting under the same conditions. The application of standardized conditions was proved as a strategy to enhance reliability of data as it helps to obtain consistent results that can be reproducible if the same methods are applied under the same circumstances (Coleman, 2022).

For document checking, validity and reliability were ensured by only checking official documents related to the blended learning model and access to higher education as the study variables. In this regard, official reports at the Ministry of Education level (MINEUDC) and annual reports from the participating higher education institutions were consulted to get information related to the study topic. The information from the checked documents helped to have a clear picture on the students' enrolment status in higher education at large, and in the participating institutions, in particular, before and after the adoption of the blended learning model in order to assess if the model has had an impact on the expansion of access to higher education in Rwanda.

Briefly, in research, validity and reliability stand as twin pillars ensuring the integrity and trustworthiness of collected data. Validity assures that the measurements capture what they intend to measure, anchoring the findings in the realm of accuracy and truth while reliability offers the assurance of consistency and stability of data. Together, these elements form the cornerstone of solid research, and they foster confidence in the data analysis and interpretations. Additionally, they help researchers to come up with credible, dependable, and impactful discoveries.

4.4. Results

Findings serve as the culmination of any detailed research, and they unveil insights, discoveries, and conclusions from a wide range of investigation. These findings encapsulate the essence of rigorous exploration, offering glimpses into the complexities of a subject by

validating hypotheses, or revealing nuanced relationships within a field of study (Timming & Macneil, 2023). As the compass guiding the trajectory of knowledge, (Hirose & Creswell, 2023) argue that research findings not only illuminate the current understanding but also set the course for future inquiries and innovations. Research findings involves the steps of data presentation, analysis and interpretation to shed light on what the findings imply with regard to the research topic.

This section consists of the presentation of primary data collected through online survey administered to university students and teachers, interviews held with academic registrars and IT senior staff, and the findings from document checking. The presentation of the findings follows a systematic order in line with the research questions. As this study is a mixed-methods research, it consists of both quantitative and qualitative data.

The quantitative data connected to the research questions are presented and analyzed using descriptive statistics so as to measure the significant relationship between nominal and ordinal variables using cross tabulation and Chi square test. To determine if the variables are independent, the p-value was used in this study. In this regard, a significance level of 0.05 was used, and it indicates a 5% probability of falsely concluding the existence of an association between the variables. Following the Chi square test principle, if the p-value is less than or equal to the significance level (p-value ≤ 0.05), this indicates a statistically significant association between the variables, and if the p-value is greater than the significance level (p-value > 0.05), there is insufficient evidence to conclude that the variables are associated (Lina et al., 2023) .

In addition to Chi square test, the study also applied One-way ANOVA test to strengthen the study results from 50 lecturers, as their total number is the minimum number of participants which is close to a limitation.

For qualitative data, the technique of thematic analysis was used. The process of qualitative data presentation and analysis followed the main steps of thematic analysis technique, namely the development and application of codes, identification of themes, and data summary and reporting.

4.4.1. Findings from Online Survey

The presentation of data from online survey consists of only voluntary consented data from both university students and lectures. The initial sample consisted of 150 university students and 50 lecturers. Hence, as one student did not consent, the overall count of participants who willingly participated in the online survey involved 149 university students and 50 university lecturers.

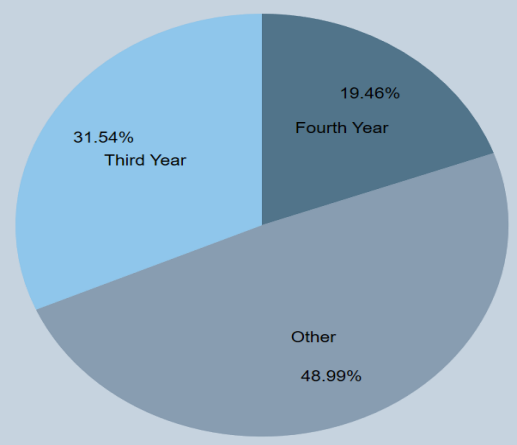
4. 4.1.1. Findings from University Students

Demographic Information of Student Respondents

The demographic information consists of the students' year of study, residence, academic status, age and gender.

Figure 5

Students' Year of Study

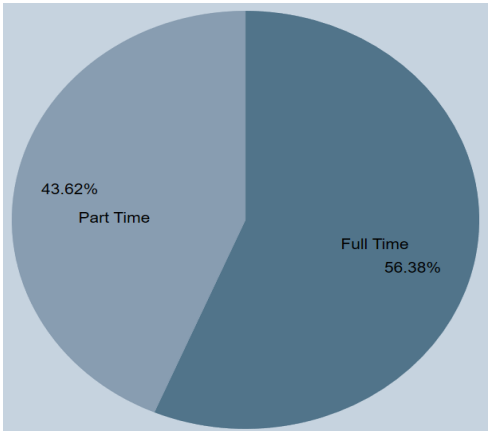


Source: Researcher

Figure 4 indicates the population of students who took part in the survey (n=149) across the year of study. The research results showed that 48.99% of the students were in other years of study (year one and year two), 31.54% were in the third year while 19.46% were in the fourth year of the study program.

Figure 6

Student's Academic Status

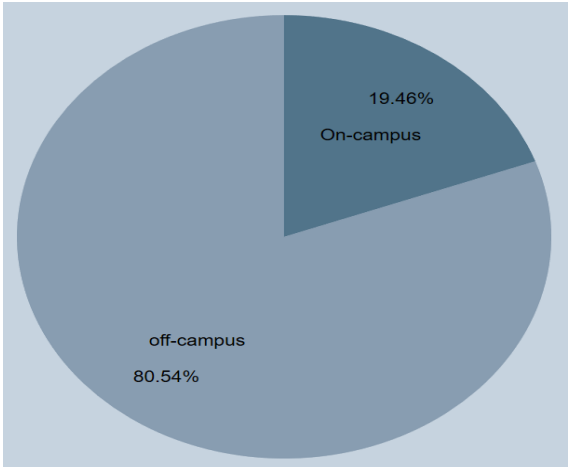


Source: Researcher

Figure 5 shows that, with n=149, 56.38% of students are full time, while 43.62 % are part-time students.

Figure 7

Students' Residence

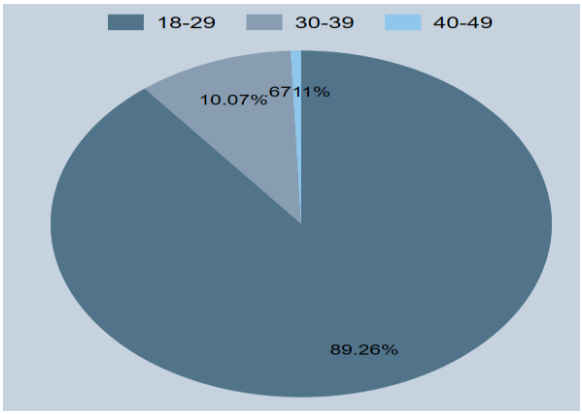


Source: Researcher

Figure 6 indicates the residence of students. The research results indicated that 80.54% of the students reside out of the campus, while 19.46% live on campus.

Figure 8

Age Groups of the Students

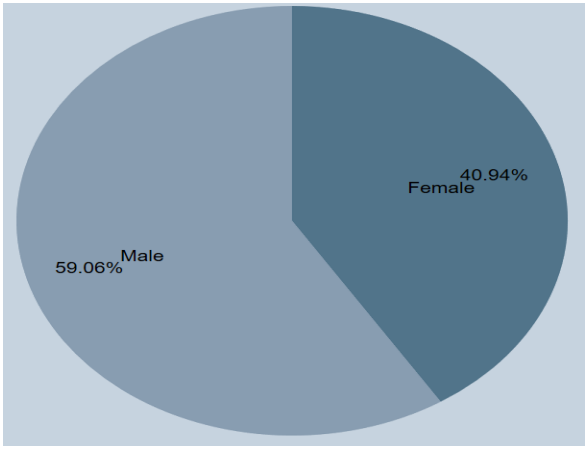


Source: Researcher

Figure 7 shows that the majority of the students who participated in this study (89.26%) were in the age range of 18-29 years old. 10.07% of the students were between 30-39 years old while only 0.67% were in the age range of 40-49 years old.

Figure 9

Gender of the Students



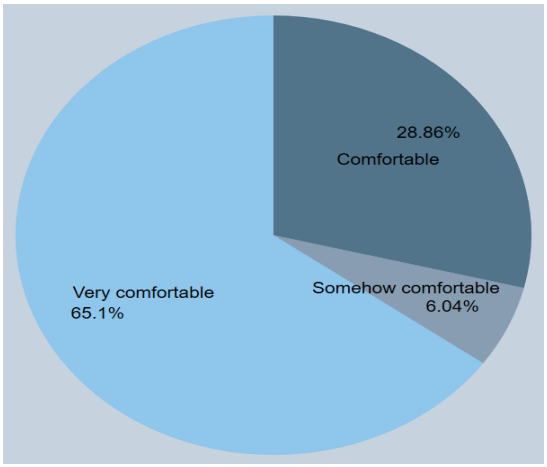
Source: Researcher

As indicated in Figure 8 above, 59.06% of the participating students were males while 40.94% were females.

Findings Related to the Research Questions

Figure 10

Students' Perceptions of the Blended Learning Model



Source: Researcher

Figure 9 summarizes the perceptions of the students regarding the blended learning model in the institutions of higher education in Rwanda. Referring to the study findings, 65.1% of the students reported that they are very comfortable with the blended learning model, 28.86% confirmed that they are comfortable with the model, while 6.04% of the students indicated that they are somehow comfortable with this model.

Table 5

Students' Perceptions versus Student's Year of Program

Perception regarding blended learning model	Year of Program			
	Fourth Year	Other	Third Year	Total
Very comfortable	22.68	44.33	32.99	100.00
Comfortable	16.28	48.84	34.88	100.00
Somehow comfortable	00	100	00	100.00
Total	19.46	48.99	31.54	100.00

Pearson Chi2 (4) = 10.76 Prob = 0.0294

Source: Author's computation

Table 5 shows the cross tabulation between students' perceptions regarding the blended learning model and their year of study. For the students who reported that they are very comfortable with the blended learning model, 44.33% are registered in other years (year 1 and 2), 32.99% are registered in the third year while 22.68% are the fourth-year students. The students who reported that they are comfortable with the blended learning model 48.84% are registered in other years (Year 1 and 2), 34.88% are the third-year students, and 16.28% are registered in the fourth year of their academic program. As revealed by the study findings, all the students (100%) who indicated that they are somehow comfortable with the blended learning are registered in other years (year 1 and 2).

For statistical test, the Chi Square associated with this table has 4 degrees of freedom and is 10.76. The probability value is 0.0294; that is, p-value is less than 0.05 (p <0.05). This means that the observed differences are statistically significant. In other words, there is a relationship between the students' perceptions of the blended learning model and the year of their program.

Table 6

Students' Perceptions versus Academic Status

Perception regarding blended learning model	Student academic status		
	Full Time	Part Time	Total
Very Comfortable	54.64	45.36	100.00
Comfortable	60.47	39.53	100.00
Somehow comfortable	55.56	44.44	100.00
Total	56.38	43.62	100.00

Pearson Chi2 = 0.41 Prob = 0.8131

Source: Author's computation

Table 6 shows the cross tabulation between students' perceptions regarding the blended learning model and their academic status. As summarized in table 2, the findings show that 54.64% of the students who reported that they are very comfortable with the blended learning model are full-time students while 45.36% are part-time students. 60.47% of the students who confirmed that they are comfortable with the blended learning model are full-time students while 39.53% are part-time students. Finally, 55.56% of the students who indicated that they are somehow comfortable with the blended learning model are full-time students and 44.44% are registered as part-time students.

Regarding the relationship, the Chi square test disclosed that there is no statistically significant association between the perception of the students and their academic status ($p>0.05$). In other words, there is no relationship between student's perceptions of the blended learning model and the fact that they are either full or part-time students.

Table 7

Students' Perceptions versus Place of Residence

Perception regarding blended learning model	Student Residence		
	On-campus	off-campus	Total
Very Comfortable	21.65	78.35	100.00
Comfortable	16.28	83.72	100.00
Somehow comfortable	11.11	88.89	100.00
Total	19.46	80.54	100.00

Pearson Chi2 = 0.97 Prob = 0.6143

Source: Author's computation

Table 7 presents the students' perceptions regarding the blended learning model in relation to their residence. The research results indicated that 78.35% of the students who reported that they are very comfortable with the blended learning model are the students residing out of campus while around 21.65% reside on campus. 83.72% of the students who stated that they are comfortable with the blended learning model are the students residing off campus while 16.28% are on-campus residents. For the students who reported that they are somehow comfortable with the blended learning model, the study findings revealed that 88.89% of them reside out of campus while 11.11% live on campus.

As far as the relationship is concerned, the Chi2 square test showed that there is no statistically significant association between students' perception of the blended learning model and their residence (off-campus and on-campus) ($p>0.05$).

Table 8

Students' Perceptions versus Age

Perception regarding blended learning model	Student Age group			
	18-29	30-39	40-49	Total
Very Comfortable	87.63	11.34	1.03	100.00
Comfortable	93.02	6.98	0.00	100.00
Somehow comfortable	8.89	11.11	0.00	100.00
Total	89.26	10.07	0.67	100.00

Pearson Chi2 = 1.21 Prob = 0.8769

Source: Author's computation

Table 8 summarizes the student's perceptions of the blended learning model in connection with their age. The study findings disclosed that 87.63% of the students who confirmed that they are very comfortable with the blended learning model are in the age group of 18-29 years old, 11.34% are in the age range of 30-39 years old while 1.03% are between 40-49 years old. The students who reported that they are comfortable with the blended learning model include 93.02% who are between 18-29 years old and 6.98% being between 30-39 years old. In addition, 88.89% of the students who reported that they are somehow comfortable with the blended learning model fall within the age range of 18 to 29 years, while 11.11% belong to the 30 to 39 age group.

Hence, the p-value = 0.8769 ($p>0.05$) indicates that this relationship between students' perceptions of the blended learning model and the student's age is not statistically significant.

Table 9

Students' Perceptions versus Gender

Perception regarding blended learning model	Gender		
	Female	Male	Total
Very Comfortable	47.42	52.58	100.00
Comfortable	25.58	74.42	100.00
Somehow comfortable	44.44	55.56	100.00
Total	40.94	59.06	100.00

Pearson Chi2 = 5.93 Prob = 0.0516

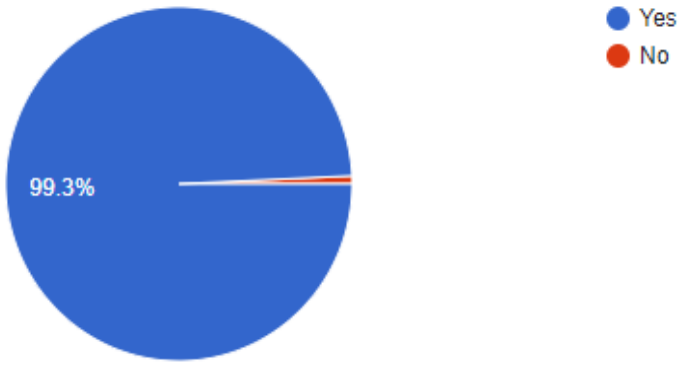
Source: Author's computation

Table 9 shows the student perceptions regarding the blended learning model in relation with their gender. The findings make it clear that 52.58% of the students who reported that they are very comfortable with the blended learning model are male students while 47.42% are females. The research results confirmed that among the students who indicated that they are comfortable with the blended learning model, 74.42% are male students and 25.58% are females. 55.56% of the students who reported that they are somehow comfortable with the blended learning model are male students while 44.44% are female students.

The p-value is 0.0516 ($p>0.05$), and therefore, this shows that the relationship between students' perceptions regarding the blended learning model with their gender is not statistically significant.

Figure 11

Students' Willingness to Recommend the Blended Learning Model to other Students



Source: Author's computation

Relying on the students' perceptions of the blended learning model, the students also expressed whether they can recommend other students to join university programs in the blended learning model or not. The study findings in Figure 10 below show that 99.3% expressed their willingness to recommend other students to do their academic programs in the blended learning model. Only 0.7% expressed their unwillingness to do so.

Table 10

Student's Perceptions versus Recommendation of the Blended Learning Model

Perception regarding blended learning model	Recommending the blended learning model		
	No	Yes	Total
Very Comfortable	0.00	100.00	100.00
Comfortable	0.00	100.00	100.00
Somehow comfortable	11.11	88.89	100.00
Total	0.67	99.33	100.00

Pearson Chi2 = 15.66 Prob = 0.0004

Source: Author's computation

As presented in Table 10, all students (100%) who stated that they feel very comfortable with the blended learning model also belong to the group of students willing to recommend the model to others. Likewise, every student (100%) who reported feeling comfortable with the model expressed a willingness to recommend it to their peers. Among those who indicated that they are somewhat comfortable with the blended learning model, 88.89% are in the group that is open to recommending the model to other students, whereas 11.11% of the same group expressed unwillingness to recommend it. The Chi-square test confirmed that there is a statistically significant association ($p<0.05$) between students' comfort levels with the model and their willingness to recommend it to others.

Table 11

Students' Views on the Effect of the Blended Learning Model on the Students' Enrolment Rate

Enrolment	**Frequency.**	**Percent**
Decreased	1	0.67
Increased	104	69.80
No difference	4	2.68
Somewhat decreased	3	2.01
Somewhat increased	37	24.83
Total	**149**	**100.00**

Source: Author's computation

To assess the impact of the blended learning on the student's enrolment rate, the students were asked if they have observed any increase or decrease of the enrolment rate after the adoption of the bended learning model in their respective higher education institutions. With reference to the findings presented in Table 11 below, 69.80% of the students indicated

that the enrolment rate has increased, 24.83% stated that the enrolment rate has somewhat increased while 2.68% mentioned that the rate remains the same. As opposite, 2.01% said that the enrolment rate has somewhat decreased while 0.67% of the students confirmed that the students' enrolment rate has decreased.

Table 12

Perception of Students versus the Level of Enrolment

	Perceptions regarding the blended learning model			
Level of enrolment of students	Very Comfortable	Comfortable	Somehow comfortable	Total
Increased	71.15	25.96	2.88	100.00
Somewhat increased	51.35	40.54	8.11	100.00
No difference	50.00	0.00	50.00	100.00
Decreased	100.00	0.00	0.00	100.00
Somewhat decreased	33.33	33.33	33.33	100.00
Total	65.10	28.86	6.04	100.00

Pearson Chi2 = 24.50 Prob = 0.0019

Source: Author's computation

Table 12 demonstrates the cross tabulation of the students' perceptions regarding the blended learning model versus their views about the level of enrolment after adopting the blended learning model. For the students who said that the enrolment level has increased, 71.15% are among the student who said that they are very comfortable with the blended learning model, 25.96% are from the category of the students who reported that they are comfortable with the model, and 2.88% are among the students who confirmed that they are

somehow comfortable with the blended learning model. For the students who reported that that the enrolment level has somewhat increased, 51.35% are from the category of the students who confirmed that they are very comfortable with the model, 40.54% are among the students who said that they are comfortable with the model, and 8.11% are among the students who said that they are somehow comfortable with the blended learning model. For the students who reported that the enrolment level has not changed, 50% are from the category of the students who indicated that they are very comfortable with the blended learning model, and 50% are in the category of who said they are somehow comfortable.

Among the students who reported that the enrolment level has decreased, all of them (100%) are from the category of the students who indicated that they are very comfortable with the blended learning model. The students who said that the enrolment level has somewhat decreased, 33.33% are from the category of the students who confirmed that they are very comfortable with the model, 33.33% are among the students who reported that they are comfortable with the model, and 33.33% are among the students who said that they are somehow comfortable with the blended learning model.

The results of the Chi-square test indicate that there is a statistically significant association between students' perceptions of the blended learning model and their opinions on student enrollment levels following the adoption of blended learning ($p<0.05$).

Advantages of the Blended Learning Model as Generated by Students

The student respondents generally highlighted different advantages of the blended learning model in higher education. According to their views, the blended learning model in higher education combines online and in-person elements to cater for diverse learning styles. So, it enhances learning engagement and provides personalized learning experiences. It was

also stated that it is cost saving, convenient, and it improves students' concentration on their learning materials.

In addition, the blended learning was appreciated for promoting self-paced learning, research skills, and optimizing students' time. It was also indicated that it empowers learners, saves time and money usually spend on various needs associated with the face-to-face model, and it fosters students' knowledge and experience. The blended learning model was also said to be a flexible approach that promotes diversity and digital literacy by accommodating preferences and enhancing learning outcomes. In the same way of thinking, it was pointed out that the blended learning model enables multitasking in learning, improves students' retention, and it promotes communication, adaptability and prioritization skills.

The students further confirmed that the blended learning model helps students to have access to job and other personal development opportunities, enhances creativity in learning, and it provides learners with networking opportunities. It was also mentioned that the blended learning model facilitates the students to accommodate work and study. Moreover, they reported that the blended learning model enhances collaboration, provides access to both online and physical learning resources, enhances individual learning, and it creates a safe and flexible learning environment.

Challenges Faced by the Students in the Implementation of the Blended Learning Model

The students who took part in this research indicated various challenges faced in the implementation of the blended learning model in higher education in Rwanda. The challenges underlined include the high cost of technology, inadequate training on the utilization of technological tools, content adaptation, decreased students' motivation, weakened relationships between students and teachers, limited internet access, digital illiteracy, poor time management, difficulties in submission and task management, attendance and participation

concerns, language barriers, lack of immediate technical support, scarcity of appropriate infrastructure inside and outside universities.

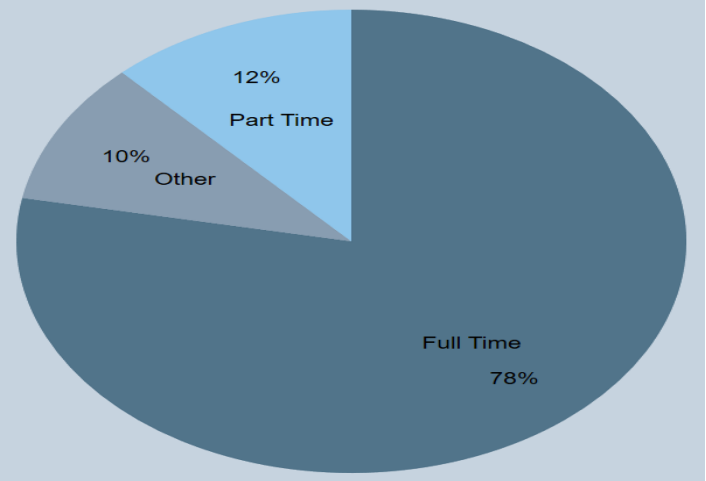
4.4.1.2 Findings from Lecturers

The study considered 50 lecturers for the online survey. As 50 is the minimum number of participants which is close to a limitation, One-way ANOVA test was additionally applied to strengthen the study findings confirmed by the Chi square test results.

Lecturers' Demographic Information

Figure 12

Lecturer's Employment Status

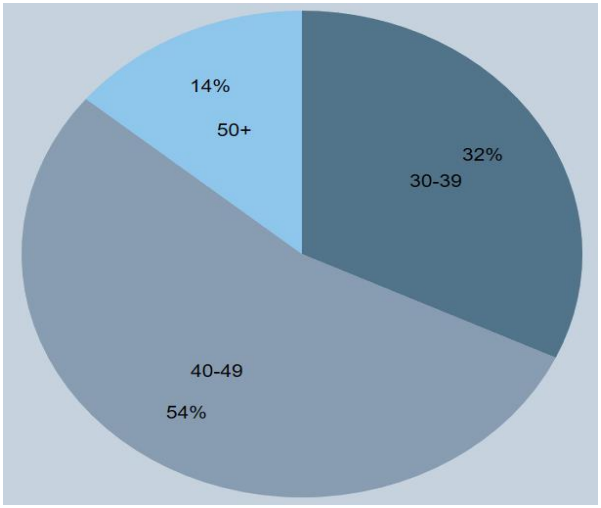


Source: Author's computation

Figure 11 shows the employment status of the 50 university lecturers who participated in this study. The study findings show that 78% are full-time lecturers, 12% are part-time lecturers and 10% have other type of employment contracts.

Figure 13

Age Groups of Lecturers

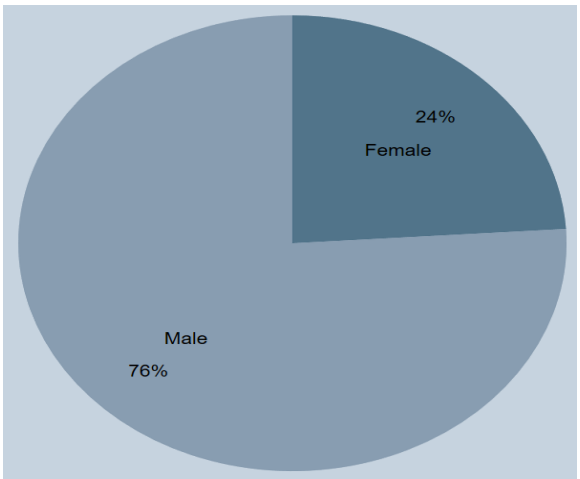


Source: Author's computation

Figure 12 presents the age group of the participating lecturers. The study results indicate that 54% of the lecturers are in the age group of 40-49 years old, 32% are in the age group of 30-39 and 14% are above 50 years old.

Figure 14

Lecturers' Gender



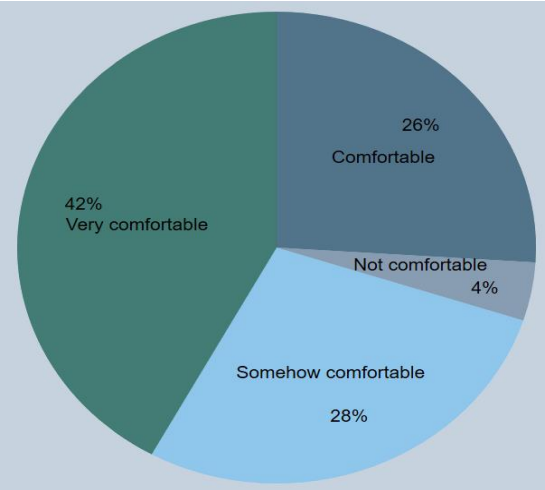
Source: Author's computation

As it is presented in Figure 13, 76% of the lecturers who participated in the study are males and 24% are females.

Findings Related to the Research Questions

Figure 15

Perceptions of Lecturers Regarding the Blended Learning Model



Source: Author's computation

The findings in Figure 14 revealed that 42% of the lecturers reported that they are very comfortable with the model, 26% confirmed that they are comfortable while 28% said they are somehow comfortable with the model. Only 4% of the lecturers reported that they are not comfortable with the blended learning model.

Table 13

Lecturers' Perceptions versus Working Status

Lecturers' perception regarding blended learning model	Lecturers working status			
	Full Time	Other	Part Time	Total
Very comfortable	71.43	9.52	19.05	100.00
Comfortable	84.62	0.00	15.38	100.00
Somehow comfortable	78.57	21.43	0.00	100.00
Not comfortable	100.00	0.00	0.00	100.00
Total	78.00	10.00	12.00	100.00

Pearson Chi2 = 6.56 Prob = 0.3634

Source: Author's computations

The findings presented in table 13 summarize the lecturers' perceptions of the blended learning in connection to their employment status. The study findings revealed that 71.43% of the lecturers who reported that they are very comfortable with the blended learning model are full-time lecturers, 19.05% are part-time lecturers while 9.52% have other type of employment contracts. Among the lecturers who confirmed that they are comfortable with the blended learning model, 84.62% are full-time while 15.38% are part-time lecturers. The lecturers who indicated that they are somehow comfortable with the blended learning model include 78.57% of full-time lecturers and 21.43% of the lectures with other type of contracts. All lecturers (100%) who reported that they are not comfortable with the blended learning model are found to be full-time lecturers.

Table 14

One-way ANOVA Test Results

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	1.48491228	1	1.48491228	0.98	0.3265
Within groups	72.5350877	48	1.51114766		
Total	74.02	49	1.51061224		

Bartlett's test for equal variances: chi2(1) = 2.9209 Prob>chi2 = 0.087

Source: Author's computation

Both the Chi square test and One-way ANOVA test results (Table 14) confirm that the association between lecturers' perceptions regarding the blended learning model and their employment status is not statistically significant ($p>0.05$). In other words, there is no relationship between the lecturers' perceptions of the blended learning model and their employment status.

Table 15

Lecturers' Perception versus Age Group

Lecturers' perception regarding blended learning model	Age group			
	30-39	40-49	50+	Total
Very comfortable	52.38	47.62	0.00	100.00
Comfortable	38.46	7.69	53.85	100.00
Somehow comfortable	0.00	100.00	0.00	100.00
Not comfortable	0.00	100.00	0.00	100.00
Total	32.00	54.00	14.00	100.00

Pearson Chi2 = 39.53 Prob = 0.0000

Source: Author's computations

As indicated in the cross-tabulation table 15, among the lecturers who reported that they are very comfortable with the blended learning model, 52.38% are aged between 30-39 years old, while 47.6% are aged between 40-49 years old. For the lecturers who pointed out that they are comfortable with the blended learning model, 53.85% are over 50 years old, 38.46% are aged between 30-39 years old while 7.69% are aged between 40-49 years old. All the lecturers (100%) who reported that they are somehow comfortable with the blended learning model are between 40-49 years old. All the lecturers (100%) who confirmed that they are not comfortable with the blended learning model are between 40-49 years old as well.

Table 16

One-way ANOVA Test Results for Lecturers Perception and Age

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	28.4158333	2	14.2079167	14.64	0.0000
Within groups	45.6041667	47	.970301418		
Total	74.02	49	1.51061224		

Bartlett's test for equal variances: chi2(1) = 8.1703 Prob>chi2 = 0.004

Source: Author's computations

Hence, based on the Chi square test and One-way ANOVA test results (Table 16) confirm that there is statistical significance between the lecturers' perceptions and their age ($p<0.05$).

Table 17

Lecturers' Perceptions and Gender

Lecturers' perception regarding blended learning model	Gender		
	Female	Male	Total
Very comfortable	19.05	80.95	100.00
Comfortable	7.69	92.31	100.00
Somehow comfortable	50.00	50.00	100.00
Not comfortable	0.00	100.00	100.00
Total	24.00	76.00	100.00

Pearson Chi2 = 8.00 Prob = 0.0461

Source: Author's computation

The findings in Table 17 revealed that the lecturers who reported that they are very comfortable with the blended learning model, 80.95% are males while 19.05% are females. For the lecturers who reported that they are comfortable with the blended learning model, 92.31% are males while 7.69% are females. Those who stated that they are somehow comfortable with the blended learning model include 50% of male and 50% of female lecturers. All lecturers (100%) who said that they are not comfortable with the blended learning model are males.

Table 18

One-way ANOVA Test Results for Blended Learning model and gender

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	1.48491228	1	1.48491228	0.98	0.3265
Within groups	72.5350877	48	1.51114766		
Total	74.02	49	1.51061224		

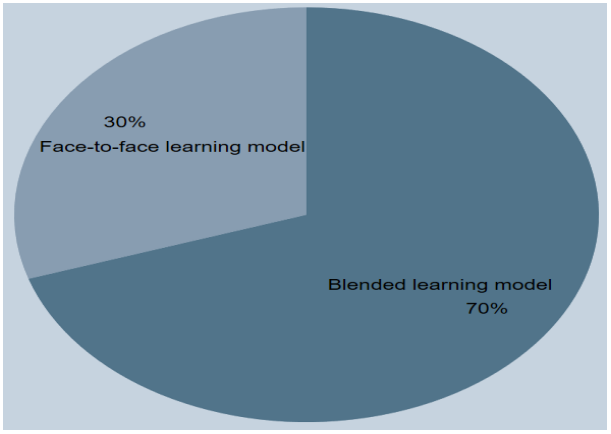
Bartlett's test for equal variances: chi2(1) = 2.9209 Prob>chi2 = 0.087

Source: Author's computations

Checking the association between the lecturers' comfortability with the blended learning model and their gender, the Chi square test results revealed that the relationship is statistically significant ($p<0.05$) while the One-way ANOVA test results (Table 18) revealed that the correlation lacks statistical significance ($p>0.05$).

Figure 16

Attractive Learning Model



Source: Author's computation

In an effort to find more about the perceptions of university lecturers regarding the blended learning model, they were also asked to identify the model that they think is more attractive between the blended learning and face-to-face model. As indicated in Figure 15, the findings revealed that 70% of the lecturers supported the blended learning model as a more

attractive model than face-to-face model while 30% of the lecturers considered the face-to-face model as the more attractive model compared to the blended learning model.

Table 19

Lecturers' Perceptions versus the Attractive Model

	Attractive Model		
Lecturers' perception regarding blended learning model	Blended learning model	Face-to-face learning model	Total
Very comfortable	76.19	23.81	100.00
Comfortable	61.54	38.46	100.00
Somehow comfortable	64.29	35.71	100.00
Not comfortable	100.00	0.00	100.00
Total	70.00	30.00	100.00

Pearson Chi2 = 1.90 Prob = 0.5931

Source: Author's computations

With reference to the findings in table 19, among the lecturers who reported that they are very comfortable with the blended learning model, 76.19% confirmed that the blended learning model is more attractive than face-to-face while 23.81% perceive face-to-face as a more attractive model than the blended learning. For the lecturers who confirmed that they are comfortable with the blended learning model, 61.54% also confirmed that the blended learning model is more attractive than face-to-face model while 38.46% proved the face-to-face learning model to be more attractive. For those who reported that they are somehow comfortable with the blended learning model, 64.29% of them take the blended learning model as the more

attractive model while 35.71% described the face-to-face learning model as more attractive than the blended learning model. All lecturers (100%) who expressed comfort with the blended learning model perceive the model as more attractive than face-to-face model.

Table 20

One-way ANOVA Test Results for Blended learning model and attractiveness

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	.800952381	1	.800952381	0.53	0.4722
Within groups	73.2190476	48	1.52539683		
Total	74.02	49	1.51061224		

Bartlett's test for equal variances: chi2(1) = 0.0798 Prob>chi2 = 0.778

Source: Author's computations

Hence, the Chi square test and One-way ANOVA test results (Table 20) confirmed that the connection between the lecturers' perceptions of the blended learning model and the attractiveness of each model is not statistically significant ($p>0.05$).

Table 21

Importance of the Blended Learning Model

Importance of the blended learning model	Frequency	Percent
It helps them complete their class assignments from anywhere at any time	6	12.00
It helps them navigate the course resources from different sources	22	44.00
It is flexible to students with other job responsibilities	7	14.00
It provides students with enough time to go through the course material prior to the face-to-face	15	30.00
Total	**50**	**100.00**

Source: Author's computations

Table 21 presents the findings about the role of the blended learning model in the students' academic programs. 44% of the lecturers said that the model helps students to navigate the course resources from different sources. 30% of the lecturers confirmed that this model provides students with enough time to go through the course material prior to the face-to-face learning model. 14% of the lecturers reported that the model is flexible to students with other job responsibilities. Finally, 12% indicated that the model helps students complete their class assignments from anywhere at any time.

Table 22

Lecturers' Perception and Importance of the Blended Learning Model

Importance of blended learning model	Lecturers' perception regarding blended learning model				
	Very comfortable	Comfortable	Somehow comfortable	Not comfortable	Total
It helps them complete their class assignments from anywhere at any time	0.00	33.33	66.67	0.00	100.00
It helps them navigate the course resources from different sources	36.36	13.64	40.91	9.09	100.00
It is flexible to students with other job responsibilities	57.14	42.86	0.00	0.00	100.00
It provides students with enough time to go through the course material prior to the face-to-face	60.00	33.33	6.67	0.00	100.00
Total	42.00	26.00	28.00	4.00	100.00

Pearson Chi2 = 18.18 Prob = 0.0332

Source: Author's computations

The findings in the cross-tabulation table 22 show the relationship between the lecturers' perceptions versus the way they perceive the blended learning model in terms of importance. The findings revealed that among the lecturers who reported that they are very comfortable with the blended learning model, 60% said that this model provides students with enough time to go through the course material prior to the face-to-face model, 57.14%

supported that the model is flexible to students with other job responsibilities, while 36.36% confirmed that the model helps students to navigate the course from different sources. For the lecturers who reported that they are comfortable with the blended learning model, 42.86% confirmed that the model is flexible to students with other job responsibilities, 33.33% said that the model helps students to complete their class assignments from any location at any time, and that it provides students with enough time to go through the course material prior to the face-to-face model, while 13.64% stipulated that the model helps students to navigate the course from different sources. For the lecturers who reported that they are somehow comfortable with the blended learning model, 66.67% proved the model to help students complete their class assignments from anywhere at any time, 40.91% reported that the model helps students navigate the course from different sources, while 6.67% confirmed that the model provides students with enough time to go through the course material prior to the face-to-face model. 9.09% of the lecturers who reported that they are not comfortable with the blended learning model also confirmed that the model helps students navigate the course from different sources.

Therefore, the Chi square test results show that the association with the lecturers' perceptions with the importance attached to the blended learning model is statistically significant ($p<0.05$).

Table 23

Lecturers' Views on the Effect of the Blended Learning Model on the Students' Enrolment Rate

Effect on enrolment	Frequency	Percent
Decreased	4	8.00
Increased	18	36.00
No difference	7	14.00
Somewhat decreased	6	12.00
Somewhat increased	15	30.00
Total	**50**	**100.00**

Source: Author's computations

Looking at the number of students before and after the adoption of the blended learning model, the lecturers were requested to express their views whether the students' enrolment has increased or decreased. The results in table 23 showed that 36% of the lecturers are of the view that the students' enrolment rate has increased. 30% of the lecturers expressed the view that the enrolment rate has somewhat increased while 14% indicated that the rate remains the same. On the other hand, 12% of the lecturers said that the enrolment rate has somehow decreased while 8% confirmed that the rate has decreased. As observed, these findings suggest that blended learning model has attracted a big number of students while a certain number of lecturers perceive that there has been an increase but not significant or substantial. These lecturers suggest that there is a moderate increase of enrolment rate.

Table 24

Lecturers' Perceptions of the Blended Learning Model versus their Views on the Students' Enrolment Level

	Perception regarding blended learning model				
Enrolment of students	Very Comfortable	Comfortable	Somehow comfortable	Not comfortable	Total
Increased	66.67	16.67	16.67	00.00	100.00
Somewhat increased	0.00	33.33	66.67	0.00	100.00
No difference	28.57	28.57	14.29	28.57	100.00
Decreased	100.00	0.00	0.00	0.00	100.00
Somewhat decreased	50.00	50.00	0.00	0.00	100.00
Total	42.00	26.00	28.00	4.00	100.00

Pearson Chi2 = 40.19 Prob = 0.0001

Source: Author's computations

Table 24 demonstrates the cross tabulation of the lecturers' perceptions of the blended learning model versus their views about the level of students' enrolment after the adoption of the blended learning model. For the lecturers who said that the enrolment level has increased, 66.67% are among the lecturers who are very comfortable with the blended learning model, 16.67% are from the category of those who reported that they are comfortable with the model, and 16.67% are among the lecturers who are somehow comfortable with the blended learning model. For the lecturers who reported that that the enrolment level has somewhat increased, 33.33% and 66.67% are from the category of the lecturers who reported that they are comfortable and somehow comfortable with the blended learning model respectively. For the

lecturers who indicated that the enrolment level has remained the same, 28.57% are respectively from the category of those who said that they are very comfortable, comfortable and not comfortable with the model while 28.57% are from the category of the lecturers who expressed discomfort with the blended learning model. For the lecturers who reported that the enrolment level has decreased, all of them (100%) are from the category of the lecturers who confirmed that they are very comfortable with the blended learning model. The lecturers who mentioned that the level of enrolment has somewhat decreased, 50% of them are from the category of those who are very comfortable with the model and other 50% are from those who feel comfortable with the model.

Consequently, the Chi-square test results validate that there is a statistically significant association between lecturers' perceptions of the blended learning model and their views on student enrollment levels following its implementation ($p<0.05$).

Advantages of the Blended Learning Model as Perceived by Lecturers

As far as the advantages of the blended learning model are concerned, lecturers highlighted a number of advantages it has. They stated that it combines the best of online and in-person learning to establish a comprehensive academic experience, provides flexibility for both teachers and students, enables personalized learning, allows learners to control the pace of their education, and it reinforces learning engagement through various teaching methods.

Additionally, it was stated that the blended learning is cost-effective, scalable, time and resources saving. It was also indicated that it supports distance learning, provides direct access to lesson content, and offers flexibility for studying and working at the same time. Some lecturers also reported that it increases students' ownership of their learning journey, individualized learning, teacher support, and it creates enjoyable, safer and more collaborative

learning environment. It was also highlighted that the blended learning model maximizes campus capacity, promotes student preparation, and it enhances communication and accessibility.

Challenges Faced in the Implementation of the Blended Learning Model

Lecturers highlighted various challenges encountered during the implementation of blended learning. These challenges include technical know-how gaps on the side of both students and teachers, limited internet access, limited student agency, inadequate professional development opportunities to improve technical skills, and lack of adequate IT tools and infrastructure. Some lecturers further mentioned that connectivity and data limitations constitute a challenge for the online aspects of the blended learning. It was also highlighted that controlling the originality of submitted work and comprehending technical content also present challenges. High cost of electronic devices, lack of student preparation, cheating concerns, and difficulties in maintaining class progress and managing behavior are also part of the challenges highlighted by the lecturers. Some lecturers also reported that the blended learning can limit social interaction, collaborative learning and access to physical resources.

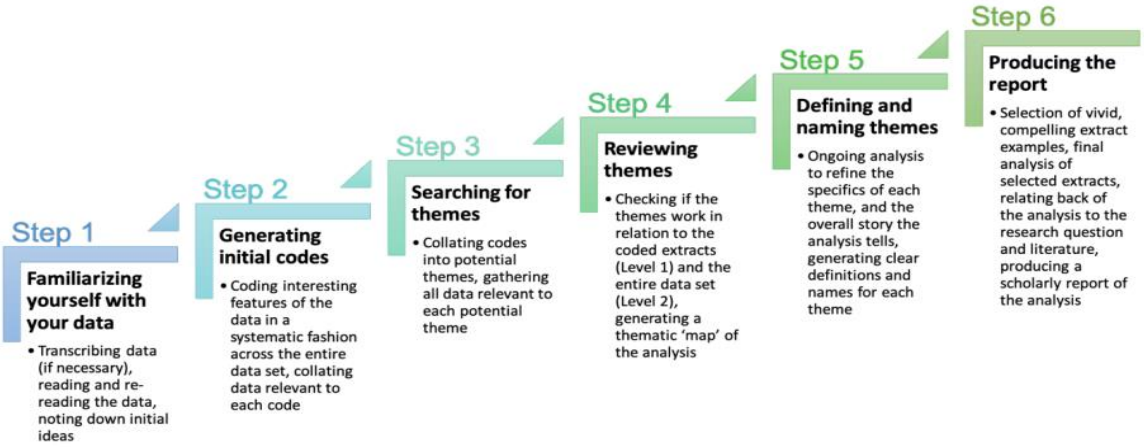
4.4.2. Findings from Interview

Apart from the online survey administered to university students and lecturers, semi-structured interviews were also organized and held with 10 academic registrars and 10 IT senior staff from all the participating higher education institutions, labeled A-J in this study for confidentiality purposes. All interview questions aimed at assessing how the blended learning model impacts on the access to higher education in Rwanda. The interview questions helped to assess the status of blended learning in each selected institution of higher education. All interview questions were asked in connection with the research questions.

The interview findings from all categories of interviewees were presented and analyzed using thematic analysis technique. The analysis of the interview findings was guided by thematic analysis through the six-step approach of thematic analysis (Cernasev & Axon, 2023) presented in Figure 16.

Figure 17

Phases of Thematic Analysis



Source: Cernasev & Axon, 2023

4.4.2.1. Data Code for thematic analysis

Table 25

Sample Data Excerpts and Initial Codes

Data Excerpts	Initial Codes
"My institution has gained a lot of benefits from the blended learning model. For example, the model has helped my institution to save money usually spent on students when they are always on campus and on classroom setting" _ *Interviewee ARG*	Benefits from the blended learning model

"As our institution adopted the blended learning model in 2014, since that time the students' enrolment rate in has progressively increased compared to the previous years" _ *Interviewee ARA*	Progressive increase of students' enrolment rate after the integration of the blended learning model
"In my institution, different challenges hamper the smooth implementation of the blended learning model. One of the key challenges that I can mention involves the lack of tech skills for both teachers and students. There is a need of ICT trainings for both students and staff to equip them with the required knowledge and skills in the blended learning" _*Interviewee ARJ*	Lack of ICT trainings for both students and staff
In our ICT department, we have various responsibilities to bear. Specifically, for blended learning my team is in charge of fixing all internet related issues in students and teachers' devices, managing Learning Management Systems (LMS) of the institution, managing internet access for students and teachers, regular maintenance of computer labs and personal devices, protecting students and teachers' devices with anti-viruses, uploading online modules	Fixing all internet related issues

for delivery, evaluate the technological aspects for the online module accessibility" *_Interviewee SSA*	

Source: Researcher

After getting familiarized with the data, the next steps focused on generating and organizing codes, a task that leads to the formulation of general and main themes that were developed for the findings report. The initial codes organize the findings by broad topics identified, which thus leads to the beginning of creating key themes. Table 25 provides the sample data excerpts and the relating initial codes.

4.4.2.2. Themes

The identified initial codes lead to the formulation of themes, and the formulation was done in relation with the study questions. Themes were developed by putting together the connected codes in subcategories of themes to interpret the main roots for codes. The formulation of themes was based on their relevance to the research questions and the number of codes relating to them. Then, the themes identified were additionally described to attribute them meaningful titles. Finally, each theme is developed based on the interviewees' views.

4.4.2.3. Interview Findings from Academic Registrars

Table 26

Themes and Associated Codes from Interviews Held with Academic Registrars

No	Themes	Associated codes
1	Time of adoption of the Blended learning	• Periods indicated • Years of starting the blended learning model
2	Students' enrolment after the adoption of the blended learning model	• Progressive increase compared with the least year • Remarkable increase after adoption of blended learning model
3	Advantages of the blended learning model	• Increase of the number of students • Save money usually spent on students • Teach more students from different locations • Teachers' motivation • Learning Management Systems (LMS) that helped their teaching modules accessible online.

4	Challenges during the implementation of the blended learning model	• Poor internet connectivity in the institution • Lack of ICT trainings for both students and staff • Insufficient computer labs and adequate IT facilities to avoid efficiency crisis. • Challenge of the digital gap • The location of the institution • Participation and attendance

Source: Researcher

The interview questions were addressed to 10 academic registrars from the participating higher education institutions. All questions were asked with the purpose to investigate the institutions' experience with the blended learning model, to examine the level of students' enrolment in the institutions after the adoption of the blended learning model, to assess academic registrars' views about the benefits that the institutions gain from the blended learning, and to examine the challenges faced in the implementation of the blended learning. To keep the respondent's privacy, all interviewees were given codes in data collection and reporting process. Table 26 shows the themes identified from the interviews held with the academic registrars.

Table 27

Adoption Period of the Blended Learning Model

Institution	Start period
University A	2014
University B	2016
University C	2017
University D	2015
University E	2018
University F	2019
University G	2017
University H	2019
University I	2019
University J	2019

Source: Researcher

The academic registrars were asked when their institutions adopted the blended learning model. As it is summarized in table 20, the interviewees revealed that the participating higher education institutions started the blended learning model in different periods of time. The interviewee ARA revealed that their university adopted the blended learning model in 2014. The interviewee ARB reported that the starting period was in 2016. The interviewees from institution ARC and ARG confirmed that their respective institutions started using the blended

learning model in 2017. The interviewees ARD and ARE said that their institutions have been using the blended learning since 2015 and 2018 respectively. As revealed by the interviews ARF, ARH, ARI, ARJ, they all introduced the blended learning model in 2019.

Level of Students' Enrolment after the Adoption of the Blended Learning Model

The researcher also asked the interviewees if the level of students' enrolment has increased or decreased in their institution after the adoption of the blended learning model. On this point, the interviewees' revealed that the level of students' enrolment has generally increased due to the integration of the blended learning model. The interviewee ARA asserted that since 2014 the enrolment rate in their institution has progressively increased compared to the previous years. The interviewee ARB confirmed that there has been a significant increase since when their institution adopted the blended learning. The interviewee ARC revealed that the student's enrolment rate in their institution has increased step by step since the adoption of the blended learning. According to the interviewee ARD, they have experienced a remarkable increase of students' enrolment rate over the last 8 years of experience with the blended learning model. The interviewee ARE reported that there has been an increase of student's enrolment rate in their institution especially during and after COVID 19 period. The interviewee ARF confirmed that they adopted the blended learning model in 2019, and they have started receiving more students since 2020. The interviewee ARF confirmed that the enrolment rate has relatively increased since the adoption of the blended learning model. As their institutions adopted the blended learning model in 2019, the interviewees ARH, ARI, and ARJ asserted that the enrolment rate has generally increased since the adoption of the blended learning model.

Advantages of the Blended Learning Model

For the advantages gained by the institutions of higher education from the blended learning model, the interviewees mentioned various advantages, and the increase of the number of students admitted every year was a shared benefit in all the institutions. In addition to the increase of students' enrolment rate, the interviewee ARG also mentioned that the blended learning model has helped the institution to save money usually spent on students when they are always on campus and on classroom setting. Another benefit stated by the interview ARJ is that the model allowed teachers to teach more students from different locations while the interviewee ARE stated that the model helped the institution increase teachers' motivation as they are not supposed to be on campus every time. Another benefit shared by the interviewees ARA, ARB, ARC, ARD, ARF, ARH and ARI is that the blended learning model helped the institutions set the Learning Management Systems (LMS) that helped their teaching modules accessible online.

Challenges faced in the Implementation of Blended Learning

As the blended learning model requires strong internet connectivity, all interviewees highlighted the issue of poor internet connectivity in their institutions which needs to be upgraded to facilitate online sessions. Another shared challenge in all participating institutions is the lack of ICT trainings for both students and staff to provide them with the required expertise in the blended learning. The interviewees ARA and ARC reported the issue of insufficient computer labs and adequate IT facilities to avoid efficiency crisis. For the continuous smooth application of the blended learning model, interviewees ARF, ARG, ARJ raised the challenge of the digital gap which implies limited capacity for some students and even teachers to access adequate required tools for the blended learning like, laptops, tablets, smart phones, etc. They added that this issue impedes the smooth running of online sessions. Another challenge reported by the interviewee ARI is about the location of the institution and

its students. The interviewee clarified that some institutions or their branches operate in remote areas where access to reliable internet is very limited. So, this may be a barrier for the institution and the students in those areas to implement the blended learning smoothly, the interviewee stated. The interviewees ARH and ARG raised the issue of active participation and attendance. They explained that some students may not be self-disciplined enough to avoid various distractions when using their personal devices during the learning sessions. This may affect negatively the students' active participation and attendance.

4.4.2.4. Interview Findings from IT Senior Staff

Interviews were conducted with 10 senior IT staff members from the participating higher education institutions. The primary aim of these interviews was to explore several key aspects related to the implementation of the blended learning model. First, the interviews focused on how both students and teachers are supported in the blended learning environment, including the resources available to facilitate teaching and learning. Additionally, the usability of these resources was assessed to determine whether they are user-friendly. The interview also sought to gather the IT senior staff's perspectives on the benefits that the institutions gain from adopting the blended learning model. Furthermore, the interviews aimed to identify the challenges faced by both students and teachers in the blended learning setting, as well as the support provided to help overcome these obstacles. Finally, the interviewees were asked to provide recommendations on how to strengthen the blended learning model in higher education institutions. To ensure privacy and confidentiality, each interviewee was assigned a code for data collection and reporting purposes. Table 28 presents the themes and the relating codes from the interviews held with IT Senior Staff.

Table 28

Themes and Associated Codes from Interviews Held with IT Senior Staff

No	Themes	Associated Codes
1	Technical Support	• Fixing all internet related issues • Trainings for students and teachers on using Learning Management Systems (LMS).
2	Availability of resources	• Format of teaching modules uploaded • Resources including projectors and accessories
3	Friendly usage of resources	• majority of the resources they have are friendly
4	Advantages of the Blended Learning Model	• Support to students • Effective and efficient use of limited resource • Modern and favorable teaching and learning environment • Faster access to information and use wider variety of learning materials. • Increase the scope for distance learning. • Environmental protection
5	Challenges of the blended learning model	• Budget limitations • The lack of continuous professional trainings • Poor network infrastructure

		• Challenge of unreliable devices and software • Limited number of IT support staff

Source: Researcher

Technical Support from IT Senior Staff

All IT Senior staff reported that their role in supporting students and teachers include fixing all internet related issues in students and teachers' devices, managing Learning Management Systems (LMS) of the institution, managing internet access for students and teachers, regular maintenance of computer labs and personal devices, protecting students and teachers' devices with anti-viruses, uploading online modules for delivery, evaluate the technological aspects for the online module accessibility. In addition, the interviewee SSA also reported that they organize one-on-one meetings with students whose devices may need some particular technical support, and they organize trainings for students and teachers on using Learning Management Systems (LMS). Other types of support as reported by the interviewee SSC involve collaborating with academic faculty to plan for the system review to maintain the quality of the learning system.

Availability of Resources for Teachers and Students in the Blended Learning Model

The interviewees revealed that the blended learning model requires both physical and online resources. The online resources mentioned by all interviewees include teaching modules uploaded on LMS, educational videos, links to different articles, formative assessment tools, webinar, blogs, and social media pages, Frequent Asked Question (FAQs) cards, interactive posters, discussion and reflection boards. Additional resources were also mentioned and they include case studies (Interviewees SSA & SSF), weekly schedule (Interviewee SSC), and chart box (Interviewee SSG).

For physical resources, the commonly reported resources include projectors and accessories, speakers, library resources, chairs and tables. Interviewees SSB, SSD, and SSH also mentioned head phones, pointers, and smart boards. Interviewee SSE also stated that educational CDs are available for teaching and learning purposes. Interviewee SSA said that a video-conference room is also available and it can be used for the blended learning sessions.

Friendly-usage of the Resources

Following the interview results, the common answer by all interviewees is that some are simple to use while others require some tech skills. On this point, interviewee SSA pointed out that the majority of the resources they have are friendly user as they always organize induction sessions for both students and teachers. Interviewee SSB pointed out that teachers and students need some tech skills to access some online resources. Interviewee SSC mentioned that there are fundamental skills required for the ability to navigate the LMS and resources uploaded on it. Interviewees SSB, SSD and SSH reported that some physical resources like smart boards, projectors are not easy to use for all students and teachers.

Advantages of the Blended Learning

From the IT senior staff perspectives, the interviewees commonly revealed that the blended learning helps their institutions to maintain and gain more students as it is a flexible model. Another advantage mentioned by all interviewees is the good use of insufficient resources that the institutions own. The explanation here is that the blended learning does not require all students to be on campus at the same time. Seven interviewees also reported that the blended learning model helps their institutions get introduced to modern technologies, and other three of them pointed out that the blended learning model helps the institutions of higher education to adopt modern and favorable teaching and learning environment. One interviewee reported that the blended learning promotes personalized learning experience as LMS and

access to online resources are always available 24/7. Four interviewees also confirmed that the blended learning helps students and teachers get a faster access to the information and use wider variety of learning materials. Another advantage listed is that the blended learning model helps the institutions to increase the scope for distance learning. Environmental protection was also listed by 2 interviewees as an additional benefit of blended learning. In this regard, the interviewees explained that the model has helped the institutions to discourage the use of papers on campus which can contribute to the rapid environmental damage.

Challenges of the Blended Learning Model

The first-order challenges commonly listed by the IT Senior Staff during the interview consisted of budget limitations that can prevent the institution from buying enough and adequate technological facilities for the successful application of the blended learning model. Another challenge commonly mentioned by all interviewees is the lack of continuous professional trainings for both students and teachers on tech skills that can help them in the blended learning model. Poor network infrastructure was also mentioned as a common challenge in all participating institutions. According to the interviewees, the lack of strong network infrastructure impedes the continued use of technology in blended learning. Another common challenge revealed by all interviewees is the resistance to change where some students and teachers demonstrated unwillingness to use technology, which is one of the essential aspects of the blended learning model. As explained by the interviewees, this resistance may be due to the fact that they don't like technology, or they may not be adequately trained in it.

Five interviewees also listed the challenge of unreliable devices and software that can help both students and teachers feel comfortable with the blended learning. On this point, the interviewees explained that some teachers and students still use old devices which may not allow the installation of effective software, others use family facilities which can be used by other family members at the moment of learning and teaching activities, etc; and this may

consequently disrupt the smooth running of learning and teaching activities in blended learning model. In addition to the commonly above-mentioned challenges, three interviewees also mentioned limited number of IT support staff in their institutions. They explained that in their institution, the department of ICT is composed of only three staff which is, according to them, a very small number compared to the number of students and teachers they are expected to support. They added that this issue can prevent students and teachers from getting timely and adequate support they need in the blended learning model.

4.4.3. Findings from Document Checking

To assess how the blended learning model affects access to higher education, the researcher checked the official reports from the Ministry of Education (MINEDUC) and the annual reports from each participating higher education institution. The document checking aimed at checking the status and specific data regarding the students' enrolment rate in higher education at large and particularly in participating higher education institutions after the adoption of the model. The findings also help to crosscheck the survey and interview results regarding the participants' views on the students' enrolment status since the integration of the blended learning model in the academic programs of the selected institutions.

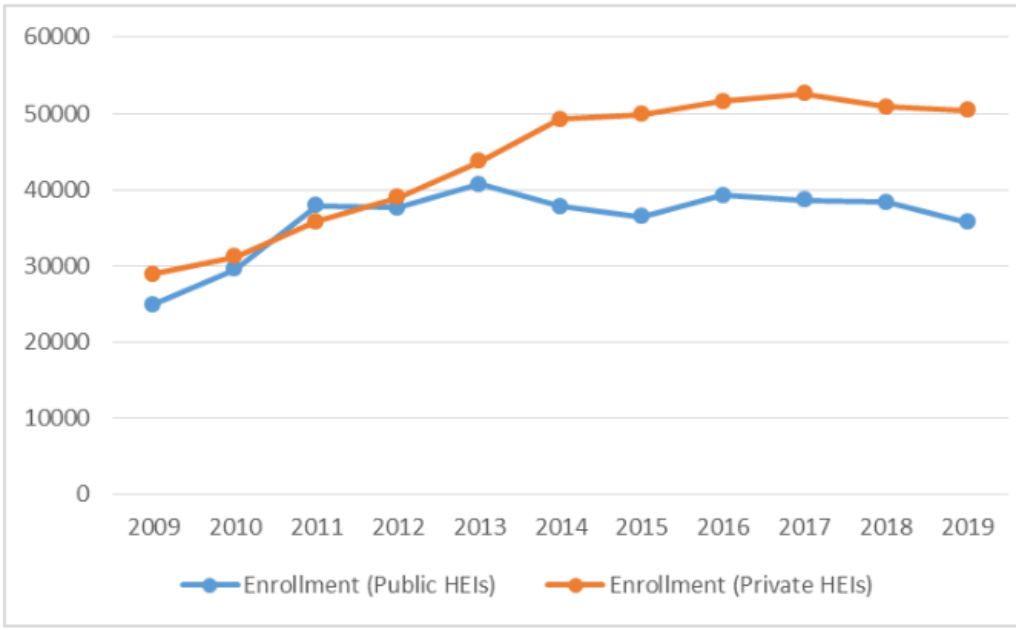
4.4.3.1 Students' Enrolment in both Public and Private Higher Education Institutions in Rwanda

The researcher checked the Ministry of Education (MINEDUC) report on students' enrolment in higher education in Rwanda. The purpose was to examine the general status of students' enrolment in both government and private institutions of higher education. The report indicates that over the past decade, enrolment in higher education institutions has generally increased even though there was a slight decline in the two years (2014 & 2015) particularly for public institutions. According to the report, the increase in enrolment is due to different

factors including the online and the blended learning mode, which are described as easy and flexible modes of learning.

Figure 18

Growth of Tertiary Education Enrolment in Rwanda



Source: Report on enrolment in higher education in Rwanda (MINEDUC, 2020)

The findings in Figure 17 indicates the growth of tertiary education enrolment in Rwanda (2009-2019), and the ten years' trajectory in MINEDUC's report also reflects the period in which all the participating institutions in this research adopted the blended learning model in their academic programs as it is summarized in table 29 below.

Table 29

Students' Enrolment Rates in the Participating Institutions after the Adoption of the Blended Learning Model

Institution	Start period	Enrolment /Start date	Enrolment in 2022	Enrolment rate %
University A	2014	8,342	13,477	55.39
University B	2016	9, 191	12,038	30.97

University C	2017	2,700	3,451	27.81
University D	2015	13,441	17,334	28.86
University E	2018	10,098	12,338	22.18
University F	2019	3,221	4,551	41.29
University G	2017	5,062	6,783	33.99
University H	2019	4,220	5,110	21.09
University I	2019	3,900	5,100	30.76
University J	2019	2,801	3,747	33.77

Source: Students' enrolment Reports

Based on the information collected from the institutions' annual reports on the students' enrolment, it was observed that the enrolment rate generally has increased in all the selected institutions of higher education. As it is summarized in table 19, since the adoption of the blended learning model up to 2022, students' enrolment rate in the institution A raised up to 55.39% over 8 years of experience with the blended learning. In the period of 6 years, the enrolment rate of the institution B moved to 30.97%. After 5 years, the enrolment rate in the institution C went up to 27.81% while in the institution D, the enrolment rate reached 28.86%. The enrolment rates of the institutions E, F, G were 22.18%, 41.29% and 33.99% respectively. For the institutions H, I and J, which adopted the blended learning model in 2019, the enrolment rate moved to 21.09%, 30.76% and 33.77% respectively.

4.5. Evaluation of Findings

This section of the research analyzes the findings and provides a brief interpretation of their implications. The evaluation is conducted in relation to existing literature on the blended learning model and access to higher education, as well as the study's hypotheses. The main objective of the study was to examine the effect of the blended learning model on access to

higher education in Rwanda. This investigation was done using descriptive statistics approach and cross tabulation to study the statistical significance of variables to verify the hypotheses of the study. The findings were spearheaded by the Constructivism theory focusing on student's active learning, Connectivism theory focusing on collaborative learning with the help of technology, Humanism Learning theory which focuses on the satisfaction of human needs, Technology Acceptance Model Theory focusing on the insights into the adoption and utilization of technology in learning, and Diffusion of Innovation Theory which focuses on the insights into how innovations are adopted and spread within a society or among groups.

4.5.1. Perceptions of the Blended Learning Model

The study explored the perceptions of both university students and teachers regarding the blended learning model in higher education. The research findings indicated that most respondents hold positive views about the blended learning model. Specifically, among university students, the results showed that a significant majority (94%) expressed comfort with the blended learning approach. Only few students (6%) indicated that they are somehow comfortable with this model. The positive attitude towards the blended learning is also strengthened by the high level (99.3%) of respondents' willingness to recommend the model to other fellow students, and their consideration of the blended learning model as a more attractive model than face-to-face model (70%).

Through the Chi square test results, the study also confirmed that there is a statistically significant association between the students' perceptions of the blended learning model and their year of study. As revealed by the study findings, all the students (100%) who indicated that they are somehow comfortable with the blended learning are registered in year 1 and 2 while those indicated that they are comfortable and very comfortable with the model are registered in year 3 and 4. This implies that the more students progress in their year of study, the more they build enough experience that helps them deal with the model. This relationship

has also been observed in various studies by different researchers such as Bryan & Volchenkova (2019), Dziuban et al., (2018) and Cassidy & Ahmad (2019). In their studies it is stated that the attitudes of the blended learning model may be contingent on different aspects such as trends of current education and society needs, globalization, technology, class size, experience with the model, etc. In addition, it is stated that the more people get enough experience with a new model, the more it becomes easy and enjoyable for them to deal with it. The results are also aligned with the constructivism learning theory which states that the blended learning model gives learners enough time for active participation in their learning at their individualized pace. In this regard, students in the final years usually have other personal responsibilities, and they may therefore need a model that can provide them with enough time to actively deal with their learning in their own time and pace in order to fulfil other personal responsibilities.

However, gender, age, academic status (whether students are registered as full or part-time) were not found to be associated with the comfortability with the blended learning model though some studies demonstrated that these factors may affect the manner in which people can perceive a learning model (Simanjuntak et al., 2020). It is well established that working memory may decline with age, and this may affect learning especially in the model that requires important skills such as problem solving and decision making (Prasad, 2021).

On the side of university teachers, the research findings also revealed that the larger number of university teachers are comfortable with the blended learning model. Only 4% of the lecturers expressed that they are not comfortable with the blended learning model. Various studies have indicated that the lack of positive attitudes may result from different factors such as the low levels or lack of digital skills to navigate the technological or web-based means for learning and facilitation, which impacts negatively the way people perceive the model (Prasad, 2021).

The Chi square test results also confirmed that there is statistically relationship between the teachers' attitudes and their age and gender. Based on the study results, the teachers who reported that they are very comfortable with the blended learning model are aged between 30-49 years old, while the teachers who reported that they are not comfortable with the model are found in the age category of 50 years and above. For gender, the research discovered that male teachers had more positive perceptions of the blended learning model than female university teachers. All university teachers who reported that they are not comfortable with the blended learning were males. Both Chi square test and One-way ANOVA test results revealed that there is no relationship between the perceptions of the university teachers in the blended learning model and their employment status. In other words, no statistically significant relationship was found between the university teachers' attitude towards the blended learning model and the fact that they work either under a full or part-time contract. The findings obtained about university teachers' attitude towards the blended learning model are aligned with the results of the study carried out by Sánchez-Caballé et al. (2020) where age and gender are considered among the factors that can influence the perceptions of people towards a new teaching and learning model. According to them, people with young age have a better-established capacity to deal with a model that requires digital navigation skills.

The positive attitudes of the respondents in this study are generally reflected in the findings obtained in other studies like the study conducted by Li & Billy (2020) and Coynea (2018) investigating faculty members and students' insights about the blended learning program. The findings also indicated that the majority of the study respondents have positive attitudes towards blended learning due to the fact that it offers great learning and teaching experiences to both university students and teachers, it increases technological knowledge and skills, and it provides flexibility in teaching and learning. These findings align with the results of the study conducted by Li & Billy (2020) on the investigation of the perceptions of the

faculty members teaching blended learning courses. The findings from their study indicated that the majority of the faculty members who participated in the study perceived the model positively with the supporting explanation that it offers great learning and teaching experiences to both university students and teachers. Similarly, in their research, Lee & Hong (2023) examined student attitudes regarding online versus in-person education and their findings revealed that there was a preference among students for internet-based instruction over face-to-face learning due to its encouragement of self-paced learning and collaborative educational experiences. In the same line of thinking, the study by Kwok-Wing Lai (2021) concluded that many teachers usually have positive attitude towards the blended learning model as they have a facilitating role, through the means of technology, in helping their students acquire and grasp the class material or knowledge and skills.

As the blended learning model requires technology involvement, the findings on the respondents' attitudes are reflected in both Technology Acceptance Modela and Diffusion of Innovation theory offering valuable insights into how innovations, including educational methodologies like blended learning, are adopted and spread within a society or among groups (Acikgoz et al., 2023). In this regard, the respondents' attitudes can be associated with their acceptance or rejection of combining traditional face-to-face instruction with online learning elements for educational practices. In the same context, the respondents' appreciation of blended learning is also reflected in in the 2 theories where they share the same view that the more people embrace new model by accepting to try new methods, the more they serve as pioneers in implementing and showcasing the benefits of that model (Takahashi et al. (2023).

On the other hand, not all people share positive attitudes toward the blended learning model. In this respect, the study findings also revealed that there were few respondents, on the side of both students and lecturers) with negative attitudes towards the blended learning model. As it was also revealed in other studies, negative attitudes toward the blended learning model

often stem from concerns and challenges associated with its implementation. In their studies, scholars like Stenalt & Lassesen (2022), reported that the constraints that people face in the implementation of blended learning such as digital divide, quality of education, lack of motivation, weak student's agency, and resistant to change can be the source of negative perceptions of blended learning. In this regard, it has been revealed that students who are not responsible for their own learning or who are not equipped with adequate independent learning skills prefer face-to-face instruction as they rely on teachers' intervention in their learning process (Shorey, 2018). These findings are also aligned with Technology Acceptance Model theory which stipulates that the attitudes of blended learning, a model which involves technology in its implementation, may depend on the acceptance or rejection of technology by the users (El Archi & Benbba, 2023).

4.5.2. Advantages of the Blended Learning Model

The research also evaluated the respondents' views on the advantages of the blended learning model in higher education through online survey and interviews. As stipulated by Park and Jo (2018), once the system is well established, it provides a lot of benefits to both educational institutions and students. The main advantages highlighted by the respondents include being flexible in accommodating work and study and completing class assignments from anywhere at any time, cost effective, enhancing diverse learning styles, self-paced learning, and research skills. In addition, the model was also said to promote skills prioritization, learning collaboration, learner-centered approach and to provide easy access to online and physical learning resources. It was also emphasized that the blended learning model contributes to a rise in student enrolment rates in higher education institutions by offering more flexible learning opportunities. Additionally, it allows institutions to reduce expenses typically incurred from maintaining students on campus full-time, such as costs related to housing, utilities, and other physical infrastructure. The integration of this model further supports the

use of digital platforms for teaching and learning, enabling institutions to streamline academic delivery and better utilize their limited resources. Moreover, the adoption of blended learning enhances institutional efficiency and extends their capacity to provide distance education, thereby reaching a wider and more diverse learner population.

The study findings regarding the advantages of the blended learning model have also been revealed in other studies conducted by different scholars. In this respect, the flexibility and accessibility highlighted in this study were also underscored in the study conducted by Menon (2019) where it is emphasized that the two advantages distinguish the blended learning model from traditional instructional methods. In their views they commented that these qualities contribute to an open and adaptable approach to education by granting numerous students access to learning opportunities. Furthermore, Calamlam (2020) emphasizes that this mode of learning broadens learning opportunities by enabling students to engage with educational resources even from their homes or remote locations. Similarly, Truss & Anderson (2023) affirm that the online elements within blended learning can be particularly advantageous for learners in remote or geographically isolated areas by offering access that might otherwise be challenging through traditional educational means. Additionally, Mukhtaramkhon & Jakhongirovich (2022) confirm that it accommodates individuals with physical disabilities that might impede their participation in traditional classes. This flexibility is particularly advantageous for non-traditional learners, employed individuals, or those with personal responsibilities that might interfere with conventional classroom timetables.

Similarly, the advantages highlighted by the respondents in this study are also associated with constructivism, connectivism and humanism theories used in this study. Constructivism learning theory insists on the role of learners and teachers to make effective learning happen. From the constructivist perspective, students can only become knowledge makers when they are given the right task, guidance and enough time to accomplish it. This

principle is in line with the respondents' view that the blended learning model gives students enough time to deal with their studies in their own time and at individual pace with the facilitation of a teacher. Olusegun (2020) also support this principle saying that this mode of learning helps students make reflection on the actual world problems, and the opportunity to learn how to solve those problems. For Saunders et al. (2019), it also supports a diversity of educational learner-centered approaches and it helps students to create new experience-based knowledge, which leads to better learning outcomes. This was also evoked by various scholars including Kwok-Wing Lai (2021) who reported that blended approaches have a greater potential to enhance students' learning outcomes compared to exclusively face-to-face or online methods. In this regard, it is explained that, within blended instruction, students engage with both online and in-person teaching strategies, which fosters opportunities for independent learning alongside collaborative experiences. It is also supported that this combination cultivates a space where students can simultaneously develop self-reliance and teamwork. Furthermore, according to Rao (2019), blended learning methods enable students to leverage educational technology by promoting the advancement of digital literacy and critical thinking skills, and it facilitates personalized education which accommodates individual learning paces.

As the blended learning model enhances connections and collaborative learning, this is also in line with connectivism principle that people's learning and growth are associated with the connections and collaboration they create in their lives. As supported by Kop & Hill (2020), the blended learning model is in connection with Connectivism theory as it helps students make connections with the exciting and helpful things that can help them learn effectively through face-to-face and online modalities. The advantages highlighted also are reflected in humanism theory which considers learning as part of self-actualization. As it was mentioned that the blended learning model helps to accommodate work and study for students and to promote digital skills, this is in connection with human development, which is one of the reasons that

can motivate students to pursue their studies. In this regard, Muhajirah (2020) indicated that the blended learning model facilitates the students to increase the satisfaction of their needs up to the level of self-actualization by providing an open accessibility to learning opportunities that facilitate individualized learning and easy access to the online learning resources with the support of face-to-face instruction. In their study, Alsalhi et al. (2021) also highlighted alike benefits that the blended learning approach helps students to boost their engagement and involvement in academic programs, save their time as students learn at their own pace, and it enhances student experience as it helps them to access professional resources, and to create connections with other professionals in their domains of study through the use of technology.

Cost effectiveness highlighted by the study respondents as one of the advantages of blended learning was also discussed in the study conducted by Brenya (2023) and Muhria et al., (2023), and Mendoza & Venables (2023). As per Brenya (2023), blended learning has the potential to minimize expenses typically linked to traditional classrooms by leveraging online resources and diminishing the necessity for physical infrastructure. This approach enables institutions to extend their reach beyond geographical boundaries, an opportunity to reach out to a wider audience. Regarding students, it has been discovered that blended learning offers various cost-effective and efficient aspects that can facilitate students to engage in part-time or full-time work alongside their education, which can eventually help students to manage educational expenses and decrease dependence on student loans (Muhria et al., 2023). The inclusion of online resources and materials within the blended learning model, as noted by Mendoza & Venables (2023), presents an opportunity for students to save expenses associated with textbooks, travel, and occasionally accommodation, particularly for courses that provide remote learning alternatives. Consequently, it's possible to infer that the cost-effective and efficient advantages of blended learning could make education more affordable and accessible for even individuals from lower-income backgrounds. This accessibility may attract a

substantial number of students and extend learning opportunities especially for those who may not be able to attend colleges due to constraints like geographical distance or scheduling conflicts.

Active engagement and diverse learning styles enhancement raised by the study respondents were also supported by the studies conducted by different scholars such as Almusaed et al. (2023) and Li (2023). As blended learning integrates diverse teaching approaches like multimedia tools, interactive content, and face-to-face teaching, it sustains student's engagement, and it accommodates various learning styles, which promotes a more dynamic learning experience (Almusaed et al., 2023). Moreover, Li (2023) contends that the effectiveness of blended learning stems from its ability to combine the strengths of traditional in-person teaching with the adaptability and interaction found in online education. According to the same author, this can contribute to a conducive learning environment, when implemented effectively, and it can therefore amplify students' motivation and dedication to learning.

For self-paced learning, this advantage was also highlighted by other study findings including the study conducted by Tonbuloğlu & Tonbuloğlu (2023), Ascencio (2023) and Yu et al., (2023). According to Tonbuloğlu & Tonbuloğlu (2023), blended learning promotes self-paced learning by offering students flexibility in accessing and engaging with educational materials. Through the integration of online resources, students can tailor their learning experience to their own pace, allowing them to review content, assignments, or lectures as needed. As commented by Ascencio (2023), this approach enables individuals to progress through material at a speed that suits their learning style and comprehension, encouraging autonomy in managing their educational journey. Additionally, self-paced learning in blended environments often involves interactive modules or platforms that allow students to choose the sequence of their learning, fostering a sense of control and independence over their educational path (Dai, & Wang, 2023).

According to the respondents, the findings of the study indicated that blended learning significantly contributes to the development and advancement of research skills among both students and educators in higher education. It enables access to a wide array of resources that support independent research through the use of technology. This benefit was also echoed in the research by Suryono et al. (2023), who emphasized that blended learning acts as a key driver in nurturing and enhancing students' research abilities in higher education. Hebebci and Nilay (2023) further support this notion by asserting that the fusion of conventional teaching with online tools transforms the environment for building strong research capabilities. With access to digital libraries, scholarly databases, and a variety of academic materials, students are better equipped to engage in complex research tasks.

This exposure broadens their scope of knowledge nurtures critical thinking, information literacy, and the ability to discern credible sources; a fundamental cornerstone in the research process (Nind & Katramadou, 2023). Moreover, the flexibility inherent in blended learning environments empowers students to engage in independent research and exploration. As commented by Versteijlen (2023), online research assignments and interactive learning modules encourage self-directed learning, enabling students to navigate through information landscapes, evaluate sources, and synthesize findings autonomously. This self-driven approach hones their research skills and it instils a sense of ownership and curiosity to foster a deeper understanding of research methodologies and strategies. In the support of the role of blended learning in enhancing research skills in learning, (Ascencio, 2023) asserts that platforms offer fertile ground for collaborative research opportunities. According to him, by transcending geographical boundaries, virtual discussions, group projects, and peer reviews provide avenues for students to collaborate seamlessly. In this regard, (Buhl-Wiggers et al., 2023) affirms that such collaborative engagements nurture teamwork and communication skills, and they expose

individuals to diverse perspectives, which contributes to their ability to conduct comprehensive research within a collaborative framework.

4.5.3. Students' Enrolment Status

Considering the findings from the academic registrars and document check, it was observable that the students' enrolment rate has generally increased in all higher education institutions selected for this study after adopting the blended learning model. The findings revealed that the selected institutions adopted the blended learning model at different periods of time since 2014. Comparing the students' enrolment rate before and after the integration of the blended learning model, the research found that the enrolment rate in the selected higher education institutions raised between 20% and 55%. This increase of enrolment rate was also supported by the views of many university lecturers and students that the blended learning model has attracted a large number of students in their respective institutions. The increase of enrolment rate in the selected higher education institutions implies that the blended learning model has helped students to access higher education without necessary being on campus every time.

The increased rate of students' enrolment can be interpreted as a motivation factor for students to join the academic programs offered through the blended learning model. The motivation to join can be linked to the benefits of the blended learning model highlighted by the respondents. Being flexible in accommodating study and work, time saving, collaborative learning, etc are the blended learning benefits that can contribute to self-motivation about learning. This is also in line with connectivism theory principle that learning takes place only when learners are self-motivated about learning. Motivation can solve various learning problems connected to feelings of loneliness, confusion and commitment (Öberg et al, 2019). On the impact that blended learning can create, John (2021) asserted that the impact of the technology integration in education has significantly contributed to a valuable and conducive

learning environment which can result in students' successful academic achievements. It was also asserted that any learning and teaching model that gives priority to student's motivation, collaboration, satisfaction, connections and flexibility in terms of availability motivates students to develop willingness to pursue their studies; and this would therefore improve the enrolment rate in higher educational institutions. This falls under the blended learning model as it offers flexible and individualized learning opportunities that take into consideration time and location constraints in students' learning process (Kurt, 2021). As a point of support, students prefer to pursue their studies when motivation, collaboration, satisfaction and good relationship are ensured (Chen & Yao, 2020).

As strong technological backbone is essential for a successful learning experience, some views advocate for integrating upgraded software, hardware, and network capabilities in order to attract more students in higher education (Kumar & Vijay, 2023). Other views, focus on pedagogy by stipulating that that effective teaching methodologies are at the core of increasing accessibility to higher education. In this respect, it is encouraged to use diverse teaching strategies that can attract and engage students in educational programs (Andrade & Alden-Rivers,2019). This goes hand in hand with the adoption of flexible learning options in higher education institutions. On this point, Van der & Hlatshwayo (2023) stress the need for adaptable curriculum design integrating various modes of delivery that can facilitate students to learn in online or blended learning mode in order to facilitate them to pursue their education without conflicting with other commitment. This suggestion is also supplemented by the creation of a diverse and inclusive learning environment within higher education institutions. In their study, Tashiro & Hartman (2023) suggest that the creation of educational programs that can facilitate students to learn from different backgrounds and locations can attract a broader range of applicants.

The respondents' good perceptions towards the blended learning model, its advantages and the increased rate of students' enrolment are the factors considered to validate the study alternative hypothesis (H1) that the blended learning model has a positive impact on access to higher education in Rwanda. Drawing from the study findings, the implementation of the blended learning model can serve as a catalyst for increasing enrolment in higher education among diverse groups of students, by offering flexible and accessible learning opportunities that accommodate varying needs and backgrounds.

4.5.4. Key Challenges in the Implementation of the Blended Learning Model

The study results showed that the implementation of the blended learning still face some challenges at student, teacher and institutional level. At student and teacher level, the findings revealed that the challenges highlighted are centered on technical know-how gaps, limited internet access, limited student urgency, resistance to change, digital illiteracy, lack of professional development trainings to improve technical skills, lack of adequate IT devices due to high cost, active attendance and participation concerns, and lack of immediate technical support. Other challenges highlighted are connected to plagiarism and cheating where the control of the originality of the submitted online is still a problem.

At institutional level, the study findings generally revealed that the institutions still face the challenges related to the scarcity and adequacy of IT facilities inside and outside universities, poor internet connectivity, remote locations where access to internet is limited, budget constraints, and lack of enough IT specialists to support students and teachers.

Looking at all the challenges identified in this study, they have a lot of similarities with the challenges highlighted in other studies conducted on the blended learning model in tertiary education. For example, in his research, Vaughan (2020) indicated that teachers have many obstacles in the implementation process such as lack of new teaching and technological skills,

resistance to change, and unwillingness to deliver courses in a blended format as a way of avoiding possible failure risks in teaching practices. In Rwanda, different studies reported that Rwanda is among countries that are not yet at advanced level in terms of technology infrastructure, which is one of the aspects required for successful online learning. In his study, Uwizeyimana (2018) indicated that the small number of computer literacy and ownership constitutes a barrier to the efficient incorporation of blended learning in different institutions of higher education. Menon & Sujatha (2019) highlighted poor or insufficiency of IT infrastructures, IT illiteracy as significant obstacles for the effective implementation of the blended instruction in a lot of higher learning institutions, especially in third world countries.

Another challenge identified include limited access to internet connection and technological devices. This is also in line with the report of the National Institute of Statistics of Rwanda (2019) which states that a small number of Rwandan households had access to electricity (27.1%), and only 17.2% could use the internet. In terms of electronic devices, findings revealed that 3.3% of households owned a computer, 10.4% possessed a TV, 66.9% had cell phones, and 73.8% had a radio or could access it via their phones (NISR, 2019). On an individual level, 36.7% of Rwandans owned a mobile phone, and just 10.5% of young people were proficient in using computers (NISR, 2019). The largest university in Rwanda, the University of Rwanda (2018), reported that 63% of its students had laptops (Uwizeyimana, 2018). This limited computer ownership and literacy might pose a challenge to effectively introducing blended learning methodologies within higher education institutions in Rwanda, potentially causing discouragement among teachers and students regarding active participation in the blended learning initiatives at their respective institutions.

There is a hope that these challenges associated with technology infrastructure and access to internet will be addressed since Rwanda's current focus, as part of its national digital transformation initiatives, is to enhance digital technologies in order to drive innovation and

creativity across various social and economic domains, including education (MINEDUC, 2023). Based on the most recent data from the Ministry of Youth and ICT in Rwanda, as of the beginning of 2023, internet users in Rwanda amounted to 4.25 million, constituting 30.5% of the population. Regarding mobile phone ownership, the report approximates a total of 10.57 million active connections in Rwanda (Ministry of Youth and ICT, 2023). This rapid advancement in digital transformation across different sectors in Rwanda is expected to facilitate the implementation of programs involving online modalities, like blended learning within the education sector.

As recommended by Halder (2023), all higher education institutions need to stay dedicated to addressing the identified challenges to guarantee the effective implementation of blended learning techniques. According to him, overcoming technological obstacles, empowering faculty through extensive training, and ensuring fair access for all students are vital steps for easy integration of the blended learning, as an innovative educational model. Additionally, fostering adaptability, continual enhancement, and collaboration within educational communities would play a crucial role in overcoming many of the highlighted challenges (Barroso et al., 2023). As institutions persist in refining strategies, allocating resources thoughtfully, and prioritizing student-centered learning experiences, Hlazunova (2023) believes that the potential of blended learning as a transformative force in education remains attainable. According to Tonbuloğlu & Tonbuloğlu (2023), embracing these challenges as opportunities for growth and advancement would facilitate a path toward a more inclusive, engaging, and efficient educational landscape in the digital era.

4.6 Summary

This chapter presented and discussed the empirical findings of the study, which investigated the impact of the blended learning model on access to higher education in Rwanda. The analysis was conducted using a descriptive statistics approach, and the results were

systematically organized in line with the research objectives and questions. The discussion of findings was enriched through the lens of three guiding educational theories—Constructivism, Connectivism, and Humanism—which provided a conceptual foundation for understanding how learners experience, interact with, and benefit from the blended learning environment.

The main objective of this chapter was to provide well-substantiated evidence on whether the adoption of blended learning in selected higher education institutions has played a significant role in improving access to education., and to what extent learners and academic staff perceive it as an effective and inclusive educational model. To achieve this, the chapter organized the results around key themes derived from the study's objectives, including the attitudes of stakeholders towards blended learning, the perceived benefits and limitations of the model, and the impact of blended learning on enrolment trends.

The findings indicated that most respondents, comprising both students and academic staff, expressed a favorable perception of the blended learning model.. Most participants indicated that blended learning offers a more flexible and convenient approach to acquiring higher education. Students appreciated the ability to learn at their own pace and to access learning materials remotely, while lecturers acknowledged that blended learning facilitates better student engagement and supports innovation in teaching. This aligns with Constructivist principles, which emphasize learner autonomy, and the Connectivist view that learning occurs through networks and access to diverse information sources. Humanist theory is also reflected in the appreciation of blended learning's capacity to meet individual learning needs and to foster a more learner-centered educational experience.

Further, the results pointed to significant perceived benefits of the blended learning model, particularly in enhancing access for traditionally underserved populations. These include students from rural areas, working adults, and those with caregiving responsibilities or physical limitations. The flexibility to attend classes without being physically present on

campus was repeatedly emphasized as a critical advantage. Additionally, the opportunity to replay or review recorded instructional content and access materials at any time was highlighted as particularly beneficial in improving comprehension and learning outcomes.

Another key outcome of the study was the observation of an upward trend in student enrolment in the selected institutions that had adopted blended learning. This suggests that the availability of blended learning options may be playing a crucial role in removing barriers to access. The study found that since the introduction of blended learning programs, several institutions experienced increased numbers of applicants and registered students, many of whom would not have been able to attend through traditional face-to-face modalities. This increase in enrolment reflects the democratizing potential of blended learning, aligning with national and global goals of widening access to higher education.

Despite the positive feedback, the study also uncovered several challenges and constraints associated with the implementation of blended learning. Respondents cited issues such as poor internet connectivity, limited access to digital devices, lack of training for both students and lecturers, and the need for stronger institutional support and infrastructure. These constraints particularly affect students from rural and low-income backgrounds, raising concerns about equity and inclusivity. The findings therefore underscore the importance of addressing the digital divide to ensure that the blended learning model can serve as a tool for access rather than reinforcing existing inequalities.

Moreover, some lecturers expressed the need for greater institutional capacity building, including professional development in digital pedagogy, improved learning management systems, and consistent technical support. Without these enabling conditions, the benefits of blended learning may not be fully realized. This concern links closely to the Diffusion of Innovation Theory, which underscores the importance of establishing a supportive

environment and implementing suitable support systems to facilitate the effective uptake and integration of innovations.

Throughout the analysis, the findings were interpreted in relation to the socio-demographic characteristics of the respondents. For example, students who were employed or living in remote areas were more likely to express strong support for blended learning, highlighting its unique value for non-traditional learners. Similarly, younger students demonstrated higher levels of digital readiness, while older students and some lecturers indicated a need for additional training to fully engage with blended learning tools.

In validating the study hypotheses, the study revealed that the combination of increased enrolment figures, the positive perceptions of students and staff, and the tangible benefits described by participants collectively support the conclusion that blended learning contributes positively to expanding educational access.

The findings also reinforced the need for ongoing monitoring and evaluation of blended learning initiatives to ensure quality, effectiveness, and equity. While the positive outcomes are clear, the sustainability of these impacts depends on strategic institutional planning, continued investment in infrastructure and training, and inclusive policies that prioritize the needs of all learners.

In summary, this chapter has thoroughly presented the research findings, illustrating the impact of the blended learning model on access to higher education in Rwanda. The results have affirmed the key assumptions of the study while also offering fresh perspectives on the practical challenges and opportunities of implementing blended learning in a developing country context, such as Rwanda. The following chapter will provide a deeper analysis of these findings, exploring their significance for policy development, educational practices, and potential areas for future research.

CHAPTER 5: IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

5.1. Implications

The first research question was formulated with the aim to assess both university students and teachers' perceptions of the blended learning model in different institutions of higher education in Rwanda. The research revealed that most university students and lecturers hold positive attitudes towards the blended learning model. As the study findings revealed that only a few students (6.04%) and lecturers (4%) expressed discomfort with the blended learning model, this validates the first study hypothesis, which states that students and teachers generally have a positive perception of the blended learning model in higher education institutions in Rwanda. The research also indicated that the respondents' attitudes towards the blended learning model can be influenced by different factors such as year of program, willingness to recommend the model to others, age, gender, employment status, place of residence, etc. As it is presented in figure 7 and 12, the positive attitude towards blended learning was also strengthened by the high level (99.3%) of respondents' willingness to recommend the model to other students, and their consideration of the blended learning model as a more attractive model than the face-to-face model (70%).

The study findings regarding the respondents' attitudes towards the blended learning model are also reflected in various studies conducted by other researchers. In their studies, Bryan & Volchenkova (2019), Dziuban et al., (2018) and Cassidy & Ahmad (2019), it is stated that the attitudes of the blended learning model may be dependent on a various of factors such as age, gender, trends of current education and society needs, globalization, technology, class size, experience with the model, etc. Similarly, Li & Billy (2020) and Coynea (2018) conducted studies to look into academic staff and learners' perceptions of the blended learning model. The study results presented in figure 6 and 11 indicated that the majority of both university students and teachers have positive attitudes towards the model due to the

advantages attributed to it such as offering great flexibility in learning and teaching experiences and increasing technological knowledge and skills (p.22 & p.34-35). The study results are aligned with the constructivism learning theory which states that the blended learning model gives students sufficient time to participate in their studies at their individual pace in order to fulfil other personal responsibilities. In his study, Prasad (2021) also indicated that the lack of positive attitudes may result from different factors such as old age, the low levels or lack of digital skills to navigate the technological or web-based means for learning and facilitation. This can be confirmed by the study results where a small number of respondents who showed negative perceptions towards the blended learning model are either in the range of 50 years old and above or in the first year of their academic program.

As blended learning necessitates technology integration, the attitudes of respondents toward the model are reflected also in both the Technology Acceptance Model and the Diffusion of Innovation theory. These theories offer valuable understanding on how innovations, such as educational approaches like blended learning, are adopted and disseminated within societies or among specific groups (Acikgoz et al., 2023). Correspondingly, the respondents' viewpoints can be linked to their acceptance or rejection of combining traditional classroom instruction and online learning components in educational settings. Moreover, within these theories, the respondents' positive attitude toward blended learning aligns with the idea that the more individuals embrace a new model with willingness to trying novel methods, the more they serve as pioneers in demonstrating and implementing the advantages of that model (Takahashi et al., 2023).

The study results on the respondents’ attitude toward the blended learning model are consistent with findings from other studies carried out by different scholars in the field of online and face-to-face educational modalities. For example, when investigating faculty perceptions of blended learning, Li & Billy (2020) revealed that most participating faculty viewed the

blended learning model favorably. As explained, their positive perceptions were based on the model ability to enhance learning experiences for both students and teachers. Similarly, Lee & Hong (2023) investigated student preferences for online versus in-person education, and they found out that appreciations were put on a modality that involves internet-based instruction due to its support for self-paced learning and collaborative educational experiences. Likewise, the results of the study carried out by Kwok-Wing (2021) also concluded that many teachers have a positive perception on blended learning as it makes them play the role of facilitators, and it helps them use technology to assist students to navigate and understand the class material, which helps them to acquire necessary knowledge and skills.

As revealed by the study findings, perceptions of blended learning are subject to change based on individual experiences and the particular setting in which it is applied. In other words, the study participants hold varying perceptions based on their experiences with the blended learning model and the specific context of their institutions. This aligns with the findings of several studies that have explored the effectiveness of blended learning and individuals' attitudes toward it. As indicated in the study carried out by Ahmad (2021), it is widely recognised that blended learning represents an educational approach capable of yielding satisfaction among learners by facilitating the achievement of educational objectives and addressing students' immediate needs. Similarly, Fakhouri's (2018) study revealed that a big number of students view blended learning favorably, and they consider it as a valuable instructional model. In contrast to the traditional in-person model, the same study revealed that students perceive blended learning as a more appropriate approach that enables them to take control of their own educational experience.

Studies conducted on faculty members also demonstrate positive attitudes toward blended learning. Li & Billy (2020) examined the perceptions of faculty members teaching

blended learning courses and found that the majority view the model favorably, citing its capacity to offer enriching learning and teaching experiences for both students and educators. Similarly, Coynea (2018) argued that blended learning does not only enhance knowledge, competencies, and skills but also it provides flexibility and fosters a sense of responsibility in learning. Lee & Hong (2023) surveyed students to gauge their attitudes toward online and in-person education, revealing a preference for internet-based instruction due to its promotion of self-paced and collaborative learning experiences. Nazara (2018) contends that the implementation of blended learning approaches facilitates interaction and reflection opportunities at both the individual and classroom levels. Furthermore, with the aid of technology, this approach enables teachers to transition from traditional roles to that of facilitators (Kwok-Wing, 2021).

The implication from the respondents' positive attitude toward blended learning may have a lot of implications for educational practice and policy. First, they may imply a readiness to embrace innovative educational methodologies that accommodate in-person instruction with online elements. As revealed by Essa (2023), this mindset often correlates with a willingness to adapt to technological advancements and explore diverse learning approaches, fostering a more dynamic educational environment. Furthermore, a positive perception of blended learning may also imply a recognition of its potential benefits which includes enhanced flexibility in learning schedules, personalized learning experiences, and the utilization of technology to augment teaching methods. Such an attitude often aligns with a proactive approach to improving teaching effectiveness and student engagement (Suryono et al., 2023).

A favorable perception of blended learning can also contribute to greater exploration and implementation of its strategies that educators and institutions may invest in in order to create strong educational programs that can offer opportunities to optimize the learning experience from different learning options. So, a positive attitude toward blended learning

paves the way for educational innovation, encourages adaptability to evolving learning landscapes, and fosters a more inclusive and adaptable educational ecosystem which can attract more students (Cheng et al., 2023). In other words, positive attitudes toward the blended learning model implies the potential benefits of integrating technology-enhanced learning approaches into educational practices and policies. By leveraging these positive attitudes, educators and institutions can lead to engaging, accessible, and effective educational experiences supporting student success (Lee & Hong, 2023).

As all people may not hold a favorable view of the blended learning model, the research results showed that a minority of respondents, both among students and lecturers, expressed negative attitudes toward blended learning. Similar to findings in other research, this negativity often arises from concerns and obstacles associated with its practical application. In this regard, scholars like Stenalt & Lassesen (2022) have highlighted various challenges in implementing blended learning that can contribute to these negative perceptions such as the digital divide, concerns about educational quality, lack of motivation, limited student agency, and resistance to change. Additionally, it's been observed that students who rely on teacher guidance in their learning process or lack sufficient independent learning skills tend to prefer traditional in-person instruction (Shorey et al., 2019). These insights align with the Technology Acceptance Model's premise, suggesting that attitudes toward blended learning, which heavily involves technology, may hinge on users' adoption or refusal of technology (El Archi & Benbba, 2023).

Other studies conducted in the area of blended learning indicated that negative perceptions of blended learning often arise from concerns and obstacles linked to its implementation. This is in line with the assumption that not all people can share the same attitudes toward the blended learning model (Alston, 2023). Some studies have highlighted that the blended learning approach may not give students optimal satisfaction due to various factors such as time constraints, the digital divide, educational quality, lack of motivation, and limited

student agency (Stenalt & Lassesen, 2022). Through research findings, it has been observed that students who do not take responsibility for their own learning or lack sufficient independent learning skills tend to prefer traditional face-to-face instruction, relying on teachers' guidance in their learning journey (Shorey et al., 2019).

Additionally, research has indicated that not all educators hold positive attitudes toward blended learning. Given that the blended learning model necessitates a high level of technological proficiency, educators and students who lack digital literacy may encounter challenges in conducting teaching and learning activities through web-based approaches (Kavan, Zameni et al., 2023). The concept of digital literacy is closely connected to the digital divide, highlighting concerns about unequal access to technology, which can put certain students and educators at a disadvantage (Neves & Stephenson, 2023). Moreover, some individuals harbor negative views regarding blended learning due to its reliance on internet connectivity. Technical glitches or poor internet connections can disrupt learning experiences, leading to frustration and hindered learning progress (Al-Obaydi, 2023).

Concerns about blended learning are also extended to some parents who may not be able to effectively monitor their children's progress and provide support within a blended learning setting. As indicated by Freer (2023), parental attitudes often evolve based on their child's experiences and the efficiency of blended learning in addressing their educational needs. The clarity of communication, availability of support systems, and addressing concerns regarding educational quality and social development are have been highlighted in shaping parental perceptions toward this educational approach (Freer, 2023). Additional worries may stem from some parents' adjustment to the evolving educational landscape, particularly when it diverges significantly from their own schooling experiences (Newman, 2023). Wong (2023) underscores that concerns are particularly pronounced when parents or their children lack

access to essential technology or feel ill-equipped to support their child's learning due to technological limitations.

In short, the implication of study results indicating respondents' negative attitudes toward the blended learning model can prompt educators and policymakers to address several key areas to enhance the implementation and perspective of blended learning. On this point, various researchers, including Newman (2023), commented that the adverse perceptions should not discount the prospective benefits of blended learning but underscore the obstacles and possible disadvantages that must be tackled for its effective adoption and endorsement by all parties involved. Addressing the issues concerning accessibility, educational quality, social engagement, and instructional methods is essential for establishing blended learning as a universally embraced approach in education (Petty et al., 2023).

The second research question was formulated to find out the advantages of the blended learning model. On this point, the research results showed that the respondents take the blended learning model as an advantageous model which enhances comprehensive educational experience, learning engagement through various teaching methods, skills prioritization, flexibility in learning and teaching, personalized-learning, collaborative learning and learner-centered approach. Apart from being time and cost saving, it was also described as model that provides easy access to online and physical learning opportunities, especially for students who have other life responsibilities to bear. It was also said to be time and cost saving especially for students who have other life responsibilities to bear; which leads to the increase of students' enrolment rate in higher education institutions. These findings validate the second study hypothesis, which states that the blended learning model provides higher education institutions in Rwanda with various advantages.

Many advantages highlighted by the respondents in this study such as flexibility, increase of technological knowledge and skills, active learning, etc are also reflected in other studies conducted in the field of the blended learning model and its advantages. For example, Muhajirah (2020) indicated that the blended learning model facilitates learners to boost their needs satisfaction to the level of personal-actualization. In this regard, it provides an open access to education opportunities that facilitate personalized learning supported by online and in-person instruction and learning resources. In their study, Alsalhi et al. (2021) also highlighted similar benefits that the blended learning strategy enhances active participation in learning, commitment and involvement in academic programs. The same scholars also indicated that the model enhances student experience and collaborative learning and teaching practices with the help of technology application.

In other studies, It is stated that the blended learning model offers a flexible learning schedule, enabling students to access educational materials and resources at times that suit their preferences. In this juncture, Truss & Anderson (2023) argue that the online aspects within blended learning can enhance accessibility for remote learners or those geographically distant from traditional educational facilities. Additionally, it facilitates access for individuals experiencing physical limitations that might impede their participation in on-site classes (Kabarungi et al., 2023). This flexibility is especially beneficial for non-traditional students, working professionals, or individuals balancing other responsibilities (Mukhtaramkhon & Jakhongirovich, 2022). In his study, Rao (2019) also emphasizes that blended approaches can significantly enhance learning outcomes compared to solely in-person or online methods. In his view, through blended instruction, students engage with an integration of both online and in-person instructional techniques, fostering both independent study and collaborative learning opportunities simultaneously. Additionally, these methods enable students to leverage

educational technology by promoting proficiency in digital and critical thinking skills (Kwok-Wing, 2021).

By incorporating diverse teaching methods such as multimedia tools, interactive content, and in-person teaching, blended learning attracts more students and it responds to students' needs and accommodates various learning preferences by fostering a more dynamic learning atmosphere (Almusaed et al., 2023). Furthermore, Li (2023) contends that the power of blended learning lies in merging the advantages of conventional in-person teaching with the adaptability and interaction found in online learning. This fusion, according to Li (2023) cultivates a conducive learning environment that can elevate students' active engagement, motivation and dedication to learning.

In line with this study findings, other studies also revealed that blended learning model can makes higher education cost-effective. On this point Brenya (2023) highlights that adopting blended learning can reduce expenses usually associated with traditional classrooms by leveraging online resources and minimizing the necessity for physical infrastructure. In this way, it can help institutions of higher education to reach a broader audience without geographical constraints. It was also argued that, by allowing students to work either part-time or full-time alongside their studies, the model has the potential to offset educational costs and reduce reliance on student loans (Muhria et al., 2023). Moreover, as the blended learning model grants access to online materials, the study conducted by Mendoza & Venables, (2023) stipulated that the blended learning model can contribute to potential savings for students on expenses related to textbooks, travel and even accommodation as it offers remote learning options. Consequently, the cost-effectiveness and efficiency of blended learning could potentially render education more affordable and accessible, particularly for individuals from lower-income backgrounds. This might attract a larger number of students and extend learning opportunities, especially for those prevented from attending colleges due to various factors

such as distance or time constraints (Katal et al., 2023). In the same line of thinking, Truss & Anderson (2023) commented that the online components of blended learning can particularly benefit learners who are remote or geographically isolated, as well as those with physical disabilities that may impede their attendance at physical classes. Mukhtaramkhon & Jakhongirovich (2022) indicated that this adaptability is especially advantageous for non-traditional students, working professionals, or individuals with diverse commitments (Mukhtaramkhon & Jakhongirovich, 2022).

The advantages highlighted are also in line with the principles of both Constructivism Learning Theory and connectivism theory. From the Constructivism perspective, when learners are given an appropriate task, timely guidance and appropriate amount of time to complete the task, they easily become knowledge makers (White, 2019). Constructivism theory and blended learning are closely linked, as both emphasize active participation, interaction, and the construction of knowledge by learners. According to Constructivism, learners build their own understanding of the world through active participation, integrating new information and experiences into their pre-existing knowledge structures (Rankapola & Zuva, 2023). With its combination of in-person and online elements, Machumu et al. (2020) commented that blended learning provides opportunities for active engagement and hands-on experiences that align with constructivist principles that favors a multifaceted approach allowing learners to explore content in diverse ways, which enhances the construction of their understanding based on their individual perspectives and prior knowledge.

Furthermore, blended learning encourages self-directed learning and autonomy, which are key components of constructivism. In this regard, students have the flexibility to navigate through online resources at their own pace, take ownership of their learning, and collaborate with peers, thereby constructing knowledge through interactions and social engagement (Gibson, 2023). Similarly, the integration of technology in blended learning supports

constructivist ideas by offering tools for active exploration, problem-solving, and collaborative learning (Albeta et al., 2023). In this regard, it provides platforms for learners to engage in meaningful activities, share perspectives, and co-construct knowledge, all fundamental aspects of the constructivist learning process. Ultimately, blended learning aligns with constructivism by providing a flexible, interactive, and multi-modal learning environment that promotes active engagement, student-centered learning, and the construction of knowledge through meaningful experiences and interactions.

In light of connectivism theory which puts emphasis on the interconnectedness of learning in a digital age, learning and growth happens depending on the connections and collaboration that learners create in their learning process. It acknowledges that learning is not limited to the classroom but occurs through interactions within networks, facilitated by technology (Kilag et al., 2023). It highlights the significance of diverse sources of information, connections between various concepts, and the ability to navigate these networks effectively. Thus, by offering a combination of physical and digital resources, blended learning encourages learners to engage with multiple sources of information and navigate digital platforms, which fosters the skills essential in a connected world (Anchunda & Jantakoon, 2023). As in a blended learning environment student can collaborate, share, and co-create knowledge using online tools, these advantages align with connectivism's notion of learning as a collective and social process which is facilitated by technology (Alrianingrum et al., 2023). This integration of various learning modalities supports the connectivism idea that learning is not restricted to a singular location or method but thrives within interconnected networks. As commented by Maxwell (2023) the highlighted advantages of blended learning share common ground with Connectivism theory in their acknowledgment of the importance of technology in facilitating diverse, networked, and collaborative learning experiences that transcend traditional boundaries.

The advantages of blended learning revealed by this study and other highlighted studies have various implications for education. As the blended learning is a model that consists of diverse educational methods that foster learning dynamics by catering for diverse learning styles and preferences, it contributes to a transformative shift in learning paradigms (Tonbuloğlu & Tonbuloğlu, 2023). As stated by Brenya (2023), its flexibility opens doors to education for remote learners and those with commitments outside traditional classrooms. This implies that its engaging blend of interactive elements tends to fuel student motivation and participation in academic programs offered in this model (Elgohary et al., 2022). Furthermore, its cost-effectiveness and reduced reliance on physical resources make education more accessible. This implies that embracing this model does not only hone essential skills for the contemporary job market, but it also signifies a readiness to innovate and adapt to the ever-evolving educational landscape (Suwannaphisit et al., 2021). Ultimately, it champions inclusivity, creating diverse, adaptive, and engaging learning environments poised to meet the needs of an evolving learner base. Generally, the implications of these advantages suggest a transformative shift in education towards a learning experience that is more accessible, captivating, and cost-effective for all students.

The third research question intended to investigate the students' enrolment status in different higher educational institutions in Rwanda before and after the implementation of the blended learning model. The findings summarized in table 22 revealed that the enrolment rate in each participating higher education institution has gone up since the adoption of the model. Referring to the students' enrolment rates in each institution (Table 22), the average rate varies between 20% and 55% depending on when the institution adopted the blended learning model. This was also backed by the findings from online survey (table 8 & 16) and interview findings where the respondents highlighted that the adoption of the blended learning model has positively impacted on the rise of the students 'enrolment rate in their respective institutions.

Based on the respondents' good attitudes towards the blended learning model, its advantages and the increased rate of students' enrolment are the factors considered to validate the third study hypothesis that the the implementation of the blended learning model has led to a significant increase in student enrollment in higher education institutions in Rwanda.

In his study, John (2021) asserted that the incorporation of technology in education has marked a great contribution to a favorable educational environment which would lead to students' great achievements in their academic journey. In the same study, it was also asserted that any educational model that prioritizes to learners' motivation, collaboration, satisfaction, connections and flexibility in leaning can also positively impact on the students' enrolment rate in higher institutions of higher education (John, 2021). Chen & Yao (2020) also reported that when students have positive attitude towards a new learning model, they also develop willingness to participate in the programs under that model. They added that students prefer to pursue their studies in the new program when motivation, collaboration, satisfaction and good relationship are ensured (Chen & Yao, 2020).

Technological infrastructure enhancement and effective pedagogy involved in blended learning are seen in different studies as crucial elements for the upgraded students' enrolment in higher education. According to Kumar & Vijay (2023), for successful learning experiences, the use of updated software, hardware, and network capabilities calls for more higher education students. In other studies, it is stated that prioritizing effective pedagogy is central to expanding access to higher education. In this regard, it is commented that employing varied teaching strategies can engage students and provide flexible learning options to university students (Van der & Hlatshwayo, 2023). Similarly, Tashiro & Hartman (2023) underscore the importance of adaptable curriculum design, incorporation of diverse delivery modes like online or blended learning which can accommodate students' diverse commitments. This idea aligns with creating

an inclusive learning environment in higher education which cater for students from various backgrounds and locations to attract a wider pool of applicants (Yashodha, 2023).

The increased rate of students' enrolment revealed by the study findings can imply that university students are motivated to join higher education to enjoy the blended learning benefits connected to its ability to combine in person instruction with digital learning components. The implication is that blended learning can boost students' enrolment rates in higher education due to its various advantages such as increased accessibility, catering for different learning styles, personalized learning experiences, cost and resource efficiency. All these benefits allow students to pursue their studies without conflicting with other responsibilities assigned them, and contribute to both students and institutions' savings. By utilizing online resources and reducing physical infrastructure requirements, universities can potentially offer more courses to accommodate higher enrolment without significant additional expenses. As blended learning enhances self-paced learning or personalized pathways, which caters for individual student needs and interests, this customization can be an attractive feature for prospective students seeking tailored educational experiences (Tulasi & Suchithra, 2020). In other words, blended learning, when effectively implemented, can positively impact enrolment rate as it contributes to improved retention rates and encourage continued enrolment in higher education (Ascencio, 2023).

The rising enrollment rates seen in higher education institutions, as discussed in this study, validate the efficacy of blended learning as a means to accommodate a larger number of students with external commitments by enabling them to access educational opportunities through technology-supported learning tools (Bozkurtm & Zawacki-Richter, 2021). This trend is expected to accelerate the enrollment of individuals who need continuous personal or professional development. It also addresses UNESCO's concerns regarding the future of global higher education which emphasizes the need to cater for the educational requirements of

different individuals from various age groups (UNESCO, 2022). Furthermore, this aligns with the core mission of Higher Education Institutions (HEIs) to generate relevant knowledge, foster well-rounded professionals, and foster a sense of social responsibility (UNESCO, 2022). Makoe (2022) emphasizes the necessity for HEIs to adopt broader strategies to enhance educational accessibility and uphold exemplary professional standards across all fields.

The expansion of access to higher education resonates with UNESCO's foundational principles, which are geared towards influencing the future landscape of post-secondary education. These principles prioritize inclusivity, advocating for equitable access to education of excellent quality for individuals regardless of their socio-economic status, gender, ethnicity, or geographical location (UNESCO, 2022). The goal is to facilitate continuous lifelong learning which allows individuals to continuously acquire new skills and adapt to the evolving needs of society. UNESCO emphasizes the urgent need for significant transformations in alignment with these core principles aiming to redefine education trajectories and establish clear pathways to enhance educational experiences and achievements for all. These pathways require the engagement of a wide range of stakeholders, including students, educators, higher education institutions, policymakers, international organizations, development partners, the private sector, civil society entities, youth groups, social initiatives, local communities, and beyond (UNESCO, 2022).

Examining the essence of these principles reveals that they form the cornerstone of the blended learning philosophy. This aligns closely with UNESCO's strong advocacy for the incorporation of technology and innovation into educational practices to promote digital literacy and innovative teaching methods in order to facilitate easy access to education for students worldwide (UNESCO, 2022). The findings of the study also correspond with reports from higher education experts highlighting a notable worldwide increase in tertiary education

enrollment, which has risen from 19% in 2000 to 40% as of 2020, although Africa continues to maintain a ratio consistently below 20% (Kigotho, 2023).

The rising enrollment rates observed in higher education institutions, as discussed in this study, validate the efficacy of blended learning as a means to accommodate a larger number of students with external commitments by enabling them to access educational opportunities through technology-supported learning tools (Bozkurtm & Zawacki-Richter, 2021). This trend is expected to accelerate the enrollment of individuals who need continuous personal or professional development. It also addresses UNESCO's concerns regarding the future of global higher education which emphasizes the need to cater for the educational requirements of different individuals from various age groups (UNESCO, 2022). Furthermore, this aligns with the core mission of Higher Education Institutions (HEIs) to generate relevant knowledge, foster well-rounded professionals, and foster a sense of social responsibility (UNESCO, 2022). Makoe (2022) emphasizes the necessity for HEIs to adopt broader strategies to enhance educational accessibility and uphold exemplary professional standards across all fields.

The contribution of blended learning to the increase of students' enrolment rate has been appreciated by UNESCO (2022) which recognizes this learning model that creates engaging, flexible, and effective learning experiences for learners of all ages and backgrounds. By combining the advantages of in-person and internet-based learning modalities, UNESCO perceives blended learning as an educational strategy offering flexibility regarding the timing, location, and speed of learning. Learners can retrieve materials and engage in activities at their own convenience, which can consider diverse methods of learning and preferences (UNESCO, 2022). In addition, the approach allows for customized educational experiences, catering for specific requirements and interests of each learner. Through a blend of virtual and in-person interactions, educators can tailor instruction to respond to the specific demands of every student, promoting better engagement and understanding. Blended learning is also recognised

for giving access to a broad range of educational resources and materials beyond traditional classroom resources. Online platforms and digital tools offer access to multimedia resources, interactive activities, and global educational content, enriching the learning experience. It is also said to encourage increased interaction and collaboration among learners. Through online discussions, collaborative projects, and virtual group activities, learners can engage with peers and educators both synchronously and asynchronously, fostering a sense of community and enhancing social learning (UNESCO, 2022).

As far as the fourth research question is concerned, it was formulated to look into possible challenges that the blended learning model implementation faces in higher education institutions in Rwanda. The study findings indicated that challenges are faced at student's level, teacher's level and institutional level. Technical know-how gaps, limited access to internet, limited student agency, resistance to change, lack of digital literacy, lack of professional development opportunities to improve technical skills, expensive IT devices and lack of immediate technical support constitute the common challenges faced by university students and teachers. At institutional level, the study findings presented on page 41 & 45 revealed that there are some common challenges faced by all the selected institutions in the implementation of the blended learning. These challenges include the scarcity of adequate IT facilities inside and outside universities, poor internet connectivity, remote locations where access to internet is limited, budget constraints, and lack of enough IT specialist to support students and teachers. The study findings validate the fourth study hypothesis, which assumes that the implementation of the blended learning model in Rwanda faces various challenges.

For the technical know-how gap, the respondents, explained that it refers to the disparity or difference in technical skills and knowledge among students and teachers. This implies that some teachers and students may possess more advanced or comprehensive technical skills related to using digital tools, online platforms, or technology devices, while others may lack

proficiency or familiarity with these technologies. As revealed by different scholars including Hill & Smith (2023, these gaps present significant obstacles in the successful adoption of blended learning initiatives. According to Tonbuloğlu & Tonbuloğlu (2023), such disparities can obstruct the effective utilization of digital tools and platforms which are essential aspects for blended learning delivery. The lack of necessary skills to navigate and leverage these technologies properly may result in poor educational experiences within the framework of blended learning (Brenya, 2023). In other words, without adequate technical expertise, both educators and students may struggle to integrate various digital resources properly into their instructional and learning practices, and this limits the efficacy of blended learning methods (Kabarungi et al., 2023).

On the side of technical support staff, technical know-how gaps can impede the maintenance and troubleshooting of technological infrastructure (Barroso et al., 20234). In blended learning environments, reliance on digital platforms and devices is paramount, and any technical issues can disrupt the learning process (Ascencio, 2023). Hence, having proficient students, teachers and technical support personnel who can address technical issues promptly, can help to avoid any frustration and disruption of scheduled learning activities (Rahman et al., 2023).

Another challenge revealed by the study findings is the limited access to internet. As revealed by the study respondents, limited access to the internet poses significant challenges in the blended learning implementation, particularly in regions or communities with inadequate infrastructure or resources like in remote areas. As indicated by the study respondents, without reliable internet access, students may struggle to participate fully in online learning activities, which hinders their ability to access course materials, engage in discussions, or submit assignments. In the same line of thinking, Muhria et al. (2023) commented that the disparity in access can aggravate existing inequalities in education, as students without reliable internet

may fall behind their peers who have better connectivity, thereby widening the digital divide. In other studies, it is indicated that limited access to the internet can impact the flexibility and scalability of blended learning initiatives (Xiao & Zhang, 2024), as many blended learning models rely on online resources and platforms to deliver content and facilitate interactions between students and instructors. This implies that without consistent internet access, teachers may be limited in their ability to deliver content effectively (Graham & Halverson, 2023), and students may be unable to engage actively in various forms of blended learning tasks, such as live virtual discussions or multimedia-rich content (Hebebci et al., 2023).

Additionally, it was revealed that limited access to the internet can also affect the professional development of educators. Many training programs and resources for blended learning are available online, but without reliable internet access, educators may struggle to access these resources or participate in online training sessions (Aisha & Ratra, 2023). The implication is that without reliable internet may not be able to enjoy online professional development opportunities that can increase their ability to effectively implement blended learning strategies in their classrooms and adapt to new technologies and teaching methodologies. As recommended by AL-Azzam et al. (2023), addressing issues of limited internet access is crucial for the smooth running of blended learning, which has significant effect on the quality of education provided to learners within the blended learning model.

As far as limited student agency is concerned, the study findings revealed that it also constitutes a serious challenge in the implementation of blended learning by affecting student involvement, motivation, and overall learning outcomes. As blended learning often demands students to take a more proactive role in managing their learning experiences, accessing online materials, and engaging in a variety of activities, whether face-to-face or online (Van der Westhuizen & Hlatshwayo, 2023), research has revealed that when students lack agency or autonomy in their learning process, they may struggle to navigate the blend of online and

traditional classroom components effectively (Tutkova et al., 2024). This can therefore lead to disengagement as students may feel overwhelmed or disempowered by the learning environment, and this can contribute to reduced participation and lower levels of motivation (Gibson, 023).

In other studies, conducted by different scholars such as Hill & Smith (2023), limited student agency has been revealed to hinder the effectiveness of personalized learning experiences within blended learning models. Personalization is considered as a key aspect of blended learning as it facilitates students to progress at their individual speed, investigate topics of interest, and it enhances active engagement with content in ways that suit their individual educational needs and preferences (Adekola et al., 2023). However, as pointed out by Antwi-Boampong & Bokolo (2022), when students lack agency, they may struggle to take advantage of personalized learning opportunities, which may eventually lead to frustration or disinterest in the learning process. Without the ability to make meaningful choices about their learning path or access additional support when needed, students may struggle to achieve their full potential within a blended learning environment (Chowdhury, 2020).

Furthermore, it has been commented that limited student autonomy can hinder the development of crucial skills. for the 21st century such as self-regulated learning, problem-solving, and critical thinking while blended learning environments are designed to promote these skills by motivating students to assume responsibility for their learning and actively engage with course materials (Augustine, 2023). In other words, students with limited agency may rely solely on traditional teacher-led instruction and struggle to develop the independence and self-efficacy required to excel in a blended learning setting (Blieck et al., 2019). Limited student agency can therefore hinder their ability to adapt to changing educational landscapes and succeed in future academic or professional endeavors that require self-directed learning and problem-solving skills (Suryono et al., 2023). Hence, it is of paramount importance to

overcome limitations in student agency to fully realize the potential benefits of blended learning and ensure that every student has the opportunity to thrive in various learning environments (Kain, 2023).

Talking about resistance to change, the study findings also revealed that it constitutes a significant challenge in the effective integration of blended learning in higher learning institutions. As explained by the study respondents, the resistance stems from the deeply entrenched traditional teaching methodologies and pedagogical practices commonly found in many institutions of higher education. In this regard, teachers and students may resist the shift towards blended learning due to different reasons including fear of the unknown, concerns about their own proficiency with technology, or skepticism about the effectiveness of online components in enhancing learning outcomes (Bruggeman et al., 2023). The implication is that this resistance can hinder the adoption of new instructional strategies and limit the exploration of innovative approaches that could benefit students (Breitkopf, 2019).

As commented by Machumu et al. (2023), resistance to change may also be fueled by cultural or organizational factors within educational institutions. In other words, institutional cultures that prioritize stability and tradition over innovation may create barriers to the adoption of blended learning as teachers and students may feel pressure to adhere to established norms and practices. Furthermore, Jiang (2022) articulates that resistance to change can be exacerbated by logistical obstacles, including limited resources and insufficient support systems, and competing priorities within the educational institution. This implies that without adequate support and resources to facilitate the transition to blended learning, people may feel overwhelmed or not well-equipped to implement new teaching strategies effectively (Singh et al., 2022), which leads to further resistance and reluctance to embrace change.

Moreover, resistance to change can also manifest among teachers and students who may be accustomed to traditional classroom settings and skeptical about the benefits of

incorporating online components into their teaching and learning experiences (Antunes et al., 2023). In this regard, students may for example resist engaging with online materials or participating in virtual discussions, preferring the familiarity and structure of in-person instruction. Consequently, this resistance can hinder their capacity to actively engage in blended learning activities and may impact their overall engagement and motivation (Rosenberg, 2023). Hence, it is implied that addressing resistance to change among both teachers and students is very important in order to overcome implementation challenges and fostering a supportive environment that can facilitate the successful adoption of blended learning initiatives (Adtani et al., 2023).

Other studies also indicated that a new learning model always brings implementation challenges at different levels. In their studies, Vaughan (2020) and Menon & Sujatha (2019) highlighted different challenges associated with online learning models. The highlighted challenges include lack of motivation in students, infrastructural constraints, digital literacy and technical issues, and resistance to change. Uwizeyimana (2018) indicated that the small number of computer literacy and ownership, lack of regular in-person interaction, and online distraction are among the constraints for the successful application of the blended learning model in different higher education institutions.

When comparing the challenges identified in this study and the challenges revealed by other studies, there are a lot of similarities in them. This implies that the implementation of blended learning in higher education poses several common challenges that can significantly impact its success. Firstly, faculty readiness and support constitute one of the main challenges. On this point, some educators may lack the necessary training or familiarity with online teaching methodologies which necessitates comprehensive professional development programs (Hill & Smith, 2023). In addition, the faculty may need more time and expertise the transformation of courses into blended formats demands time and expertise to redesign their

curriculum and create engaging online content while ensuring alignment with face-to-face instruction (Mendoza & Venables, 2023).

Secondly, the study findings also revealed that ensuring fair access to technology and a strong infrastructure is still a problem in some higher learning institutions. This implies that the persistent disparities in students' availability of devices and consistent internet access to devices and reliable internet still impede their capacity to fully interact with online components, and it prevents all students to have equal learning opportunities (Irwan et al., 2020). Next, because blended learning is still new in many institutions of higher education, another identified challenge lies in effectively balancing in-person and online engagement and interaction (Dayagbil et al., 2021). This implies that sustaining student engagement in online modules and fostering meaningful interactions similar to those in traditional classrooms is still a challenge for the successful integration of blended learning in institutions of higher education. Equally, this goes hand in hand with the challenge to create assessments that accurately evaluate learning outcomes across various modes of instruction (Hartle, 2023). To overcoming all these challenges, Muxtorjonovna (2020) suggest that institutions of higher education should strongly engage in technological investment and a comprehensive approach focusing on faculty training, equitable access, and the creation of engaging, cohesive learning experiences across different learning environments.

To overcome all the obstacles, and the effective implementation of blended learning in higher learning institutions, UNESCO urges all the institutions to prioritize educational innovation, organize regular professional development opportunities for teachers, establish strong Student Support Services, offer flexible learning pathways, and establish strong quality assurance mechanisms (UNESCO, 2022). By Pedagogical innovation, UNESCO advised high education institutions to prioritize pedagogical innovation when integrating blended learning into their programs. This involves designing educational tasks that capitalize on the distinctive

advantages of both in-person and digital learning environments to promote active engagement, critical thinking, and collaborative learning among students.

By professional development, institutions should ensure that teachers receive sufficient training and opportunities for professional growth to effectively design, deliver, and assess blended learning experiences. Training programs should focus on developing educators' digital literacy skills, instructional design competencies, and proficiency in leveraging educational technologies to support student learning. To ensure learners have the resources and support needed to thrive in blended learning environments, institutions should offer comprehensive student support services that provide the necessary tools and assistance for success. This includes access to technical support, academic advising, tutoring services, and counseling support to address any challenges or barriers to learning that students may encounter. To have the smooth integration of blended learning, institutions of higher learning are also requested to implement solid quality assurance mechanisms to ensure the efficiency and quality of blended learning programs. This includes establishing clear learning objectives, assessing student learning outcomes, soliciting feedback from stakeholders, and continuously evaluating and improving the design and delivery of blended learning experiences based on evidence-based practices and feedback. (UNESCO, 2022)

5.2. Recommendations for Application

The foundation of all blended learning programs is a people-centred approach, and every decision made within these programs should prioritize the needs of the individuals involved, including both educators and learners (John, 2021). Recognizing the importance of relationships, a people-first approach acknowledges that learning is a social process, particularly in the framework of literacy education (Alsalhi et al., 2021). Blended learning programs emphasize the value of social interactions among learners and educators, working

together to create meaningful learning activities. For the smooth blended learning implementation, there is a number of points to consider.

Based on the study findings, there should be an increase of investment in IT infrastructure and accessibility. The investment in IT tools and resources would help the institutions to ensure equitable access to technology by investing in infrastructure, upgrade and provide necessary devices or resources for students who may face technological barriers. Institutions of higher education should also establish measures to improve internet connectivity on campus and in remote areas to facilitate smooth and continuous participation in online components. This can contribute to the smooth running of the blended learning and therefore, it can expand and ease access to higher education to many beneficiaries.

The research results also demonstrated that the blended learning implementation cannot be successful without effective Faculty Development Programs which aim to equip both teachers and students with adequate digital literacy skills required in blended learning. As blended learning is a teaching and learning approach that integrates both digital and face-to-face approaches of content delivery, establishing comprehensive and ongoing training programs for faculty members and students would improve their expertise in online teaching methodologies, content creation, and technology integration. This would also encourage a culture of continuous learning to adapt to evolving educational practices. In this regard, institutions of higher education should facilitate educational instructors and learners to boost their digital literacy skills. Once digital literacy is boosted, This can assist both teachers and students in overcoming the challenges associated with IT illiteracy as highlighted by the study findings. Higher education institution should organize ongoing tech trainings for students and teachers to help them cope with technology which is evolving rapidly in education systems. Once the students are conversant with the technology skills required in the blended learning model, they would also feel motivated to constantly join programs under the blended learning

model. Regular trainings on the use of web-based learning platforms would also help teachers feel comfortable in their facilitating role in the blended learning model. In addition, higher education would also help students and teachers create learning communities where they can regularly meet and engage in reflective discussions to foster peer learning and support. In such meetings, they can share the best practices, challenges and solutions as part of learning experiences in blended learning.

The successful integration of a new learning model also requires a shift in mindset among educators, students, and administrators. The study findings presented in figure 6 and 11 also revealed that some teachers and students do not have good perceptions of the blended learning model due to resistance to change. For a successful implementation, higher learning institutions should establish effective mechanisms that can help people get out of fear and understand the rationale of the integration of technology in education. This would help students and teachers to develop positive attitudes of the blended learning model, and it would increase their willingness to participate actively in the blended learning model programs. The institutions of higher learning can also foster communities of practice where faculty members can share experiences, best practices, and innovative ideas related to blended learning. This can encourage interdisciplinary collaborations, flexibility embracement, adaptation, culture of innovation, continuous Professional development, and the sharing of successful strategies to overcome implementation challenges, which can significantly contribute to the mindset change.

To mitigate the issue of mindset change, institutions of higher education need to provide strong leadership support in fostering a mindset change towards blended learning. Leaders should communicate a clear vision, provide resources, and advocate for the importance of embracing innovative teaching methods. Additionally, they should encourage a mindset that acknowledges that implementing blended learning is an evolving process that requires

continuous evaluation, reflection, and refinement. This should be accompanied by clear communication of the benefits and potential of blended learning to all stakeholders by showcasing success stories, research findings, and examples of how blended learning positively impacts student engagement, learning outcomes, and access to education. This may help build enthusiasm and buy-in for embracing this new approach. Ultimately, by promoting a mindset shift that values flexibility, innovation, student-centeredness, continuous learning, adaptation, and leadership support, institutions can effectively embrace and successfully implement blended learning in tertiary education.

The research results also confirmed that the successful implementation of the blended learning in tertiary education requires computer literacy and ownership. The research results revealed that a lot of students and teachers do not own appropriate IT devices and skills that can help them participate in the blended learning programs comfortably. To solve this problem, educational institutions in collaboration with parents should encourage and facilitate personal computer ownership to guarantee equal learning opportunities for every student in order to enhance students' blended learning experience by offering flexibility and consistency, convenience, and the acquisition of digital skills. By flexibility and convenience, personal computer ownership would provide facilitate students to access learning materials and engage with online components of their courses from any location and at any time that suits their schedule. This flexibility is particularly beneficial for students with work or family commitments. Ownership of a computer and regular use of personal devices would additionally promote the development of digital literacy skills and prompt familiarity with different software, internet browsing, research skills, and troubleshooting techniques. This would also allow students to maintain consistency in their learning environment by being able to customize their settings, organize materials, and create an environment conducive to their learning preferences.

To facilitate students and teachers to own their personal IT devices needed in blended learning, higher education institutions should collaborate with Government and other stakeholders to facilitate students and teachers to obtain their own adequate IT devices and easy access to internet. In addition, higher education in collaboration with their stakeholders should invest in providing free access to technological devices and reliable internet connection in computer labs and libraries.

For the effective implementation of blended learning, the provision of comprehensive support and resources is of paramount importance. This includes technical support for troubleshooting issues, tutorials or guides for using digital tools, and access to reliable internet connectivity on campus or and other necessary areas. In this framework, the study findings revealed that in some institutions, IT support is still limited because of the small number of IT staff in comparison with large number of people they expect to support.

Given the crucial role of adequate and timely IT support in the implementation of the blended learning model, institutions of higher education should also ensure they have enough IT staff who can support students and teachers struggling with IT issues. As any new approach to delivering learning requires a timely comprehensive support for all stakeholders, institutions of higher education ought to offer technical assistance to both teachers and students to help identify and address any issues that may arise. To make it possible, institutions should increase technical support staff where necessary and avail their contact information to ensure both students and teachers can contact them in case they need a help. This would help students and teachers feel comfortable with the blended learning model, and it can motivate more students to join academic programs in the blended learning mode.

5.3. Recommendations for Future Research

Given the significance of the blended learning model and the increasing need to integrate technology into conventional teaching methods, several areas still require additional research. While this study focused on examining the impact of the blended learning model on access to higher education, it is crucial to explore other factors that may influence its effectiveness. These include completion rates in traditional versus blended learning models, the cost-effectiveness of blended learning compared to traditional methods, student learning outcomes in both environments, and the long-term effects on graduate employment rates for those who have participated in blended learning programs.

More research efforts are also needed to study appropriate teaching methodologies that would enhance active learning in the blended learning model. This can provide some insights on how to enhance students' motivation, interaction and active learning in the blended learning model. This would help researchers come with effective pedagogical practices in blended environments and their influence on access to education.

In addition, there is a need of conducting studies over an extended period to track the long-term impact of blended learning on access to higher education. This can be done by following cohorts of students over several years to analyze enrolment rates, retention, academic performance, and graduation rates in relation to their exposure to blended learning environments.

It would also be essential to conduct research on comparative analysis across institutions, for instance, comparing the impact of blended learning on access across public vs. private, urban vs. rural, or large vs. small higher education institutions. This can help investigate how variations in institutional resources, student demographics, and teaching methodologies influence the efficacy of blended learning in expanding access.

Given that technological infrastructure and access to digital tools are critical for the successful integration of blended learning in higher education, there may be a need to explore the impact of technological infrastructure and access to digital devices on the effectiveness of blended learning initiatives. The focus of such a study could be to examine how differences in technology access among students affect their engagement and performance in blended learning courses.

As equity and inclusivity are the key elements in blended learning, there should be a need of investigating the significance of blended learning in promoting equity and inclusivity in higher education. In this regard, the study can for example aim to analyze how blended learning addresses barriers to access for marginalized or disadvantaged student populations and whether it contributes to closing educational gaps.

As policy implications play a crucial role in shaping and supporting the successful integration of blended learning into higher education, there could be an interest to conduct a study to analyze the effectiveness of existing policies or recommend new policies that support and enhance access through blended learning initiatives. Such studies can shed light on how policy implications create an enabling environment that supports innovation, ensures quality, addresses accessibility concerns, and promotes equity in higher education.

By exploring the above research areas, it would expand a more profound understanding of blended learning and its impact on access to education by providing valuable insights for educators, policymakers, and institutions that strive for improving educational opportunities for diverse student populations. By focusing on longitudinal studies, comparative analyses across institutions, and investigations into the equity and inclusivity aspects, researchers can investigate and explain the complex dynamics of blended learning's influence in higher education. Additionally, exploring the role of policies, technological infrastructure, and pedagogical practices would be a great contribution to the creation of a nuanced understanding

of how to optimize blended learning to create an educational landscape that values and supports the success of all learners, regardless of their backgrounds or circumstances.

5.4 Conclusions

This study aimed to investigate the impact of the blended learning model on the higher education accessibility in Rwanda. This mixed-methods research carried out in 10 institutions of higher education in Rwanda that have integrated the blended learning model in their academic programs. University students and lecturers, academic administrators and senior technical staff were considered as the research population. Data collection included the utilization of an online questionnaire administered to university students and lecturers, and the use of in-person semi-structured interviews held with academic registrars and IT senior staff. The presentation and analysis of the quantitative study findings was done in line with the research questions using descriptive statistics through cross tabulation and statistical tests such as Chi square and One-way ANOVA test in order to measure the significance of the relationship between nominal and ordinal variables. Qualitative data were presented and analyzed with the help of thematic analysis technique.

Building on the findings, the study revealed that both students and lecturers hold positive perceptions of the blended learning model. Their positive perceptions are associated with the high degree of comfortability with the blended learning model, advantages attributed to it, and their willingness to recommend the model to other students. In addition, the research results showed that the blended learning model is much more appreciated than face-to-face model as it facilitates many students to peruse their higher education and perform other responsibilities for their personal life and development. This reflects the life realities in Rwanda where many students in different higher education institutions in Rwanda peruse their studies along with their job responsibilities, especially in evening and weekend programs for their personal and professional growth. Moreover, the study also found that the blended

learning is a flexible, time and cost saving model, and it creates a good educational environment that promotes self-paced and collaboration in learning. The study showed that the respondents' positive attitudes and the advantages attributed to the blended learning model are mirrored in several other existing studies conducted in the same research area.

As stipulated by (AL-Azzam et al., 2023), understanding and addressing the perspectives of both teachers and students regarding blended learning can serve as an important step towards the journey of shaping the success of this transformative educational approach. Different perspectives, concerns, and readiness of educators and students in adopting innovative teaching methodologies significantly impact the implementation and effectiveness of blended learning. Hence, recognizing and respecting these attitudes is useful in fostering a supportive environment that encourages professional growth and adaptation (Bekbaev & Menglibekov, 2023). As commented by (Graham & Colin, 2023), embracing a positive and open-minded attitude toward blended learning among educators and learners involves providing adequate support, comprehensive training, and platforms for collaborative learning and sharing of best practices. As the educational landscape evolves, the attitudes of teachers and students toward blended learning serve as the cornerstone for cultivating engaging, student-centered, and effective learning experiences that accommodate the diversity of learners' needs in the digital age (Panda & Kaur, 2023).

The study also assessed the perspectives of participants regarding the benefits of the blended learning approach in higher education using both online surveys and interviews. The main benefits emphasized by the participants include flexibility in balancing work and study commitments, completing coursework from any location and at one's own pace, cost-effectiveness, catering to diverse learning preferences, fostering research skills, and enabling access to both online and physical learning materials. Furthermore, respondents noted that this approach promotes skills prioritization, collaborative learning, a student-centred approach, and

easy access to both online and offline resources. They also highlighted that implementing blended learning leads to a rise in higher education enrolment rates while saving institutions expenses typically incurred when students are constantly on campus. In this regard, it was pointed out that the adoption of this model allows institutions to utilize digital teaching tools effectively, manage their limited resources more efficiently, and expand opportunities for distance education.

According to the findings of this research and other studies, it can be concluded that blended learning presents a various advantage in higher education which are mainly based on its ability to accommodate the advantages of both in-person teaching and online learning Mukhtaramkhon and Jakhongirovich (2022) highlight that one of its key benefits lies in its flexible learning options that accommodate diverse learning styles and schedules. With this respect, students have the freedom to engage with course materials and complete assignments from anywhere at any time, which helps them to balance work, personal commitments, and education (Muhria et al., 2023). This flexibility also enables learners to pace their studies according to their needs. Moreover, the blended learning model is described as highly cost-effective, and it offers institutions and students significant financial advantages by reducing the need for physical infrastructure and resources associated with a solely on-campus education. Simultaneously, it was supported that blended learning can help students save on commuting costs and have access to a wider array of learning materials, often available at a lower cost digitally, and this cost efficiency extends to institutions, which makes education more accessible, affordable and sustainable over the long term (Brenya, 2023).

Furthermore, different studies revealed that the blended learning approach nurtures a diverse range of learning methodologies to support varied learning styles and preferences (Hill & Smith, 2023). In this regard, the integration of digital resources, multimedia materials, and interactive activities within blended learning fosters greater engagement, supports self-paced

learning, and enhances research skills. It encourages collaboration, critical thinking, and independent research, skills that are crucial in the ever-evolving academic and professional environments (Suryono et al., 2023). Ultimately, the advantages of blended learning in higher education extend beyond convenience and cost-effectiveness, encompassing enhanced learning encounters customized to meet the requirements of an evolving student population.

For the effect of blended learning on higher education accessibility, the study findings showed that blended learning model can potentially increase students' enrolment rate in higher education. The research revealed that in all participating academic institutions, the students' enrolment rate has gone up after the adoption of the blended learning approach. In support of this, the respondents confirmed that the blended learning model has helped their respective higher education institutions to boost the students' enrolment rate. This implies that the blended learning contributes to students' motivation to register for higher education and peruse their studies without necessarily being on campus every time. The findings can also be in line with realities in many institutions of higher education in Rwanda, especially during COVID 19 period, where many institutions used online and blended learning modalities to help students keep having access to higher education during that hard period. The findings support the study's hypothesis, confirming that the blended learning model has a positive impact on access to higher education.

The revolutionary capacity of blended learning in enhancing access to higher education emerges has been described as a beacon of innovation in the educational landscape (Chen et al., 2023. The exploration of its impact reveals promising avenues for widening educational opportunities, breaking down barriers, and fostering inclusivity (Castro, 2019). Blended learning's flexible nature catering for diverse learning styles and schedules, presents a pathway to accommodate the needs of a wide range of students. By providing a flexible and dynamic learning approach, blending traditional instruction with online components has the potential to

transcend geographical constraints, socioeconomic barriers, and time limitations (Honen-Delmar & Rega, 2023). This paradigm shift in educational delivery signifies an important step toward democratizing access to higher education, ultimately empowering individuals from varied backgrounds to embark on and succeed in their academic pursuits (Chodzko-Zajko, 2023). As institutions continue to harness the power of blended learning, the horizon of educational access expands, and it leads to a bright future where learning would know no boundaries and where opportunities would be within reach for all aspiring learners (Shesha, 2023).

Although the study revealed that the blended learning model contributes to the expansion of access to higher education, it also showed that there are some persistent obstacles that hinder the effective adoption and implementation of the model across various higher education institutions. The key challenges highlighted include limited students and teachers' digital skills, limited access to adequate IT devices that can ease educational practices within the blended learning framework, scarcity of adequate IT facilities in higher education institutions, insufficient number of tech team members who can provide necessary support to students and teachers in the blended learning model, etc. The highlighted obstacles can be observed in various higher education institutions in Rwanda where some institutions still experience the issue of internet connection, ill-equipped computer labs, a small number of IT support team members compared to the substantial number of individuals who need support in blended learning environment, etc.

The identification and understanding of obstacles hindering the implementation of blended learning in higher education underscore the complexities involved in integrating innovative educational models. The identification and clarification of these obstacles act as a vital initial stage for devising strategic solutions. Acknowledging these obstacles does not only highlights the complexities of reshaping traditional educational paradigms but also it signifies

the potential for growth and adaptation within the academic sphere. By addressing these challenges through collaborative efforts, effective support mechanisms, and adaptable strategies, institutions can get prepared for a more smooth and appropriate implementation of blended learning, which fosters an educational environment that transcends barriers and empowers diverse learners on their academic journey.

While the blended learning model presents a number of benefits, including flexibility, cost-effectiveness, and diversified learning approaches, it also presents obstacles such as technological barriers, the need for comprehensive faculty professional training, and maintaining a cohesive learning experience across varied platforms. According to Ascencio (2023), though blended learning approach carries both strengths and drawbacks, its benefits far surpass the drawbacks in meeting present educational demands. It has been revealed that the exceptional advantages of this model significantly contribute to expanding learning opportunities by enabling students to engage in learning from their homes without requiring physical presence within educational institutions' facilities (Staff, 2020). The equilibrium between the positives and negatives underscores the necessity for a holistic approach that can leverage the strengths of blended learning while addressing its limitations. Embracing this balance pushes the evolution of blended learning, and it fosters an educational landscape that maximizes its strengths while actively addressing and overcoming its limitations for the holistic benefit of higher education (Versteijlen, 2023).

The research, highlighting the obstacles hindering the smooth implementation of the blended learning model in various higher education institutions in Rwanda, offers recommendations for its effective integration. It emphasizes the need for these institutions to update their existing IT infrastructure and acquire new equipment where necessary. Additionally, there is a need for institutions to create mechanisms for continuous training aimed at equipping both students and educators with the essential digital skills required for

blended learning. To ensure adequate and timely support for the blended learning model, institutions should also consider increasing the number of technical support staff in proportion to the number of individuals they are expected to assist. To help students and teachers own adequate IT devices, the study suggested that the institutions should work together with the government and other partners to come up with different ways of making IT devices affordable to both students and teaching staff.

All in all, although the study discovered that the application of the blended learning model in higher education institutions in Rwanda still faces different obstacles, the students and teachers have positive attitudes towards it, and it has a lot of advantages that can help students have easy access to higher education. It contributes to students' motivation to peruse their higher education as it does not impose them to be on campus every time, which facilitates them to perform other duties along with their studies. Hence, drawing from the research findings and existing studies conducted in the area of blended learning and higher education accessibility, it can be concluded that blended learning stands as a transformative force in reshaping access to higher education by revolutionizing the traditional boundaries and constraints that have historically limited learning opportunities.

By combining in-person instruction with digital resources, this model surmounts geographical barriers, and it enables a broader range of students to engage in educational pursuits. Its flexibility allows individuals to transcend limitations imposed by distance or travel constraints, and, it eventually offers a pathway for non-traditional students, working professionals, and those balancing family responsibilities to access educational resources and coursework from various locations. It also fosters an inclusive learning environment that accommodates diverse needs and circumstances, amplifying educational opportunities for a more varied student demographic. In addition to its flexibility and accessibility, its scalability and cost-effectiveness come to additionally amplify access to higher education. This can attract

more students, and the institutions can benefit it from receive larger number students. The reduction in physical infrastructure expenses and optimized resource allocation further contributes to making education more financially accessible. For students, the reduction in commuting costs and the availability of digital learning materials alleviate financial burdens, which enhances access for those previously limited by economic constraints. All these benefits make blended learning model emerge as a catalyst in broadening the scope of higher education and facilitate the creation of an educational landscape that is more equitable and open to a diverse range of learners.

5.5 Summary

This chapter provided a synthesis of the key research findings, explored their implications for both theory and practice, and outlined actionable recommendations alongside a concluding summary. The central aim of this mixed-methods study was to examine the impact of the blended learning model on access to higher education in Rwanda. The study was driven by concerns that the traditional face-to-face teaching model, though effective in certain settings, has often struggled to accommodate the needs of a diverse student population. Institutional and structural barriers such as geographical constraints, limited physical infrastructure, and rigid academic schedules have been identified as significant obstacles to equitable access to higher education throughout the country.

The study was carried out in ten higher education institutions, each selected based on their active adoption of the blended learning model. The participant pool comprised students enrolled in blended programs, lecturers involved in delivering blended modules, and administrative and technical staff, including academic registrars and IT personnel. Ethical considerations were central to the research design, with informed consent, anonymity, and confidentiality maintained throughout the data collection and analysis processes. Data was gathered using a mixed-methods approach: an online questionnaire administered to students

and lecturers, complemented by semi-structured interviews with administrative staff. This approach allowed for a robust triangulation of data, offering both quantitative and qualitative insights.

For the quantitative strand, data were analyzed using descriptive statistics, cross-tabulation, and chi-square tests, supplemented by a One-way ANOVA test for lecturer responses to strengthen statistical reliability. On the qualitative side, thematic analysis allowed the study to capture nuanced perceptions and lived experiences of various stakeholders in the blended learning system. Codes and themes were systematically derived and used to summarize key insights, including benefits, limitations, and stakeholder recommendations regarding blended learning.

The implications of the study point to several important conclusions. Firstly, the adoption of blended learning has contributed positively to expanding access to higher education, especially among non-traditional students such as working adults, rural learners, and those with mobility constraints. Flexibility in time and location of study emerged as a recurring theme. The study's findings affirm the relevance of Constructivism, Connectivism, and Humanism as theoretical frameworks for interpreting how blended learning facilitates personalized, autonomous, and network-based learning pathways. The humanistic focus on learners' needs and well-being is particularly aligned with participants' views that blended learning allows them to manage their studies alongside personal and professional responsibilities.

Secondly, while access has improved, the study also revealed critical constraints that must be addressed to ensure equity and sustainability. Technological challenges—particularly unreliable internet, limited access to digital devices, and inconsistent digital literacy—continue to hamper the full realization of blended learning's potential. Institutional weaknesses, including insufficient training for lecturers and the absence of comprehensive digital policies

or infrastructure in some institutions, also emerged as significant barriers. These challenges reinforce the need for a systems-level approach to blended learning implementation, encompassing technological readiness, human capacity development, and curriculum redesign.

The recommendations section drew upon these findings to propose actionable suggestions. The study advises policymakers and institutional leaders to allocate more resources toward improving digital infrastructure, ensuring reliable internet access, and offering affordable learning devices to students. It also emphasizes the importance of ongoing professional development for lecturers to strengthen their digital teaching competencies. Establishing national quality standards for blended learning would help ensure uniformity and uphold quality across higher education institutions. For researchers, the study underscores the importance of conducting longitudinal research to assess the lasting impact of blended learning on student performance, retention rates, and employability. Additionally, future research could explore how blended learning affects particular student groups, such as individuals with disabilities or those from economically disadvantaged backgrounds.

The conclusion of the study emphasized that while blended learning is not a panacea, it holds transformative potential for higher education in Rwanda. Its success depends on thoughtful implementation, adequate resource allocation, and continued engagement with all stakeholders—students, educators, administrators, and policymakers alike. The study has not only validated the alternative hypothesis that blended learning has a positive impact on access to higher education, but it has also contributed to the growing body of literature that sees blended learning as a catalyst for educational innovation and inclusiveness in the 21st century.

In summary, Chapter 5 served as a reflection and synthesis of the entire research process. It tied the empirical findings back to the original research problem, clearly demonstrated how the study contributes to existing knowledge, and offered practical pathways forward for improving access to higher education through blended learning. The blended

learning model, when strategically implemented, is not only a response to current educational challenges but also a proactive step toward building a more inclusive, adaptable, and future-ready higher education system in Rwanda and similar contexts.

REFERENCES

Abad, D. J. V., & Abad, E. M. (2023). Self-Paced Learning Practices during Educational Disruption in a Public Higher Education Institution. *East Asian Journal of Multidisciplinary Research*, 2(5), 1957-1978.

Abbas, A., Rincón, G. B., Wang, L., & Siddiqui, M. K. (2023). Investigate the Impact of Technostress on Perceived Hybrid Learning Environment and Academic Performance. *Electronic Journal of e-Learning*, 21(4), 382-393.

Abeer, A. O. (2019). Integrating Blended Learning in Higher Education. *Procedia - Social and Behavioral Sciences*, 186, 600-603.

Abulibdeh, A., Zaidan, E., & Abulibdeh, R. (2024). Navigating the confluence of artificial intelligence and education for sustainable development in the era of industry 4.0: Challenges, opportunities, and ethical dimensions. *Journal of Cleaner Production*, 140527.

Abusalim, N., Rayyan, M., Jarrah, M., & Sharab, M. (2020). Institutional adoption of blended learning on a budget. *International Journal of Educational Management*, 34(7), 1203-1220.

Acikgoz, F., Elwalda, A., & De Oliveira, M. J. (2023). Curiosity on Cutting-Edge Technology via Theory of Planned Behavior and Diffusion of Innovation Theory. *International Journal of Information Management Data Insights*, 3(1), 100152.

Adams, C., Pente, P., Lemermeyer, G., & Rockwell, G. (2023). Ethical principles for artificial intelligence in K-12 education. *Computers and Education: Artificial Intelligence*, 4, 100131.

Adedoyin, O. B., & Soykan, E. (2023). Covid-19 pandemic and online learning: the challenges and opportunities. *Interactive learning environments*, 31(2), 863-875.

Adetayo, A. J., Adekunmisi, S. R., Otonekwu, F. O., & Adesina, O. F. (2023). The role of academic libraries in facilitating friendships among students. *IFLA Journal*, 49(4), 694-703.

Adtani, R., Neelam, N., Raut, R., Deshpande, A., & Mittal, A. (2023). Embracing ICT in academia: adopting and adapting to the new normal pedagogy. *Global Knowledge, Memory and Communication*.

Adler, S. J., Röseler, L., & Schöniger, M. K. (2023). A toolbox to evaluate the trustworthiness of published findings. *Journal of Business Research*, 167, 114189.

Adekola, J., Dale, V. H., Gardiner, K., & Fischbacher-Smith, M. (2017). Student transitions to blended learning: an institutional case study. *Journal of Perspectives in Applied Academic Practice*, 5(2), 58-65.

Adtani, R., Neelam, N., Raut, R., Deshpande, A., & Mittal, A. (2023). Embracing ICT in academia: adopting and adapting to the new normal pedagogy. *Global Knowledge, Memory and Communication*.

Agarwal, A., Mohanan, P. P., Kondal, D., Baldridge, A., Davies, D., Devarajan, R., ... & Prabhakaran, D. (2021). Effect of a quality improvement intervention for acute heart failure in South India: An interrupted time series study. *International journal of cardiology*, 329, 123-129.

Ahmad, S., Wasim, S., Irfan, S., Gogoi, S. (2019). Qualitative v/s Quantitative Research. *Journal of Evidence Based Medicine and Healthcare* 6(43):2828-2832. https://journals.indexcopernicus.com/api/file/viewByFileId/916903.pdf

Ahmad, S. F., Rahmat, M. K., Mubarik, M. S., Alam, M. M., & Hyder, S. I. (2021). Artificial intelligence and its role in education. *Sustainability*, 13(22), 1–11. https:// doi.org/10.3390/su132212902 Akdeniz, M., &

Ahmed, K.K, Al-Jumaili, A.Z., Salman, S.S., Kathem, S.S. (2021). The Students' Experience of Hybrid- Education Model at the University of Baghdad College of Pharmacy: Lessons and Future Directions. *Iraqi J Pharm Sci*, 30(2)

Ahmed, A., Al Maliki, A., Hashim, B., Alshamsi, D., Arman, H., & Gad, A. (2023). Flood susceptibility mapping utilizing the integration of geospatial and multivariate statistical analysis, Erbil area in Northern Iraq as a case study. *Scientific reports*, 13(1), 11919.

Aiello, A. (2023). *Is There a Difference in Academic Achievement Between Remote Learners and Face-To-Face Learners Between the School Years of 2020-21 and 2021-22?* (Doctoral dissertation, St. John's University (New York)

Aisha, N., & Ratra, A. (2023). NEP 2020: Blended Learning-The Road Ahead for Higher Education in India. *Global Journal of Enterprise Information System*, 15(3), 42-46.

Aithal, P. S., & Aithal, S. (2023). Predictive Analysis on Future Impact of Ubiquitous Education Technology in Higher Education and Research. *International Journal of Applied Engineering and Management Letters* (IJAEML), 7(3), 88-108.

Aithal, P. S., & Maiya, A. K. (2023). Innovations in Higher Education Industry–Shaping the Future. *International Journal of Case Studies in Business, IT and Education (IJCSBE)*, 7(4), 294-322.

Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics*, 2(3), 431-440.

Akintunde, T. Y., Musa, T. H., Musa, H. H., Musa, I. H., Shaojun, C., Ibrahim, E., et al. (2021). Bibliometric analysis of global scientific literature on effects of COVID-19 pandemic on mental health. *Asian Journal of Psychiatry*. , Article 102753. https://doi. org/10.1016/J.AJP.2021.102753

Akkerman, S. F., Bakker, A., & Penuel, W. R. (2021). Relevance of educational research: An ontological conceptualization. *Educational Researcher*, 50(6), 416-424.

Akotia, J., Awuzie, B. O., & Egbu, C. (2023). Onto-Epistemological Assumptions Underpinning Mixed Methods Research Designs. In *Mixed Methods Research Design for the Built Environment* (pp. 17-29). Routledge.

Akour, I., Rahamneh, A. A. L., Al Kurdi, B., Alhamad, A., Al-Makhariz, I., Alshurideh, M., & Al-Hawary, S. (2023). Using the Canonical Correlation Analysis Method to Study Students' Levels in Face-to-Face and Online Education in Jordan. *Inf. Sci. Lett*, 12, 901-910.

AL-Azzam, M. M., Hamadneh, B. M., Alqarni, T. M., & Almalki, A. D. (2023). The degree of using blended learning among teachers of students with learning disabilities. International Journal of Education in Mathematics, Science and Technology, 11(6), 1443-1457.

Albeta, S. W., Islami, N., Copriady, J., & Alimin, M. (2023). Blended Learning: Learning Outcomes, Class Dynamics, and Perceptions of Students and Teachers-A Systematic Literature Review. *Educational Administration: Theory and Practice*, 29(1), 43-57.

Albert, M. A. (2023). *Investigating the Trustworthiness of Research Evidence Used to Inform Public Health Policy: A Descriptive and Qualitative Study on the Use of Predatory Journal Citations in Public Health Policy Documents* (Doctoral dissertation, Université d'Ottawa/University of Ottawa).

Alenezi, M., & Akour, M. (2023). Digital Transformation Blueprint in Higher Education: A Case Study of PSU. *Sustainability*, 15(10), 8204.

Alessa, I. A., & Hussein, S. (2023). Using traditional and modern teaching methods on the teaching process from teachers 'own perspective. *RESS Journal Route Educational & Social Science Journal Route*, 10(2), 65-92.

Alhammadi, K., Marashdeh, H., & Hussain, M. (2023). Assessing the effect of innovation diffusion and technology readiness theories on attitude, behavioral intention and implementation of smart learning. *Cross Cultural & Strategic Management*, 30(4), 657-675.

Ali, Z. (2020). Artificial intelligence (AI): A review of its uses in language teaching and learning. *IOP Conference Series: Materials Science and Engineering*, 769(1). https://doi.org/10.1088/1757-899X/769/1/012043

Ali, O., Murray, P. A., Momin, M., Dwivedi, Y. K., & Malik, T. (2024). The effects of artificial intelligence applications in educational settings: Challenges and strategies. *Technological Forecasting and Social Change*, 199, 123076.

Almasco, M. A. A. (2023). 21st century skills: Teachers' integration in face-to-face instruction. *World Journal of Advanced Research and Reviews*. 19. 315-333. 10.30574/wjarr.2023.19.1.1316.

Almanasreh, E. et al. *(2019).* Evaluation of methods used for estimating content validity. *Journal of Research in Social and Administrative Pharmacy*

Almasco, M. A. A. (2023). 21st century skills: Teachers' integration in face-to-face instruction.

Almazroa, H., & Alotaibi, W. (2023). Teaching 21st Century Skills: Understanding the Depth and Width of the Challenges to Shape Proactive Teacher Education Programs. *Sustainability 2023*, 15, 7365.

Almedimigh, A. A., Albabtain, M. A., Alfayez, L. A., Alsubaie, F. F., Almoghairi, A., Alotaiby, M., ... & Arafat, A. A. (2023). Isolated surgical vs. transcatheter aortic valve replacement: a propensity score analysis. *The Cardiothoracic Surgeon*, 31(1), 1-10.

Almufarreh, A., & Arshad, M. (2023). Promising Emerging Technologies for Teaching and Learning: Recent Developments and Future Challenges. *Sustainability*, 15(8), 6917.

Almusaed, A., Almssad, A., Yitmen, I., & Homod, R. Z. (2023). Enhancing Student Engagement: Harnessing "AIED"'s Power in Hybrid Education—A Review Analysis. *Education Sciences*, 13(7), 632.

Alneyadi, S., Abulibdeh, E., & Wardat, Y. (2023). The Impact of Digital Environment vs. Traditional Method on Literacy Skills; Reading and Writing of Emirati Fourth Graders. *Sustainability*, 15(4), 3418.

Al-Obaydi, L. H. (2023). Humanistic learning elements in a blended learning environment: a study in an EFL teaching context. *Interactive Learning Environments*, 31(5), 3098-3111.

Alotaibi, N. S., & Alshehri, A. H. (2023). Prospers and Obstacles in Using Artificial Intelligence in Saudi Arabia Higher Education Institutions—The Potential of AI-Based Learning Outcomes. *Sustainability*, 15(13), 10723.

Alrianingrum, S., Rianto, Y., & Bahri, B. S. (2023, March). Blended Learning Development Based on Connective Theory to Improve Results of Learning Concepts and Digital Literacy. In *International Joint Conference on Arts and Humanities 2022* (IJCAH 2022) (pp. 1129-1138). Atlantis Press.

Alsalhi, N.R., Najeh, R., Eltahir, M. et al (2021). The Effect of Blended Learning on the Achievement in a Physics Course of Students of a Dentistry College: A Case Study at Ajman University. The *Electronic Journal of e-Learning*, 19(1). https://www.ejel.org

Alshami, A., Elsayed, M., Ali, E., Eltoukhy, A. E., & Zayed, T. (2023). Harnessing the power of ChatGPT for automating systematic review process: Methodology, case study, limitations, and future directions. *Systems*, 11(7), 351.

Alston, M. (2023). *Student Perception and the Influence of Blended Learning in an Alternative School Pursuing a Diploma* (Doctoral dissertation, Grand Canyon University).

Amaniampong, A., & Hartmann, M. D. (2023). Factors affecting technology integration in colleges of education. *International Journal of Studies in Education and Science (IJSES)*, 4(2), 176-194.

Amrhein, V., Trafimow, D., & Greenland, S. (2019). Inferential statistics as descriptive statistics: There is no replication crisis if we don't expect replication. *The American Statistician,* 73(sup1), 262-270.

Amutuhaire, T. (2023). Improving access and equity in East African higher education through internationalization. In FIRE*: Forum for International Research in Education* (Vol. 8, No. 1, pp. 22-39).

Anabalón, Y. B. A., & Roman, E. A. V. (2023). Tutoring in the university. A bibliometric and thematic analysis to the scientific production of the web of science (2013-2023). *Russian Law Journal*, 11(3).

Anchunda, S., & Jantakoon, J. (2023). *A Development of a Blended Training Curriculum Based on Connectivism Approach to Enhance Innovational Creation Skills from Local Related Content for Thai Language Student Teachers of Rajaphat University* (Doctoral dissertation, Naresuan University).

Anderson, C. R. (2023). *Traditional versus modern teaching methods amongst special education students and enhancing students' self-concept: A comprehensive literature review* (Doctoral dissertation, The Chicago School of Professional Psychology).

Andrade, C. (2020). Sample Size and its Importance in Research. *Indian Journal of Psychological Medicine,* 42 (1): 102-103

Andrade, M. S., & Alden-Rivers, B. (2019). Developing a framework for sustainable growth of flexible learning opportunities. *Higher Education Pedagogies*, 4(1), 1-16.

Antunes, V. T., Armellini, A., & Howe, R. (2023). Beliefs and engagement in an institution-wide pedagogic shift. Teaching in Higher Education, 28(6), 1328-1348.

Antwi-Boampong, A., & Bokolo, A. J. (2022). Towards an institutional blended learning adoption model for higher education institutions. *Technology, Knowledge and Learning*, 27(3), 765-784.

Arnone, K., Hutson, J., & Woodruff, K. (2023). Demystifying Artificial Intelligence (AI) for Early Childhood and Elementary Education: A Case Study of Perceptions of AI of State of Missouri Educators. *Journal of Innovation and Technology*, 2023(18), 1-18.

Arnull, L. G., Kapilashrami, A., & Sampson, M. (2023). Visualizing patterns and gaps in transgender sexual and reproductive health: A bibliometric and content analysis of literature (1990–2020). *International Journal of Transgender Health*, 24(4), 381-396.

Arogundade, O.R.(2023). Structuring Knowledge Bases with AI and Machine Learning. *Information and Knowledge Management* 8: 31–39.

Aryal, A., & Balan, S. (2023). Evaluation of a technical information systems module for distance learning during the COVID-19 pandemic. *Journal of Research in Innovative Teaching & Learning*, 16(1), 53-66.

Ascencio, R. (2023). *The Impact of Blended Learning in Higher Education Retention* (Doctoral dissertation, University of Maryland University College).

Ashraf, M. A., Yang, M., Zhang, Y., Denden, M., Tlili, A., Liu, J., ... & Burgos, D. (2021). A systematic review of systematic reviews on blended learning: Trends, gaps and future directions. *Psychology Research and Behavior Management*, 1525-1541.

Asmawi, A., Dong, H., Zhang, X., & Sun, L. (2024). Exploring the transformative power of blended learning for Business English majors in China (2012–2022)–A bibliometric voyage. *Heliyon*.

Atenas, J., Havemann, L., & Timmermann, C. (2023). Reframing data ethics in research methods education: a pathway to critical data literacy. *International Journal of Educational Technology in Higher Education*, 20(1), 1-27.

Ates-Cobanoglu, A., & Ermis, K. (2023). Review of Vanek, J., Simpson, D., & Goumas, J.(2022*). IDEAL Distance Education and Blended Learning Handbook: EdTech Books*.

Augustine, J. E. (2023). Effects of a Self-Monitoring Tracking System Combined with Blended Learning Intervention Time on Students' Self-Regulated Learning Skills and Academic Performance (Doctoral dissertation, University of South Carolina).

Awaad, A. (2019). *Students harness the skills of preparedness through blended learning*. https://www.blendedlearning.org/students-harness-the-skill-of-preparedness-through-blended-learning/

Awasthy, R (2019), "Nature of Qualitative Research", Subudhi, R.N and Mishra, S.(Ed.).Methodological Issues in Management Research: Advances, Challenges, and the Way Ahead, Emerald Publishing Limited, Bingley, pp. 145-161. https://doi.org/10.1108/978-1-78973-973-220191010

Ayanwale, M. A., Sanusi, I. T., Adelana, O. P., Aruleba, K. D., & Oyelere, S. S. (2022). Teachers' readiness and intention to teach artificial intelligence in schools. *Computers and Education: Artificial Intelligence*, 3, 100099.

Ayoo, P.O and Lubega J.T. (2020). *Exploring the Implementation of Blended Learning in a Developing Country:* [online] Available at http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.604.2035 [Accessed 19 Feb. 2020].

Babintseva, E., Kartseva, E., Spynu, L., & Tavberidze, D. (2023). Flipped classroom as an innovative technology for blended learning of professional english in higher education institutions. *Revista on line de Política e Gestão Educacional*, e023056-e023056.

Baddianaah, I., Baatuuwie, B. N., & Adongo, R. (2023). Local perspectives on the adverse environmental effects and reclamation of illegally mined degraded landscapes in North-western Ghana. *Mineral Economics*, 36(1), 139-155.

Bahroun, Z., Anane, C., Ahmed, V., & Zacca, A. (2023). Transforming education: A comprehensive review of generative artificial intelligence in educational settings through bibliometric and content analysis. *Sustainability*, 15(17), 12983.

Bahtiar, B., Yusuf, Y., Doyan, A., & Ibrahim, I. (2023). The Trend of Technology Pedagogical Content Knowledge (TPACK) Research in 2012-2022: Contribution to Science Learning of 21st Century. *Jurnal Penelitian Pendidikan IPA*, 9(5), 39-47.

Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI*, 7(1), 52-62.

Bakhshi Khilgavani, V., Aliabadi, K., Ahmadabadi, N., Borzoeian, S., & Delavar, A. (2023). Exploring the elements of educational model for connectivism teaching-learning environment. *Technology of Education Journal (TEJ)*, 17(4), 837-848.

Baloyi, G.P (2023). *Strategies to Increase Higher Education Access in Selected Higher Education Institution*. DOI: https://doi.org/10.47814/ijssrr.v6i10.1599

Ban, S., & Mahmud, S. N. D. (2023). Research and Trends in Socio-Scientific Issues Education: A Content Analysis of Journal Publications from 2004 to 2022. *Sustainability*, 15(15), 11841.

Barroso, C. J. V., Paloma, Z. B., & Sedon, M. R. C. (2023). Blended Learning, Challenges, and Its Effects to Heis during Covid Pandemic: A Systematic Review. *Resmilitaris*, 13(2), 6619-6643.

Basantes-Andrade, A., López-Gutiérrez, J. C., Mora Grijalva, M., & Ricardo, Y. (2023). Validity and reliability of the questionnaire of academic knowledge of teachers of basic general education. *F1000Research*, 12, 642.

Bastedo, M. N., Altbach, P. G., & Gumport, P. J. (Eds.). (2023). *American higher education in the twenty-first century: Social, political, and economic challenges*. JHU Press.

Bateman, J. A., & Tseng, C. I. (2023). Multimodal discourse analysis as a method for revealing narrative strategies in news videos. *Multimodal Communication*, 12(3), 261-285.

Baykasoğlu, A., Özbel, B. K., Dudaklı, N., Subulan, K., & Şenol, M. E. (2019). Process mining based approach to performance evaluation in computer-aided examinations. *Computer Applications in Engineering Education*, 26(5), 1841–1861.

Bazeley P. (2018). *Integrating analyses in mixed methods research*. Sage Publications Ltd.

Becher Araujo Moraes, S. (2023). Blended learning in higher education: an approach, a model, and two theoretical frameworks. *Journal of Teaching and Learning in Higher Education*. 4 (1). Malmö universitet.

Beckmann, M., Garkisch, M., & Zeyen, A. (2023). Together we are strong? A systematic literature review on how SMEs use relation-based collaboration to operate in rural areas. *Journal of Small Business & Entrepreneurship*, 35(4), 515-549.

Bekbaev, G. A., & Menglibekov, R. M. (2023). The Use of Educational Technology in Blended Learning Environments. *Oriental renaissance: Innovative, educational, natural and social sciences*, 3(9), 701-713.

Bellas, F., Guerreiro-Santalla, S., Naya, M., & Duro, R. J. (2023). AI curriculum for European high schools: an embedded intelligence approach. *International Journal of Artificial Intelligence in Education*, 33(2), 399-426.

Belt, E. S., & Lowenthal, P. R. (2023). Synchronous video-based communication and online learning: an exploration of instructors' perceptions and experiences. *Education and Information Technologies*, 28(5), 4941-4964.

Benvenuti, M., Cangelosi, A., Weinberger, A., Mazzoni, E., Benassi, M., Barbaresi, M., & Orsoni, M. (2023). Artificial intelligence and human behavioral development: A perspective on new skills and competences acquisition for the educational context. *Computers in Human Behavior*, 148, 107903.

Berg, B.L. (2019). *Qualitative Research Methods for Social the Sciences*. Allyn and Bacon:

Berg, E., Madelaine, L., Baste, J. M., Dahan, M., Thomas, P., Falcoz, P. E., ... & Pagès, P. B. (2021). Interest of anatomical segmentectomy over lobectomy for lung cancer: a nationwide study. *Journal of Thoracic Disease*, 13(6), 3587.

Berkovich, I., & Grinshtain, Y. (2023). A review of rigor and ethics in qualitative educational administration, management, and leadership research articles published in 1999-2018. *Leadership and Policy in schools*, 22(3), 549-564.

Beyene, W. M., Mekonnen, A. T., & Giannoumis, G. A. (2023). Inclusion, access, and accessibility of educational resources in higher education institutions: exploring the Ethiopian context. *International Journal of Inclusive Education*, 27(1), 18-34.

Bhandari, P. (2022). *Population vs. Sample | Definitions, Differences & Examples.* https://www.scribbr.com/methodology/population-vs-sample/

Bhardwaj, P. (2020). Types of sampling in research. *Journal of the Practice of Cardiovascular Sciences*; 5:157-63

Biasutti, M.; Philippe, R.A.; Schiavio, A. (2021). Assessing teachers' perspectives on giving music lessons remotely during the COVID-19 lockdown period. Mus. Sci, 1–19.

Bibi, H., Khan, S., & Shabir, M. (2022). A Critique Of Research Paradigms And Their Implications For Qualitative, Quantitative And Mixed Research Methods. *Webology*, 19(2).

Bishumba, N. (2020). "Minister Irere Sheds Light on Positivo Challenges". The New Times, 3 December 2020.

Black, K. (2023). *Business statistics: for contemporary decision making*. John Wiley & Sons.

Blieck, Y., Ooghe, I., Zhu, C., Depryck, K., Struyven, K., Pynoo, B., & Van Laer, H. (2019). Consensus among stakeholders about success factors and indicators for quality of online

and blended learning in adult education: a Delphi study. *Studies in Continuing Education*, 41(1), 36-60.

Boelens, R., Voet, M., & Wever, B.D. (2018). The design of blended learning in response to student diversity in higher education: Instructors' views and use of differentiated instruction in blended learning. *Computers & Education Journal*. DOI:10.1016/j.compedu.2018.02.009

Bogucka, R. (2023). Teaching a Reading Method for Scientific Research Articles: Transforming an Exercise from In-Person to Virtual Instruction in Volume 1 of Teaching Critical Reading Skillss: Strategies for Academic Librarians. In *UT Faculty/Researcher Works*. ACRL.

Boram, L. E. E., CHO, J. Y., Hanisah, G. U. R. O., Ho-Seong, H. A. N., Yoo-Seok, Y. O. O. N., LEE, H. W., ... & Yeongsoo, J. O. (2023). Comparative study of propensity score matching method and benchmark article method on the outcomes of laparoscopic major liver and open major liver resection for hepatocellular carcinoma. *Annals of Hepato-Biliary-Pancreatic Surgery*, 27(1), S280-S280.

Borgstede, M. and Scholz, M. (2021). Quantitative and Qualitative Approaches to Generalization and Replication–A Representationalist View. *Frontiers in Psychology Journal*. 12:605191. doi: 10.3389/fpsyg.2021.605191

Børte, K., Nesje, K., & Lillejord, S. (2023). Barriers to student active learning in higher education. *Teaching in Higher Education*, 28(3), 597-615.

Bourn, D. (2021). Pedagogy of hope: Global learning and the future of education. *International Journal of Development Education and Global Learning*, 13 (2), 65–78.

Boveda, M., Ford, K. S., Frankenberg, E., & López, F. (2023). Editorial Vision 2022–2025. *Review of Educational Research*, 00346543231170179.

Bozkurt, A., & Zawacki-Richter, O. (2021). Trends and Patterns in Distance Education (2014–2019): A Synthesis of Scholarly Publications and a Visualization of the Intellectual Landscape. *The International Review of Research in Open and Distributed Learning*, *22*(2), 19-45. https://doi.org/10.19173/irrodl.v22i2.5381

Braun, V. & Clarke,V. (2022). Toward good practice in thematic analysis: Avoiding common problems and be(com)ing a knowing researcher. *International Journal of Transgender Health*, DOI: 10.1080/26895269.2022.2129597

Braun, V., & Clarke, V. (2023). Is thematic analysis used well in health psychology? A critical review of published research, with recommendations for quality practice and reporting. *Health Psychology Review*, 1-24.

Breitkopf, M. (2019). But this is how we have always done it: Overcoming resistance to change in the quest to support distance learners. *Journal of Library & Information Services in Distance Learning*, 12(3-4), 148-164.

Brenya, B. (2023). Higher education in emergency situation: blended learning prospects and challenges for educators in the developing countries. *Journal of Applied Research in Higher Education.*

Brown, N., & Collins, J. (2021). Systematic visuo-textual analysis: A framework for analyzing visual and textual data. *The Qualitative Repor*t, 26(4), 1275-1290. https://doi.org/10.46743/2160-3715/2021.4838.

Bruck, S., van Loenen, B., Vermeulen, E., Roblin, N. P., Cornelissen, F., Voogt, J., & Volman,

M. (2022). *Characteristics of effective and meaningful blended education: A literature review.*

Bruggeman, B., Tondeur, J., Struyven, K., Pynoo, B., Garone, A., & Vanslambrouck, S. (2021). Experts speaking: Crucial teacher attributes for implementing blended learning in higher education. The Internet and Higher Education, 48, 100772.

Bryan, A. & Volchenkova, K.N. (2019). Blended learning: definition, models, implications for higher education. *Educational Technology Journal*, 43(6), pp. 51–54.

Bryda, G., & Costa, A. P. (2023). Qualitative Research in Digital Era: Innovations, Methodologies and Collaborations. *Social Sciences*, 12(10), 570.

Buck, E., & Tyrrell, K. (2022). Block and blend: A mixed method investigation into the impact of a pilot block teaching and blended learning approach upon student outcomes and experience. *Journal of Further and Higher Education*, 46(8), 1078-1091.

Buhl-Wiggers, J., Kjærgaard, A., & Munk, K. (2023). A scoping review of experimental evidence on face-to-face components of blended learning in higher education. *Studies in Higher Education*, 48(1), 151-173.

Buningwire, W. (2021). *Rwanda Coding Academy Provides the First Solution*. KT Press, Kigali, Rwanda

Buntins, K., Kerres, M., Heinemann, A. (2021). A scoping review of research instruments for measuring student engagement: In need for convergence. *International Journal of Educational Research*, 2(2):100099. DOI:10.1016/j.ijedro.2021.100099

Burr, C., & Leslie, D. (2023). Ethical assurance: a practical approach to the responsible design, development, and deployment of data-driven technologies. *AI and Ethics*, 3(1), 73-98.

Burrill, G., & Pfannkuch, M. (2023). Emerging trends in statistics education. *ZDM–Mathematics Education*, 1-11.

Çağataylı, M., & Çelebi, E. (2022). Estimating academic success in higher education using big five personality traits, a machine learning approach. *Arab Journal Scientific Engineering*, 47, 1289–1298.

Cahya, U. D., Astari, W., & Susanto, H. (2023). The Impact of 21st Century in Education as a Learning Revolution. Humanitatis: *Journal of Language and Literature*, 10(1), 135-146.

Campbell, M. (2019). Sample size: methods of calculation and reporting. *American Journal of Medicine* (13), 2. https://doi.org/10.12968/AJMW.2019.0007

Campbell, R., Goodman-Williams, R., Feeney, H., & Fehler-Cabral, G. (2020). Assessing Triangulation across Methodologies, Methods, and Stakeholder Groups: The Joys, Woes, and Politics of Interpreting Convergent and Divergent Data. *American Journal of Evaluation*, 41(1), 125–144. https://doi.org/10.1177/1098214018804195

Campbell, S., Greenwood, M., Prior, S., et al. (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, 25(8): 652–661.

Candela, A. G. (2020). Exploring the function of member checking. *The Qualitative Report*, 24(3).

Carcary, M. (2021). The Research Audit Trail: Methodological Guidance for Application in Practice. *Electronic Journal of Business Research Methods*, 18(2).

Carrasco, I. B., Riquelme, E. R., Saldivia, X. G., & Vilugrón, G. F. (2023). Education of the Affective Ideal in Contexts of Cultural Diversity: BIBLIOMETRIC and Thematic Analysis (2006-2021). *International Journal of Membrane Science and Technology*, 10(2), 866-878.

Carter, E., Leonard, P., Nzaramba, S. and Rose, P. (2020*). Effects of school closures on secondary school teachers and school leaders in Rwanda: Results from a phone survey*. Leaders in Teaching Research and Policy Series, November 2020. Laterite, Rwanda and REAL Centre, University of Cambridge.

Cassidy, R., & Ahmad, A. (2019). Evidence for conceptual change in approaches to teaching. Teaching in higher education, 1-17 https://doi.org/10.1080/13562517.2019.1680537.

Casteel, A., & Bridier, N. L. (2021). Describing populations and samples in doctoral student research. *International Journal of Doctoral Studies*, 16, 339-362. https://doi.org/10.28945/4766

Castro, R. (2019). Blended learning in higher education: Trends and capabilities. *Education and Information Technologies*, 24(4), 2523-2546.

Caudill, D. W., & Slater, P. J. (2023). Content analysis and ranking model of research related to qualities of excellent college teaching: Implications for business educators. *Journal of Education for Business*, 1-10.

Celik, I., Dindar, M., Muukkonen, H. & Järvelä, S. (2022). The promises and challenges of artificial intelligence for teachers: A systematic review of research. *TechTrends*, 66, 616–630. https://doi.org/10.1007/s11528-022-00715-y

Celik, I. (2023). Towards Intelligent-TPACK: An empirical study on teachers' professional knowledge to ethically integrate artificial intelligence (AI)-based tools into education. *Computers in Human Behavior*, 138, 107468.

Cernasev, A., & Axon, D. R. (2023). Research and scholarly methods: Thematic analysis. *Journal of the American College of Clinical Pharmacy*, 6(7), 751-755.

Chan, C. K. Y., & Lee, K. K. W. (2021). Refection literacy: A multilevel perspective on the challenges of using refection in higher education through a comprehensive literature review. *Educational Research Review*, 32. https://doi.org/10.1016/j.edurev.2020.100376

Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. *International journal of educational technology in higher education*, 20(1), 38.

Chauhan, S., Gupta, P., & Goyal, S. (2023). The role of innovation type and country context in diffusion of innovative technologies in organizations–a meta-analytic review. *Behavior & Information Technology*, 42(11), 1845-1873.

Chavulak, J., Smyth, T., Sutcliffe, N., & Petrakis, M. (2023). Staff Perspectives in Mental Health Research Regarding Restrictive Interventions: An Australian Scoping Review and Thematic Analysis. *Behavioral Sciences*, 14(1), 9.

Chen, L., & Xu, Y. (2022). Theoretical Development of Connectivism through Innovative Application in China. *Canadian Journal of Learning and Technology*, 48(4), 1-19.

Chen, M., Wang, Z., Liang, L., Ma, Z., & Liu, Y. (2023). Typical Practical Cases in Blended Learning. In *Handbook of Educational Reform Through Blended Learning* (pp. 231-377). Singapore: Springer Nature Singapore.

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE* Access, 8, 75264–75278.

Chen, T., Gascó-Hernandez, M., & Esteve, M. (2023). The Adoption and Implementation of Artificial Intelligence Chatbots in Public Organizations: Evidence from US State Governments. *The American Review of Public Administration*, 02750740231200522.

Chen, X., Xie, H., & Hwang, G. J. (2020). A multi-perspective study on artificial intelligence in education: Grants, conferences, journals, software tools, institutions, and researchers. *Computers and Education: Artificial Intelligence*, 1, 100005.

Chen, X., Chang-Richards, A. Y., Yiu, T. W., Ling, F. Y. Y., Pelosi, A., & Yang, N. (2023). A multivariate regression analysis of barriers to digital technologies adoption in the construction industry. *Engineering, Construction and Architectural Management*.

Chen, M. T., Huang, S. T., Lin, C. W., Ko, B. S., Chen, W. J., Huang, H. H., & Hsiao, F. Y. (2021). Tyrosine kinase inhibitors and vascular adverse events in patients with chronic myeloid leukemia: a population-based, propensity score-matched cohort study. The *Oncologist*, 26(11), 974-982.

Cheng, J., Yuen, A. H., & Chiu, D. K. (2023). Systematic review of MOOC research in mainland China. *Library Hi Tech*, 41(5), 1476-1497.

Cheng, X., Bai, J., Pan, S. Q., Li, Y. Q., & Yang, X. (2023). Assessing Chinese anatomists' perceptions and attitudes toward blended learning through faculty development training programs. *PeerJ*, 11, e16283.

Cherkasova, V. (2022). Development of Critical Thinking in Higher Education: A Subject Field Review. *Journal of Education and Practice,* (7) 19-39. 10.47941/jep.1565.

Cherry, W. (2021). An Empirical Evaluation of Critical Factors Influencing Learner Satisfaction in Blended Learning: A Pilot Study. *Universal Journal of Educational Research*, 4(7), 1667-1671.

Cheshmehzangi, A., Zou, T., Su, Z., & Tang, T. (2023). The growing digital divide in education among primary and secondary children during the COVID-19 pandemic: An overview of social exclusion and education equality issues. *Journal of Human Behavior in the Social Environment*, 33(3), 434-449.

Cheung, A. (2023). Language teaching during a pandemic: A case study of zoom use by a secondary ESL teacher in Hong Kong. *RELC journal*, 54(1), 55-70.

Cheung, S. K., Wang, F. L., & Poulová, P. (Eds.). (2023). *Personalized Learning: Approaches, Methods and Practices*.

Cheek, C. L., Garcia, J. L., Mehta, P. D., Francis, D. J., & Grigorenko, E. L. (2023). The Exceptionality of Twice-Exceptionality: Examining Combined Prevalence of Giftedness and Disability Using Multivariate Statistical Simulation. *Exceptional Children*, 00144029221150929.

Chiu, T. K., Xia, Q., Zhou, X., Chai, C. S., & Cheng, M. (2023). Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education. *Computers and Education: Artificial Intelligence*, 4, 100118.

Chodzko-Zajko, W. (2023). Transforming higher education. *Kinesiology Review*, 1(aop), 1-5.

Choi, J., Mark A. and Zainab, U. (2020). The Future of Work in Africa: Harnessing the Potential of Digital Technologies for All. World Bank. Available at:

https://openknowledge.worldbank.org/bitstream/handle/10986/32124/9781464814440.pdf?sequence=11&isAllowed=y.

Choi, S., Jang, Y., & Kim, H. (2023). Influence of pedagogical beliefs and perceived trust on teachers' acceptance of educational artificial intelligence tools. *International Journal of Human–Computer Interaction*, 39(4), 910-922.

Chowdhury, R. R., & Singha, A. K. (2023). Importance of Integration Modern Technology in Higher Education. *Knowledgeable Research: A Multidisciplinary Journal*, 1(09), 71-82.

Chowdhury, F. (2020). Blended learning: how to flip the classroom at HEIs in Bangladesh?. *Journal of Research in Innovative Teaching & Learning*, 13(2), 228-242.

Chu, S. K. W., Reynolds, R. B., Tavares, N. J., Notari, M., Lee, C. W. Y., Chu, S. K. W., ... & Lee, C. W. Y. (2021). Twenty-first century skills and global education roadmaps. *21st century skills development through inquiry-based learning: From theory to practice*, 17-32.

Chuang, R. and Koomar, S. (2020). *EdTech Initiatives Focused on Classrooms and Teachers: A Curated List for Rwanda* (No. 28). EdTech Hub.

Cole, R. (2023). Inter-rater reliability methods in qualitative case study research. *Sociological Methods & Research*, 00491241231156971.

Coates, A. (2021). The prevalence of philosophical assumptions described in mixed methods research in education. *Journal of Mixed Methods Research*, 15(2), 171-189.

Coke, K., Hite, R., & Harper, I. (2023). Perceived Barriers to Transfer that Rural Community College Students Experience when Transitioning to a Regional University. *Community College Journal of Research and Practice*, 47(11), 709-714.

Coleman, P. (2022). Special Article Validity and Reliability within Qualitative Research in the Caring Sciences. *International Journal of Caring Sciences*; 14, 2041-2045.

Collingridge D. S., Gantt E. E. (2019). The quality of qualitative research. *American Journal of Medical Quality*, 34(5), 439–445. https://doi.org/10.1177/1062860619873187

Contreras M. M., Páramo D., Rojano Y. N. (2020). The grounded theory as a theoretical construction methodology. *Revista Científica Pensamiento Y Gestión*, 47, 283–306. https://doi.org/10.14482/pege.47.9147

Corotto, F. S. (2022). *Wise Use of Null Hypothesis Tests: A Practitioner's Handbook*. Elsevier. https://www.amazon.com/Wise-Null-Hypothesis-Tests-Practitioners/dp/0323952844

Cox, A. M. (2021). Exploring the impact of Artificial Intelligence and robots on higher education through literature-based design fiction. *Int. J. Educ. Technol. Higher Educ*., 18(1). https://doi.org/10.1186/s41239-020-00237-8

Creswell J. W., Clark V. L. P. (2019). *Designing and conducting mixed methods research*. Newberry Park, CA: Sage.

Criollo-C, S., Govea, J., Játiva, W., Pierrottet, J., Guerrero-Arias, A., Jaramillo-Alcázar, Á., & Luján-Mora, S. (2023). Towards the Integration of Emerging Technologies as Support for the Teaching and Learning Model in Higher Education. *Sustainability*, 15(7), 6055.

Crompton, H. & Burke, D. (2022). Artificial intelligence in K-12 education. *SN Social Sciences*, 2, 113.

Cruz-Sandoval, M., Vázquez-Parra, J. C., & Carlos-Arroyo, M. (2023). Complex thinking and social entrepreneurship. An approach from the methodology of compositional data analysis. *Heliyon*, 9(2).

Cypress, B.S. (2020). Rigor or reliability and validity in qualitative research: perspectives, strategies, reconceptualization, and recommendations. *The Journal of Dimensions of critical care nursing*; 36:25363. https://doi.org/10.1097/DCC.0000000000000253.

Dahal, N. (2023). How can I thank Scott Tunison, Keith D. Walker, and Janet Mola Okeko for presenting over 70 qualitative research concepts? A book review of Varieties of Qualitative Research Methods: Selected Contextual Perspectives. *The Qualitative Report*, 28(2), 556-561.

Dai, K., and Wang, Y. (2023). Investigating the interplay of Chinese EFL teachers' proactive personality, flow, and work engagement. *J. Multiling. Multicult. Dev*., 1–15. doi: 10.1080/01434632.2023.2174128

Dangi, M. R. M., Saat, M. M., & Saad, S. (2023). Teaching and learning using 21st century educational technology in accounting education: Evidence and conceptualization of usage behavior. *Australasian Journal of Educational Technology*, 39(1), 19-38.

Darmuh, M. M., & Kadar, A. S. (2023). Unveiling the Efficacy of Virtual and In-Person Presentations in Delivering Teaching Material: An Analysis Across Traditional Classroom and Online Learning Environments. Klasikal: *Journal Of Education, Language Teaching And Science*, 5(1), 224-235.

Dariyono, D., & Rusman, R. (2023). Curriculum Transformation in The 21st Century Education: Perspectives, Challenges, and Prospects. In *Conference Proceedings International Conference on Education Innovation and Social Science* (pp. 57-68).

Davison, R.M. et al. (2022). The ethics of action research participation. *Information Systems Journal,* 32 (3) 573-594

Dawadi, S., Shrestha, S., & Giri, R. A. (2021). Mixed-Methods Research: A Discussion on its Types, Challenges, and Criticisms. *Journal of Practical Studies in Education*, 2(2), 25-36 DOI: https://doi.org/10.46809/jpse.v2i2.20

Dayagbil, F. T., Palompon, D. R., Garcia, L. L., & Olvido, M. M. J. (2021). Teaching and Learning Continuity Amid and Beyond the Pandemic. *Frontiers in Education*, 6(July), 1–12.

De Fina, A. (2019). The interview as an interactional event. *Language in Society Journal*, 40(1), 1-11.https://doi.org/10.1017/S0047404510000849

Del Arco, I., Silva, P., Flores, O. (2021). University Teaching in Times of Confinement: The Light and Shadows of Compulsory Online Learning. *Sustainability,* 13, 375

Demir, S. (2023). Being a doctoral student in measurement and evaluation in education: a phenomenological study from the perspectives of doctoral students. *Journal of Advanced Education Studies*, 5, 269-287.

Deng, Z. (2023). A quantitative overview of the approaches influencing traditional and new teaching methods on technical college students. *Soft Computing*, 1-19.

De Paoli, S. (2023). Performing an Inductive Thematic Analysis of Semi-Structured Interviews With a Large Language Model: An Exploration and Provocation on the Limits of the Approach. *Social Science Computer Review,* 08944393231220483.

Deschenes, S., Tate, K., Scott, S. D., & Kunyk, D. (2021). Recommendations for navigating the experiences of moral distress: A scoping review. *International Journal of Nursing Studies,* 122, 104035.

Devault, G. (2020). *Advantages and Disadvantages of Quantitative Research*. https://www.thebalancesmb.com/quantitative-research-advantages-and-disadvantages-2296728.

Dever, D. A., Azevedo, R., Cloude, E. B., & Wiedbusch, M. (2020). The impact of autonomy and types of informational text presentations in game-based environments on learning: Converging multi-channel processes data and learning outcomes. *International Journal of Artificial Intelligence in Education,* 30(4), 581–615.

Dinata, D. S., Manuputty, J. A., & Tinopi, Y. K. (2023). Engaging Presence of Constructivism Philosophy in and through Management of Christian Education: Reflective Investigation. *Journal of Scientific Research, Education, and Technology (JSRET)*, 2(4), 1602-1616.

Ding, J., & Du, D. (2023). A study of the correlation between publication delays and measurement indicators of journal articles in the social network environment—based on online data in PLOS. *Scientometrics,* 128(3), 1711-1743.

Di Pietro, G. et al. (2020). *The Likely Impact of COVID-19 on Education: Reflections Based on the Existing Literature and Recent International Datasets*. Luxembourg: European Union.

Divjak, B., Rienties, B., Iniesto, F., Vondra, P., & Žižak, M. (2022). Flipped classrooms in higher education during the COVID-19 pandemic: Findings and future research recommendations. *International Journal of Educational Technology in Higher Education*, 19(1), 1-24.

Dodd, E., Ellis, S., & Singh, S. (2023). Making the invisible, visible: a twenty-first century approach to tertiary preparation, attainment and access for student equity. *International Journal of Inclusive Education*, 27(2), 167-187.

Dogani, B. (2023). Active learning and effective teaching strategies. *International Journal of Advanced Natural Sciences and Engineering Researches*, 7(4), 136–142. https://doi.org/10.59287/ijanser.578

Dollinger, M., Finneran, R., & Ajjawi, R. (2023). Exploring the experiences of students with disabilities in work-integrated learning. *Journal of Higher Education Policy and Management*, 45(1), 3-18.

Donna L.M, Rudolf, J.F., William J.W. (2022). *Statistical Methods*. DOI https://doi.org/10.1016/C2019-0-02521-6

Downes, S. (2021). *Connectivism Learning Theory*. https://www.wgu.edu/blog/connectivism-learning-theory2105.html#close

Drew, C. (2021). *What Is The Humanistic Theory In Education?* https://helpfulprofessor.com/humanist-theory-in-education/

Drost, E. (2021). Validity and Reliability in Social Science Research. *The journal of Education Research and Perspectives*. 38. 105-124.

Drury A., Payne S., Brady A. M. (2021). Prevalence vs impact: A mixed methods study of survivorship issues in colorectal cancer. *Journal of Quality of Life Research*, 31(4), 1117–1134. https://doi.org/10.1007/s11136-021-02975-2

Du, L., Zhao, L., Xu, T., Wang, Y., Zu, W., Huang, X., ... & Wang, L. (2022). Blended learning vs traditional teaching: The potential of a novel teaching strategy in nursing education-a systematic review and meta-analysis. *Nurse Education in Practice*, 63, 103354.

Duckett LJ. (2021). Quantitative Research Excellence: Study Design and Reliable and Valid Measurement of Variables. *Journal of Human Lactation*, 37(3):456-463.

Duggan, M. F. (2023). *Struggling to Maintain Academic Success: A Phenomenological Study of Students with Disabilities' Experiences with Limited and/or Reduced Supports in Higher Education* (Doctoral dissertation, Northcentral University).

Duha, M. S. U. (2023). ChatGPT in education: An opportunity or a challenge for the future? *TechTrends* (0123456789) https://doi.org/10.1007/s11528-023-00844-y.

Dumont, H., & Ready, D. D. (2023). On the promise of personalized learning for educational equity. *Npj science of learning*, 8(1), 26.

Dziuban, C., Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended learning: The new normal and emerging technologies. *International Journal of Educational Technology in Higher Education*, *15*(1). https://doi.org/10.1186/s41239-017-0087-5

Dziubaniuk, O., Ivanova-Gongne, M. & Nyholm, M. (2023). Learning and teaching sustainable business in the digital era: a connectivism theory approach. Int J Educ Technol High Educ 20, 20 (2023). https://doi.org/10.1186/s41239-023-00390-w

Eakin, J. M., Gladstone, B. (2020). "Value-adding" analysis: Doing more with qualitative data. *International Journal of Qualitative Methods*, 19, 1609406920949333. https://doi.org/10.1177/1609406920949333

Easterday, M. W., Rees Lewis, D. G., & Gerber, E. M. (2018). The logic of design research. *Learning. Research and Practice Journal*, 4(2), 131–160. https://doi.org/10.1080/23735082.2017.128636

Egede, D. D., & Mahamed, D. M. (2023). A Guide on Quantitative Research Paradigms, Theory, and Frameworks in Social Sciences Research. *Theory, and Frameworks in Social Sciences Research* (April 13, 2023).

Eisha, J.Q & Widodo, P. (2019). Attitude Conception: The Role of Blended Learning in Environmental Education. *International Journal of Linguistics, Literature and Translation* (IJLLT). 2 (6). DOI: 10.32996/ijllt.2019.2.6.7

El Archi, Y., & Benbba, B. (2023). The Applications of Technology Acceptance Models in Tourism and Hospitality Research: A Systematic Literature Review. *Journal of Environmental Management & Tourism*, 14(2), 379-391.

Elfert, M. (2023). Humanism and democracy in comparative education. *Comparative Education*, 1-18.

Elgohary, M., Palazzo, F. S., Breckwoldt, J., Cheng, A., Pellegrino, J., Schnaubelt, S., ... & Lockey, A. (2022). Blended learning for accredited life support courses–A systematic review. *Resuscitation plus*, 10, 100240.

Elias, A., & Mansouri, F. (2023). Towards a critical transformative approach to inclusive intercultural education. *Journal of Multicultural Discourses*, 1-18.

Emary, P. C., Stuber, K. J., Mbuagbaw, L., Oremus, M., Nolet, P. S., Nash, J. V., ... & Busse, J. W. (2023). Quality of Reporting Using Good Reporting of A Mixed Methods Study Criteria in Chiropractic Mixed Methods Research: A Methodological Review. *Journal of Manipulative and Physiological Therapeutics.*

Emrouznejad, A., Abbasi, S., & Sıcakyüz, Ç. (2023). Supply chain risk management: A content analysis-based review of existing and emerging topics. *Supply Chain Analytics*, 3, 100031.

Enciso Domínguez, G., Ramírez-March, Á., & Montenegro, M. (2023). The geopolitics of knowledge production, or how to inhabit a contradiction: introduction to the special issue on the narrative productions methodology. *Qualitative Research in Psychology*, 20(4), 525-541.

Englander, M., & Morley, J. (2023). Phenomenological psychology and qualitative research. *Phenomenology and the Cognitive Sciences*, 22(1), 25-53.

Erdem, Z. Ç. (2023). Thematic analysis of studies on gifted students in the field of mathematics education. *Journal of Gifted Education and Creativity*, 10(3), 235-258.

Ergen, M. (2019). What is artificial intelligence? Technical considerations and future perception. *The Anatolian Journal of Cardiology*, 22, 5–7. https://doi.org/10.14744/AnatolJCardiol.2019.79091

Eslit, E. (2023). *Exploring the Dimensions of 21st Century Teaching: Unveiling the Gaps and Opportunities for Educational Transformation*.

Essa, E. K. (2023). The Effectiveness of Hybrid Learning in Enhancing Academic Mindfulness and Deeper Learning of University Students. *International Journal of Research in Education and Science*, 9(1), 188-202.

European Commission (2020). *Commission Staff Working Document Accompanying the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "Digital Education Action Plan (2021-2027)"*, European Commission, Brussels, https://eur-lex.europa.eu/legal-content/LT/TXT/?uri=CELEX:52020SC0209

Fàbregues S., Molina-Azorin J. F., Fetters M. D. (2021). Virtual special issue on "quality in mixed methods research". *Journal of Mixed Methods Research*, 15(2), 146-151. https://doi.org/10.1177/15586898211001974

Fakhouri, F.A.N, Alawamrah, H.A, & Rababah, O. (2018). Students Attitudes toward Blended learning among students of the University of Jordan. *The journal of Modern Applied Science*; Vol. 12, No. 12. doi:10.5539/mas.v12n12p217

Fang, M., & Abdullah, R. (2024). EFL Teachers' Use of ICT and Learner-centered Teaching Strategies to Improve English Listening Instruction-A Bibliometric Analysis. *Educational Administration: Theory and Practice*, 30(1).

Fatimah, S. M & Wahyudi, A. (2019). Undergraduate Students' Perceptions Toward Blended Learning Through Instagram in English For Business Class. *International Journal of Language Education* Vol. 3 No. 1, 2019, pp. 64-7

Ferrando, M., Hoogerwerf, E.J., Kadyrbaeva, A. (2021). Qualitative research on the factors affecting transferability of digital solutions for integrated care. *International Journal of Integrated Care*, 19, 236. DOI: 10.5334/ijic.s3236

Fetters M. D. (2022). A comprehensive taxonomy of research designs, a scaffolded design figure for depicting essential dimensions, and recommendations for achieving design naming conventions in the field of mixed methods research. *Journal of Mixed Methods Research*, 16(4), 394–411. https://doi.org/10.1177/15586898221131238

Fia, M., Ghasemzadeh, K., & Paletta, A. (2023). How higher education institutions walk their talk on the 2030 agenda: a systematic literature review. *Higher education policy*, 36(3), 599-632.

Fields, B., & Brint, S. (2023). The Disruption in US Public Higher Education Enrolments, 2009–2019: Sources of Inter-State Variation by Tier. *The Journal of Higher Education*, 94(2), 256-285.

FitzPatrick B. (2019). Validity in qualitative health education research. *Currents in Pharmacy Teaching and Learning*, 11(2), 211–217. https://doi.org/10.1016/j.cptl.2018.11.014

Formenti, L., & Hoggan-Kloubert, T. (2023). Transformative learning as societal learning. *New Directions for Adult and Continuing Education*, 2023(177), 105-118.

Frances, R. & Coughlan, M. (2019). Interviewing in Qualitative Research. *International Journal of Therapy and Rehabilitation*, 16(6):309-314. DOI:10.12968/ijtr.2009.16.6.42433

Freer, J. R. (2023). Students' attitudes toward disability: A systematic literature review (2012–2019). *International Journal of Inclusive Education*, 27(5), 652-670.

Friedman, L., Blair Black, N., Walker, E., & Roschelle, J. (November 8, 2021) Safe AI in education needs you. *Association of Computing Machinery blog*, https://cacm.acm.org/blogs/blog-cacm/256657-safe-ai-in-education-needs-you/fulltext

Friedner-Parrat, C. (2023). Interpretivists in the English School: Aren't we all?. *Journal of International Political Theory*, 19(2), 221-241.

Fuller, L. (2021). Negotiating a new blend in blended learning: Research roots. *Digital Commons* @ VCCS. https://commons.vccs.edu/inquiry/vol24/iss1/6

Fulton, J., Kerrigan, S., & McIntyre, P. (2023). Extended-mixed methods: a new research paradigm for the creative industries. *Communication Research and Practice*, 1-18.

Gallagher, S. E., & Savage, T. (2023). Challenge-based learning in higher education: an exploratory literature review. *Teaching in Higher Education*, 28(6), 1135-1157.

Gandhi, M. H., & Mukherji, P. (2023). Learning Theories. *In StatPearls [Internet]*. StatPearls Publishing.

Ganesh Prasad Adhikari (2021). Calculating the Sample Size in Quantitative Studies. *A Multidisciplinary Peer Reviewed, Open Access Journal.*

Garcia, T., & Pintrich, P. R. (2023). Regulating motivation and cognition in the classroom: The role of self-schemas and self-regulatory strategies. In *Self-regulation of learning and performance* (pp. 127-153). Routledge.

Garrison, D. R., Vaughan, N. D., Dell, D. & Cleveland-Innes, M., & (2023). *Principles of Blended Learning: Shared Metacognition and Communities of Inquiry*. Athabasca University Press.

Gellai, D. B. (2023). Enterprising academics: Heterarchical policy networks for artificial intelligence in British higher education. *ECNU Review of Education*, 6(4), 568-596.

George, B. & Paul, J. (2020). *Digital Transformation in Business and Society*. New York: Springer International Publishing.

George, B., & Wooden, O. (2023). Managing the strategic transformation of higher education through artificial intelligence. *Administrative Sciences*, 13(9), 196.

Ghosh, S., Bhowmik, C., Sinha, S., Raut, R. D., Mandal, M. C., & Ray, A. (2023). An integrated multi-criteria decision-making and multivariate analysis towards sustainable procurement with application in automotive industry. *Supply Chain Analytics*, 3, 100033.

Gibson, E. (2023*). Blended Learning Approaches that Raise Engagement, Motivation, and Self-Efficacy of Post-Secondary Students* (Doctoral dissertation, Trevecca Nazarene University).

Giga (2022). *Giga Project: Connecting Every School in the World to the Internet*. PowerPoint. Presentation used at the Giga Project Stakeholders Meeting.

Glazer, F. S. (Ed.). (2023). *Blended learning: Across the disciplines, across the academy*. Taylor & Francis.

Gerberry, C. V. (2023). Developing self-efficacy through the social constructivist mentorship. *Theory Into Practice*, 62(1), 62-69.

Gherhes, V.; Stoian, C.E.; F ˘arcas,iu, M.A.; Stanici, M. (2021). E-Learning vs. Face-To-Face Learning: Analyzing Students' Preferences and Behaviors. *Sustainability*, 13, 4381. https:// doi.org/10.3390/su13084381

Gherheș, Vasile, et al. (2021). "E-learning vs. face-to-face learning: Analyzing students' preferences and behaviors." *Sustainability*, 13.8: 4381.

Gibson, E. (2023). *Blended Learning Approaches that Raise Engagement, Motivation, and Self-Efficacy of Post-Secondary Students* (Doctoral dissertation, Trevecca Nazarene University).

Glazer, F. S. (Ed.). (2023). *Blended learning: Across the disciplines, across the academy*. Taylor & Francis.

Glover, N. (2023). *The Perception of K-2 Teachers' Use of Technology to Support Student Growth in 21 st Century Skills: A Qualitative Descriptive Study* (Doctoral dissertation, Northcentral University).

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of Education 4.0 in 21st century skills frameworks: systematic review. *Sustainability*, 14(3), 1493.

Government of Rwanda (2020). *An Architecture for the Integrated Education Management Information System*. Kigali: Ministry of Education.

Gorriz, ´ J. M., Ramírez, J., Ortíz, A., Martínez-murcia, F. J., Segovia, F., Suckling, J., et al. (2020). Artificial intelligence within the interplay between natural and artificial computation: Advances in data science, trends, and applications. *Neurocomputing*. https://doi.org/10.1016/j.neucom.2020.05.078

Graham, C. R., Woodfield, W., & Harrison, J. B. (2019). A framework for institutional adoption and implementation of blended learning in higher education. *The internet and higher education*, 18, 4-14.

Graham, C. R. (2018). Emerging practice and research in blended learning. In M. G. Moore (Ed.), *Handbook of distance education*, (3rd ed., pp. 333–350). New York: Routledge.

Graham, J., & Colin, C. (2023). Exploring the Dynamics of Education in Australia: Policies, Practices, and Progressions in the 21st Century. *Influence*: *International Journal of Science Review*, 5(3), 14-23.

Graham, C. R., & Halverson, L. R. (2022). Blended Learning Research and Practice. In *Handbook of open, distance and digital education* (pp. 1-20). Singapore: Springer Nature Singapore.

Granić, A. (2023). Technology acceptance and adoption in education. In *Handbook of open, distance and digital education* (pp. 183-197). Singapore: Springer Nature Singapore.

Gray, D. (2019). *Doing Research in the Real World*. 4th Edition. London, Sage.

Gray-Lobe, G., Keats, A., Kremer, M., Mbiti, I. and Ozier, O.W.. (2022). *Can Education be Standardized? Evidence from Kenya. Evidence from Kenya*. University of Chicago, Becker Friedman Institute for Economics Working Paper. (2022-68).

Grenier, A. (2023). The qualitative embedded case study method: Exploring and refining gerontological concepts via qualitative research with older people. *Journal of Aging Studies*, 65, 101138.

Grey, S., & Morris, P. (2022). Capturing the spark: PISA, twenty-first century skills and the reconstruction of creativity. *Globalization, Societies and Education*, 1-16.

Griffin, B. R., You, Z., Holmen, J., SooHoo, M., Gist, K. M., Colbert, J. F., ... & Jovanovich, A. (2019). Incident infection following acute kidney injury with recovery to baseline creatinine: a propensity score matched analysis. *PloS one*, 14(6), e0217935.

Guan, X., Feng, X., & Islam, A. Y. M. (2023). The dilemma and countermeasures of educational data ethics in the age of intelligence. *Humanities and Social Sciences Communications*, 10(1), 1-14.

Guin, A. J. (2023). *Exploring Lived Experiences of Suicide Surviving Spouses: An Interpretive Phenomenological Qualitative Study*. https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&as_vis=1&q=Exploring+Lived+Experiences+of+Suicide+Surviving+Spouses%3A+An+Interpretive+Phenomenological+Qualitative+Study&btnG=

Guenther, J., Falk, I. H. (2021). Generalizing from qualitative evaluation. *Evaluation Journal of Australasia*. 21(1), 7–23. https://doi.org/10.1177/1035719x21993938

Guo, X., & Li, X. (2023). Development of online education satisfaction research in 2011–2022: A systemic review based on bibliometric and content analysis. *Education and Information Technologies*, 1-36.

Gupta, J., & Garg, K. (2021). Reflections on blended learning in management education: a qualitative study with a push-pull migration perspective. *FIIB Business Review*, 23197145211013686.

Guraya, S. S., Harkin, D. W., Yusoff, M. S. B., & Guraya, S. Y. (2023). Paradigms unfolded–developing, validating, and evaluating the Medical Education e-Professionalism framework from a philosophical perspective. *Frontiers in Medicine*, 10.

Gurcan, F., & Cagiltay, N. E. (2023). Research trends on distance learning: A text mining-based literature review from 2008 to 2018. *Interactive Learning Environments*, 31(2), 1007-1028.

Gustafsson, J. (2018). *Single case studies vs. multiple case studies: A comparative study*. Halmstad University. Sweeden

Guo, Y., Wang, Y., & Ortega-Martín, J. L. (2023). The impact of blended learning-based scaffolding techniques on learners' self-efficacy and willingness to communicate. *Porta Linguarum Revista Interuniversitaria de Didáctica de las Lenguas Extranjeras*, (40), 253-273.

Guttesen, K. (2022). *Character Education Through Poetry*. A thesis submitted to the University of Birmingham for the degree of Doctor of philosophy.

Habtegebriel, H., & Valdramidis, V. (2023). Descriptive statistics and meta-analysis approaches to assess the effect of microbial contamination on the cultivation of microalgal biomass and its derivatives. *Algal Research*, 74, 103205

Haftador, A. M., Tehranineshat, B., Keshtkaran, Z., & Mohebbi, Z. (2023). A study of the effects of blended learning on university students' critical thinking: A systematic review. *Journal of Education and Health Promotion*, 12.

Hakim, Y. E. (2023, June). 21st Century Learning Based on 4C Skills (Critical Thinking, Communication, Collaboration and Creativity and Innovation) Against Literacy Culture in Elementary Schools. In *International Conference on Elementary Education* (Vol. 5, No. 1, pp. 721-735).

Halder, S. (2023). *Readiness for Blended Learning in Higher Educational Institutions of Bangladesh*. https://efaidnbmnnnibpcajpcglclefindmkaj/https://dspace.aiub.edu/jspui/bitstream/123456789/900/1/Research%20Report%2CIntern%2CMBA%2CB-1.pdf

Hamal, O., Faddouli, N. El, Hachem, M., Harouni, A., & Lu, J. (2022). *Sustainability artificial intelligent in education.* (March). https://doi.org/10.3390/su14052862.

Hammack, P. L., Hughes, S. D., Atwood, J. M., Cohen, E. M., & Clark, R. C. (2022). Gender and sexual identity in adolescence: A mixed-methods study of labeling in diverse community settings. *Journal of adolescent research*, 37(2), 167-220.

Hammad, W., & Bush, T. (2023). Exploring the perceptions of Omani school principals about their leadership preparation: A mixed-methods study. *Leadership and Policy in Schools*, 22(2), 283-298.

Hammel, J. K. (2023). *A Qualitative Phenomenological Study Exploring the High Turnover Rate of Elementary School Teachers in the Southwest United States Due to the Coronavirus Pandemic* (Doctoral dissertation, Northcentral University).

Hammer, M. J., Cartwright-Alcarese F., Budin W. C. (2019). Theoretical frameworks and philosophies of care. In Payne J., Murphy-Ende K. (Eds.), *Current trends in oncology nursing* (2nd ed.). Oncology Nursing Society.

Hammersley, M. (2023, January). Are there assessment criteria for qualitative findings? A challenge facing mixed methods research. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, 24, 1.

Han, F & Ellis, RA. (2019). Identifying consistent patterns of quality learning discussions in blended learning. *Internet and Higher Education*. https://doi.org/10.1016/j.iheduc.2018.09.002

Han, C., Lu, X., & Zhang, P. (2023). Use of statistical methods in translation and interpreting research: A longitudinal quantitative analysis of eleven peer-reviewed journals (2000–2020). *Target*.

Handema, M., Lungu, J., Chabala, M., & Shikaputo, C. (2023). Conceptualizing the Philosophical Underpinning of the Study: A Practical Perspective. *Open Journal of Philosophy*, 13(2), 257-268.

Hannan, E. & Liu, S. (2021). AI: New source of competitiveness in higher education. Competitiveness Review: *An International Business Journal* 33: 265–79.

Harkko, J., Sipilä, N., Nordquist, H., Lallukka, T., Appelqvist-Schmidlechner, K., Donnelly, M., & Kouvonen, A. (2023). External context in individual placement and support implementation: a scoping review with abductive thematic analysis. *Implementation Science*, 18(1), 61.

Harrell, K. B. and Wendt, J. L. (2019). The impact of blended learning on community of inquiry and perceived learning among high school learners enrolled in a public charter school. *Journal of Research on Technology in Education*, 51(3), pp.259-272. DOI: 10.1080/15391523.2019.1590167.

Harris J. (2021). Mixed methods research in developing country contexts: Lessons from field research in six countries across Africa and the Caribbean. *Journal of Mixed Methods Research*, 16(2), 165-182. https://doi.org/10.1177/15586898211032825

Hartika, A., Fitridiani, M., & Asbari, M. (2023). The Effect of Job Satisfaction and Job Loyalty on Employee Performance: A Narrative Literature Review. *Journal of Information Systems and Management (JISMA)*, 2(3), 9-15.

Hartle, S. (2023). Integrating the Formative and Summative Post Covid-19 in a Blended Learning Approach to Higher Educational Assessment: Challenges and Opportunities. *Iperstoria*, (21).

Harvey-Burks, J. (2023). *A Constructivist Grounded Theory Study: Reimagining Leadership and Psychological Contract Theory* (Doctoral dissertation, Capella University).

Hazra, A. (2023). Descriptive and Inferential Statistics in Biomedical Sciences: An Overview. *The Quintessence of Basic and Clinical Research and Scientific Publishing*, 461-478.

Hatch, J. A. (2023). *Doing qualitative research in education settings*. State university of New York press.

Hauken, M. A., Larsen, T. M. B., & Holsen, I. (2019). ‘‘Back on track’’: A longitudinal mixed methods study on the rehabilitation of young adult cancer survivors. *Journal of* Mixed Methods Research, 13(3), 339-360. https://doi.org/10.1177/1558689817698553

Hebebci, M. T., & Nilay, O. Z. E. R. (2023). Blended Learning in Higher Education: A Bibliometric Analysis. *Turkish Online Journal of Distance Education*, 24(3), 93-116.

HEC (2020). *Higher Education in Rwanda*. Kigali, Rwanda. Higher Education Council. https://www.mineduc.gov.rw/higher-learning-institutions

Heilinger, J.C., Hendrik K. & Saskia N. (2023). Beware of sustainable AI! Uses and abuses of a worthy goal. *AI And Ethics* 26: 1–12

Heinonen, K., & Strandvik, T. (2022). applying pragmatism to stimulate service research and practice–a European perspective. *Journal of Services Marketing*, 36(4), 467-475.

Helskog, G. H. (2020). *Philosophising the Dialogos Way Toward Wisdom in Education. Between Critical Thinking and Spiritual Contemplation*. London and New York: Routledge.

Henderson, F., Hammill, J., Nguyen, T., & (2021). Encouraging the flip with a gamified process. *International Journal of Educational Research* Open, 2, 100085.

Hendren, K., Newcomer, K., Pandey, S. K., Smith, M., & Sumner, N. (2023). How qualitative research methods can be leveraged to strengthen mixed methods research in public policy and public administration?. *Public Administration Review*, 83(3), 468-485.

Hennigh, B. (2023). *21st-Century Classroom Demands: A Qualitative Case Study of Teacher Defined Necessary Needs* (Doctoral dissertation, Concordia University Texas).

Henrik, L. H. & Forsberg, C. (2023). Constructivist grounded theory and educational research: constructing theories about teachers' work when analyzing relationships between codes. *International Journal of Research & Method in Education*, 46:2, 200-210, DOI: 10.1080/1743727X.2022.2095998 To link to this article: https://doi.org/10.1080/1743727X.2022.2095998

Hennessy, S., Jordan, K., Wagner, D.A. and Team, E.H. (2021). *Problem analysis and focus of EdTech Hub's work: Technology in education in low-and middle-income countries.* (Working Paper No. 7). EdTech Hub. https://doi.org/10.5281/zenodo.4332693

Hidayat, M. A. (2023). *The Implementation of Flex Blended Learning in Teaching Writing of Report Text Using Google Classroom*. A Doctoral dissertation, Universitas Pancasakti Tegal.

Hill, J., & Smith, K. (2023). Visions of blended learning: identifying the challenges and opportunities in shaping institutional approaches to blended learning in higher education. *Technology, Pedagogy and Education*, 32(3), 289-303.

Hirose, M., & Creswell, J. W. (2023). Applying core quality criteria of mixed methods research to an empirical study. *Journal of Mixed Methods Research*, 17(1), 12-28.

Hlazunova, I. (2023). Blended Learning and Foreign Experience of Its Use in Pedagogical Practice. LAPLAMBERT Academic Publishing.

Hirose, M., & Creswell, J. W. (2023). Applying core quality criteria of mixed methods research to an empirical study. *Journal of Mixed Methods Research*, 17(1), 12-28.

Hoadley, C. & Fabio, C. (2022). Design-based research: What it is and why it matters to studying online learning. *Educational Psychologist Journal*, 57:3, 207-220, DOI: 10.1080/00461520.2022.2079128

Hodges C, Moore S, Lockee B, Trust T, Bond A. (2020). *The Difference Between Emergency Remote Teaching and Online Learning*. https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

Hojiyeva, I. A. (2023). Project-Based Learning and project-based methods as a development of innovative pedagogy. *Journal of Modern Educational Achievements*, 5(5), 63-69.

Holman, L., & Perreault, G. P. (2023). Diffusion of innovations in digital journalism: Technology, roles, and gender in modern newsrooms. *Journalism*, 24(5), 938-957.

Holloway, I., & Galvin, K. (2023). *Qualitative research in nursing and healthcare*. John Wiley & Sons.

Honen-Delmar, M., & Rega, I. (2023). Intercultural competence for peaceful communities: The role of blended learning higher education in refugee camps. *International Journal of Intercultural Relations*, 97, 101891.

Horton, R. & Lucassen, A. (2022). Ethical Considerations in Research with Genomic Data. *Journal of medical ethics*, 45 (6), 357. doi.org/10.1080/20502877.2022.2060590

Horvath, K., Steinberg, M., & Frei, A. I. (2023). Bridging inquiry and critique: a neo-pragmatic perspective on the making of educational futures and the role of social research. *Learning, Media and Technology*, 1-14.

Houser, V. (2020). *Radio Learning in the Time of Coronavirus: UNICEF and Partners Support Rwanda Education Board to Develop Radio Lessons for Students Affected by COVID-19 School Closures.* UNICEF.

Howell-Moroney, M. (2023). Inconvenient truths about logistic regression and the remedy of marginal effects. *Public Administration Review.*

Hsu, T. C., Abelson, H., Lao, N., Tseng, Y. H., & Lin, Y. T. (2021). Behavioral-pattern exploration and development of an instructional tool for young children to learn AI. *Comput. Educ.: Artificial Intelligence*, 2(January), Article 100012. https://doi.org/10.1016/j.caeai.2021.100012

Hu, Y. F., Hu, H. J., Ma, W. J., Jin, Y. W., & Li, F. Y. (2023). Laparoscopic versus open liver resection for intrahepatic cholangiocarcinoma: a systematic review of propensity score-matched studies. *Updates in Surgery*, 1-13.

Hua, T., & Yanjun, S. (2023). A Study on the Effect Mechanism of Blended Learning Model on the Learning Effect of Diversified Students in Higher Vocational Education Enrolment Expansion. *Journal of Namibian Studies: History Politics Culture*, 33, 3644-3666.

Huang, X., Zou, D., Cheng, G., Chen, X., & Xie, H. (2023). A bibliometric analysis of the trends, topics, and findings of research publications on asynchronous and synchronous online language learning over three decades. *Knowledge Management & E-Learning*, 15(2), 153.

Huang, Y. C., Li, L. N., Lee, H. Y., Browning, M. H., & Yu, C. P. (2023). Surfing in virtual reality: An application of extended technology acceptance model with flow theory. *Computers in Human Behavior Reports*, 9, 100252.

Huang, Y. C., Chang, C. C., Yeh, C. C., Lin, C. S., Hu, C. J., Chen, T. L., & Liao, C. C. (2021). The protective effect of statins against pressure ulcers in stroke patients: A propensity-score matched study based on a real-world database. *Atherosclerosis*, 317, 22-28.

Huda, M., Ali, A. H., Za, T., Ahmad, R., Selamat, A. Z., Ibrahim, M. H. & Glorino, M. (2023). Understanding of digital ethics for information trust: a critical insight into gender violence anticipation. In *Communication Technology and Gender Violence* (pp. 165-181). Cham: Springer International Publishing.

Hung, C. C., Tu, M. Y., Chien, T. W., Lin, C. Y., Chow, J. C., & Chou, W. (2023). The model of descriptive, diagnostic, predictive, and prescriptive analytics on 100 top-cited articles of nasopharyngeal carcinoma from 2013 to 2022: bibliometric analysis. *Medicine*, 102(6).

Huitt, W. (2019). Humanism and open education. *Educational Psychology Interactive*. Valdosta, GA: Valdosta State University. http://www.edpsycinteractive.org/topics/affect/humed.html

Hung, B. P., Pham, A. T. D., & Purohit, P. (2022). Computer mediated communication in second language education. *New trends and applications in Internet of things (IoT) and big data analytics*, 45-60.

Hunduma, C. M., & Seyoum, Y. (2023). Constraints Hindering ICT Integration in Ethiopian Public Secondary Schools: A Literature Review. *International Journal of Membrane Science and Technology*, 10(2), 691-702.

Huntington, R. N., Badgett, N. M., Rosenberg, N. E., Greeny, K., Bravo, A., Bristol, R. M., ... & Park, M. S. (2023). Social validity in behavioral research: A selective review. *Perspectives on behavior science*, 46(1), 201-215.

Hutson, J., Jeevanjee, T., Vander Graaf, V., Lively, J., Weber, J., Weir, G., ... & Edele, S. (2022). Artificial Intelligence and the Disruption of Higher Education: Strategies for Integrations across Disciplines. *Creative Education*, 13(12).

Ibukunoluwa, J. B. (2022). *Teachers Embrace New Tech-Enabled Methods In Rwandan Primary Schools*. Available at: https://techpression.com/teachers-embrace-new-tech-in-rwandan

Idrees, H., Xu, J., Haider, S. A., & Tehseen, S. (2023). A systematic review of knowledge management and new product development projects: Trends, issues, and challenges. *Journal of Innovation & Knowledge*, 8(2), 100350.

Ilhomovna, N. F. (2023). The role of information and communication technologies in education and professional training of students. *Open Access Repository*, 4(3), 680-686.

Iliyasu, R., & Etikan, I. (2021). Comparison of quota sampling and stratified random sampling. *Biometrics Biostat. Int. J.*, 10 (1).

Imran, R., Fatima, A., Salem, I. E., & Allil, K. (2023). Teaching and learning delivery modes in higher education: Looking back to move forward post-COVID-19 era. *The International Journal of Management Education*, 21(2), 100805.

Irvine, V., Code, J. & Richards, L.(2019). Realigning Higher Education for the 21st-Century Learner through Multi-Access Learning. *Journal of Online Learning and Teaching*. 9 (2).

Irwan, Angraini, R., & Tiara, M. (2020). Analysis of Student Interest on Blended Learning. 458 (Icssgt 2019), 329–335. https://doi.org/10.2991/assehr.k.200803.041

Irwanto, I., Wahyudiati, D., Saputro, A. D., & Lukman, I. R. (2023). Massive open online courses (MOOCs) in higher education: A bibliometric analysis (2012-2022). IJIET: *International Journal of Information and Education Technology*, 13(2), 223-231.

Janczyk, M., & Pfister, R. (2023). Understanding Inferential Statistics: From A for Significance Test to Z for Confidence Interval. *Springer Nature*.

Jang, H. W., & Park, J. (2023). Evaluation of medical school faculty members' educational performance in Korea in 2022 through analysis of the promotion regulations: a mixed methods study. *Journal of educational evaluation for health professions*, 20(1), 7-0.

Jeet, G., & Pant, S. (2023). Creating joyful experiences for enhancing meaningful learning and integrating 21st century skills. *International Journal of Current Science Research and Review*, 6(2), 900-903.

Jia, F., Sun, D., & Looi, C. K. (2023). Artificial Intelligence in Science Education (2013–2023): Research Trends in Ten Years. *Journal of Science Education and Technology*, 1-24.

Jiang, L. (2022). Factors influencing EFL teachers' implementation of SPOC-based blended learning in higher vocational colleges in China: A study based on grounded theory. *Interactive Learning Environments*, 1-20.

Jnr, B. A., & Petersen, S. A. (2023). Using an extended technology acceptance model to predict enterprise architecture adoption in making cities smarter. *Environment Systems and Decisions*, 43(1), 36-53.

Johnson R. B., Walsh I. (2019). Mixed grounded theory: Merging grounded theory with mixed methods and multimethod research. *The SAGE Handbook of Current Developments in Grounded Theory*, 517-531. https://doi.org/10.4135/9781526485656.n27

Johnson, S.B., et al., (2020). Rethinking the ethical principles of genomic medicine services. *European Journal of Human Genetics*, 28 (2), 147–154.

Jonker, H. (2018). Curriculum flexibility in a blended curriculum. *Australasian Journal of Educational Technology*, 2020, 36(1).

Jose Mari Calamlam, J.M. (2020). The Development of 21st-Century e-Learning Module Assessment Tool. *Journal of Educational Technology Systems.* DOI:10.1177/0047239520953792

Joynes, C., Rossignoli, S., & Amonoo-Kuofi, E. F. (2019). *21st Century Skills: evidence of issues in definition, demand and delivery for development contexts*.

Jung, E., Lim, R., & Kim, D. (2022). A schema-based instructional design model for self-paced learning environments. *Education Sciences*, 12(4), 271.

Kabarungi, M., Habinka, A., Kawuma, S., & Ntwari, R. (2023). Blended Learning: Systematic Literature Review in The Context of Covid19 Pandemic. In: Eilu, E., Pettersson, J.S., Baguma, R., Bhutkar, G. (eds) *Rethinking ICT Adoption Theories in the Developing World. Signals and Communication Technology*. Springer, Cham. https://doi.org/10.1007/978-3-031-57880-9_12

Kabera, C. (2021). *The role of ICT in higher education. A press conference with University World News.* Retrieved from https://www.universityworldnews.com/post.php?story=20210222034159306

Kabudi, T., Pappas, I., & Olsen, D. H. (2021). AI-enabled adaptive learning systems: A systematic mapping of the literature. *Comput. Educ.*: Artificial Intelligence, 2(March), Article 100017. https://doi.org/10.1016/j.caeai.2021.100017

Kadam, P., Sutcliffe, R. P., Scatton, O., Sucandy, I., Kingham, T. P., Liu, R., ... & Lopez-Lopez, V. (2022). An international multicenter propensity-score matched and coarsened-exact matched analysis comparing robotic versus laparoscopic partial liver resections of the anterolateral segments. *Journal of Hepato-Biliary-Pancreatic Sciences*, 29(8), 843-854.

Kahraman, E., & Akay, O. (2023). Comparison of exponential smoothing methods in forecasting global prices of main metals. *Mineral Economics*, 36(3), 427-435.

Kain, C. (2023). *Discussing 21st century skills in the educational context of secondary schools: a literature review of works pub-lished between 2010 and 2023*/Christina KAIN, BEd.

Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). New era of artificial intelligence in education: towards a sustainable multifaceted revolution. *Sustainability*, 15(16), 12451.

Kambhampati, S. B., Menon, J., & Maini, L. (2023). Ethics in Research and Publications. *Indian Journal of Orthopaedics*, 57(11), 1722-1734.

Kamila, M. K., & Jasrotia, S. S. (2023). Ethical issues in the development of artificial intelligence: recognizing the risks. *International Journal of Ethics and Systems*.

Karaca-Atik, A., Meeuwisse, M., Gorgievski, M., & Smeets, G. (2023). Uncovering important 21st-century skills for sustainable career development of social sciences graduates: a systematic review. *Educational Research Review*, 100528.

Karakoyun, F., & Lindberg, O. J. (2020). Preservice teachers' views about the twenty-first century skills: A qualitative survey study in Turkey and Sweden. *Education and Information Technologies*, 25, 2353-2369.

Kardipah, S., & Wibawa, B. (2020). A flipped-blended learning model with augmented problem based learning to enhance students' computer skills. *TechTrends*, 64(3), 507-513.

Kasirye, F. (2021). *A Conceptual Paper on Ensuring Quality in Qualitative Research*. Conference Paper, International Islamic University, Malaysia

Katal, A., Upadhyay, J., & Singh, V. K. (2023). Blended learning in COVID-19 era and way-forward. In *Sustainable Blended Learning in STEM Education for Students with Additional Needs* (pp. 55-85). Singapore: Springer Nature Singapore.

Kaukko, M., Wilkinson, J., Whatman, S., Vedeler, G. W., Blue, L. E., & Reimer, K. E. (2023). Challenging Ontological and Epistemological Assumptions of Researching: A Practice Architectures Approach. In *Researching Practices Across and Within Diverse Educational Sites: Onto-epistemological Considerations* (pp. 23-36). Emerald Publishing Limited.

Kaur, P., Stoltzfus, J., & Yellapu, V. (2019). Descriptive statistics. *International Journal of Academic Medicine*, 4(1), 60-63.

Kaushik, V., & Walsh, C. A. (2019). Pragmatism as a research paradigm and its implications for social work research. *Social sciences*, 8(9), 255.

Kavan, M., Zameni, F., & Enayati, T. (2023). Web-based interactive learning and the quality of learning experiences in medical sciences. *Clinical Excellence*, 12(4), 13-29.

Kebritchi, M., Rominger, R., & McCaslin, M. (2023). Contributing Factors for Success of Nontraditional Students at Online Doctoral Programs. *Journal of College Student Retention: Research, Theory & Practice*, 15210251231155488.

Kelly, S., Kaye, S. A., & Oviedo-Trespalacios, O. (2023). What factors contribute to the acceptance of artificial intelligence? *A systematic review. Telematics and Informatics*, 77, 101925.

Kendra, C. (2021). *The Review of the 5 Levels of Maslow's Hierarchy of Needs*. https://www.verywellmind.com/what-is-maslows-hierarchy-of-needs-4136760

Khalil, M., Prinsloo, P., & Slade, S. (2023). The use and application of learning theory in learning analytics: a scoping review. *Journal of Computing in Higher Education*, 35(3), 573-594.

Khan, S., Ramsey, P., & Khan, M. (2023). Embracing educational transformation: exploring personalized, collaborative and contextualized education through dilemma theory. *Innovations in Education and Teaching International*, 1-14.

Khamzaev, N. U. (2023). Differences between traditional and modern methods in teaching literature. *Academic research in educational sciences*, 4(5), 768-774.

Khushk, A., Dacholfany, M. I., Abdurohim, D., & Aman, N. (2023). Social Learning Theory in Clinical Setting: Connectivism, Constructivism, and Role Modeling Approach. *Health Economics and Management Review*, 3, 40-50.

Kifor, C. V., Benedek, A. M., Sîrbu, I., & Săvescu, R. F. (2023). Institutional drivers of research productivity: a canonical multivariate analysis of Romanian public universities. *Scientometrics*, 128(4), 2233-2258.

Kigotho, W. (2023). *The Right to Higher Education in Africa: Briefing note compendium*. UNESCO Report

Kilag, O. K. T., Abalo, S. J. R., Retes, G. P., & Dalogdog, L. G. (2023). Enhancing Student Learning through the Integration of Connectivism Theory in Blended Learning Environments. *European Journal of Innovation in Nonformal Education*, 3(6), 1-10.

Kim, H., Lee, E. R., & Park, S. (2023). Debiased inference for heterogeneous subpopulations in a high-dimensional logistic regression model. *Scientific Reports*, 13(1), 21979.

Kimenyi, E., Chuang, R. and Taddese, A. (2020). *EdTech in Rwanda: A Rapid Scan* (No. 11). EdTech Hub.

Kimura, R., Matsunaga, M., Barroga, E., & Hayashi, N. (2023). Asynchronous e-learning with technology-enabled and enhanced training for continuing education of nurses: a scoping review. *BMC Medical Education*, 23(1), 505.

Klaveren, L.V., Peter, G.M.J, Hendriks, R., Luk, F. (2020). Content, Delivery Modes, and Social-Epistemological Dimensions of Online Information for Renal Transplant Patients and Living Donors during the COVID-19 Pandemic: Lessons Learned. *Journal of Medical Internet Research* 22(10). DOI:10.2196/22068

Knottnerus, J. A. & Tugwell, P. (2018). Ethics of research methodology requires a methodology of research ethics. *Journal of Clinical Epidemiology*. (100), 5-6, DOI:https://doi.org/10.1016/j.jclinepi.2018.07.001

Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). Exploring generative artificial intelligence preparedness among university language instructors: A case study. *Computers and Education: Artificial Intelligence*, 5, 100156.

Kömür, İ. A., Kılınç, H., & Okur, M. R. (2023). The Rotation Model in Blended Learning. *Asian Journal of Distance Education*.

König, J., Heine, S., Kramer, C., Weyers, J., Becker-Mrotzek, M., Großschedl, J., ... & Strauß, S. (2023). Teacher education effectiveness as an emerging research paradigm: a synthesis of reviews of empirical studies published over three decades (1993–2023). *Journal of Curriculum Studies*, 1-21.

Kop, R., & Hill, A. (2020). Connectivism: Learning theory of the future or vestige of the past? *Journal of International Review of Research in Open and Distributed Learning*. 9 (3)1-13. https://id.erudit.org/iderudit/1071651ar

Korson, C. (2023). A place-based approach to blended learning. *Journal of Geography in Higher Education*, 47(4), 569-588.

Korstjens, I. & Moser, A. (2020) Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *European Journal of General Practice*, 24:1, 120-124, DOI: 10.1080/13814788.2017.1375092

Koulidiati, S. (2022). *Beyond Limits*. New Ways to Reinvent Higher Education-Roadmap proposed for the WHEC2022

Kraemer H.C. (2019). Is it time to ban the *P* value? *JAMA Psychiatry.*76:1219–20. Lakens D. (2021). Sample size justification. *PsyArXiv Journal*. https://doi.org/10.31234/osf.io/9d3yf

Kraus, S., Mahto, R. V., & Walsh, S. T. (2023). The importance of literature reviews in small business and entrepreneurship research. *Journal of small business management*, 61(3), 1095-1106.

Kreuter, J., & Kreuter, J. (2021). The Tools for Empirical Analysis—The Method of Qualitative Content Analysis. *Climate Engineering as an Instance of Politicization: Talking Tomorrow's Technology—Framing Political Choice?*, 165-186.

Kroshilin, S. (2022). Digital Transformation of Russian Universities during the Pandemic. *Science Culture Society* 28: 93–110.

Kumar, J., & Vijay, P. (2023). Digital technology Integration in Education: Challenges and Opportunities for Teachers. *ldealistic Journal of Advanced Research in Progressive Spectrums* (IJARPS) eISSN–2583-6986, 2(07), 17-24.

Kumatongo, B., & Muzata, K. K. (2021). Research paradigms and designs with their application in education. *Journal of Lexicography and Terminology* (Online ISSN 2664-0899. Print ISSN 2517-9306)., 5(1), 16-32.

Kurniaman, O., & Zufriady, Z. (2019). The effectiveness of teaching materials for graphic organizers in reading in elementary school students. *Journal of Educational Sciences*, 3(1), 48-62.

Kurt, S. (2021). *Constructivist Learning Theory*. https://educationaltechnology.net/constructivist-learning-theory/

Kuzat, H. (2023). *Blended Learning Implementation Among Mathematics Students: A Comparison to Traditional Learning Platform* (Doctoral dissertation, Tennessee State University).

Kwok-Wing, L. (2021). Mobile Learning, Challenges. In KW Lai (2020): *Encyclopedia of Education and Information Technologies*, 10.1007/978-3-030-10576-1_242.

Kyngäs, H., Kääriäinen, M., Elo, S. (2020). The Trustworthiness of Content Analysis. In: Kyngäs, H., Mikkonen, K., Kääriäinen, M. (eds) *The Application of Content Analysis in Nursing Science Research*. Springer, Cham. https://doi.org/10.1007/978-3-030-30199-6_5

Lai. K-W. (2021). Digital technology and the culture of teaching and learning in higher education. Australasian Journal of Educational Technology. 27 (8), 1263-1275.

Lahiassi, J., Aammou, S., & Warraki, O. E. (2023). Enhancing personalized learning with a recommendation system in private online courses. *Conhecimento & Diversidade*, 15(39), 176-189.

Lashayo, D. M., & Mhina, J. R. A. (2023). Evaluating the extent of adoption and integration of artificial intelligence content into computing curricula in high education institutions in Tanzania: a focus on the design and delivery of academic programs: Artificial Intelligence (AI), Higher Education Institutions (HEIs), Curricula, Academic Programs, Tanzania. *Business Education Journal*, 9(1).

Laterite, N. (2023). *Unlocking the potential of technology for learning: the EdTech landscape in Rwanda*. Kigali, Rwanda.

Laurillard, D., Kennedy, E., Horan, B., Charlton, P. (2015). Making meaningful decisions about time, workload and pedagogy in the digital age: The Course Resource Appraisal Model, *Distance Education*, 36:2, 177-195, DOI: 10.1080/01587919.2015.1055920

Lazenby, K., Tenney, K., Marcroft, T. A., & Komperda, R. (2023). Practices in instrument use and development in chemistry education research and practice 2010–2021. *Chemistry Education Research and Practice*.

Leach, N. (2022). Impactful learning environments: A humanistic approach to fostering adolescents' postindustrial social skills. *Journal of Humanistic Psychology*, 62(3), 377-396.

Lee, Y. H., & Hong, H. Y. (2023). Preservice teachers' intention for constructivist ICT integration: implications from their Internet epistemic beliefs and internet-based learning self-Efficacy. *Interactive Learning Environments*, 1-13.

Lee, D., & Pirog, M. (2023). Geographical Constraints and College Decisions: How Does For-Profit College Play in Student's Choice?. *Innovative Higher Education*, 48(2), 309-328.

Levina, L. V., & Levin, A. I. (2023). On the Possibility of Using Blended Learning Technology in Teaching Foreign Languages in Graduate School. *Russian Linguistic Bulletin*, (10 (46).

Lewin, Keith M. (2019). *Educational access, equity, and development: planning to make rights realities. Fundamentals of Educational Planning 98.* Paris: UNESCO-IIEP.

Li, C., & Lalani, F. (2020). *The COVID-19 pandemic has changed education forever. this is how.* World Economic Forum. https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/

Li., K.C. & Billy Won, T-M. (2020). Blended Learning. Education in a Smart Learning Environment: Personalizing Learning with Learning Analytics: A Review of the Literature. *A paper presented at the 13th International Conference*, ICBL 2020, Bangkok, Thailand, August 24–27, 2020

Li, K. C., & Wong, B. T. M. (2021). Features and trends of personalised learning: A review of journal publications from 2001 to 2018. *Interactive Learning Environments*, 29(2), 182-195.

Li, S. (2023). Study on the Influence of College Students' Learning Engagement on Learning Effectiveness in Blended Learning. *Learning*, 5(6), 7.

Li, T., Wang, W., Li, Z., Wang, H., & Liu, X. (2022). Problem-based or lecture-based learning, old topic in the new field: a meta-analysis on the effects of PBL teaching method in Chinese standardized residency training. *BMC Medical Education*, 22(1), 221.

Li, D., Chen, D., Jin, B., Shi, L., Goh, J., & Ng, S. K. (2019). MAD-GAN: Multivariate anomaly detection for time series data with generative adversarial networks. In *International conference on artificial neural networks* (pp. 703-716). Cham: Springer International Publishing.

Liang, W. (2023). Towards a set of design principles for technology-assisted critical-thinking cultivation: A synthesis of research in English language education. *Thinking Skills and Creativity*, 47, 101203.

Lim, T., Gottipati, S., & Cheong, M. L. (2023). Ethical Considerations for Artificial Intelligence in Educational Assessments. In *Creative AI Tools and Ethical Implications in Teaching and Learning* (pp. 32-79). IGI Global.

Lim, W. M. (2023). Philosophy of science and research paradigm for business research in the transformative age of automation, digitalization, hyperconnectivity, obligations, globalization and sustainability. *Journal of Trade Science*, 11(2/3), 3-30.

Liu, C., & Tseng, M. Y. (2021). Paradigmatic variation in hedging and boosting: A comparative study of discussions in narrative inquiry and grounded theory research. *English for Specific Purposes*, 61, 1-16.

Liu, S. Y., Liu, C., Nehus, E., Macaluso, M., Lu, B., & Kim, M. O. (2020). Propensity score analysis for correlated subgroup effects. *Statistical Methods in Medical Research*, 29(4), 1067-1080.

Loução, A., & Pedro, A. (2023). What do we know about 21st Century Skills, Technologies and Initial Teachers Training? A Scoping Literature Review. *Revista de Estilos de Aprendizaje*, 16(31), 45-55.

Loyola, M., Nelson, J. D., Clifton, G., & Levinson, D. (2023). Narratives in transport research: a thematic and functional analysis. *Transportation research interdisciplinary perspectives*, 17, 100754.

Lucas, M., & Vicente, P. N. (2023). A double-edged sword: Teachers' perceptions of the benefits and challenges of online teaching and learning in higher education. *Education and Information Technologies*, 28(5), 5083-5103.

Lucarelli, A., Shahriar, H., Ulver, S., & Egan-Wyer, C. (2023). Research contributions in interpretivist marketing and consumer research studies: A kaleidoscopic framework. *Marketing Theory*, 14705931231202430.

Maarouf, H. (2019). Pragmatism as a supportive paradigm for the mixed research approach: Conceptualizing the ontological, epistemological, and axiological stances of pragmatism. *International Business Research*, 12(9), 1-12

Maarouf, H. (2019). Pragmatism as a supportive paradigm for the mixed research approach: Conceptualizing the ontological, epistemological, and axiological stances of pragmatism. *International Business Research*, 12(9), 1-12.

Macdonald, C., Adeloye, D., Sheikh, A., & Rudan, I. (2023). Can ChatGPT draft a research article? An example of population-level vaccine effectiveness analysis. *Journal of global health*, 13.

Machado, H., Silva, S., & Neiva, L. (2023). Publics' views on ethical challenges of artificial intelligence: a scoping review. *AI and Ethics*, 1-29.

Machumu, H., Zhu, C., & Almasi, M. (2020). Students' motivational factors and engagement strategies in constructivist-based blended learning environments. *Afrika focus*, 31(1), 13-34.

Machumu, H. J., Mwamkinga, T., & Seni, J. A. (2023). Stakeholders' Perceptions on Adoption of Blended Learning Approach in Tanzania Secondary Schools. *Qeios*

Mahardika, I. K., Mudakir, I., Wahono, B., & Wicaksono, I. (2023). Science Textbook Based on Merdeka Belajar Curriculum: Integration of Learning Implementation for Critical Thinking Skills. *Journal of Education, Society and Behavioral Science*, 36(10), 109-115.

Mahmood, A., Imran, M., & Adil, K. (2023). Modeling Individual Beliefs to Transfigure Technology Readiness into Technology Acceptance in Financial Institutions. *SAGE Open*, 13(1), 21582440221149718.

Makoe, M. (2022). *Beyond Limits*. New Ways to Reinvent Higher Education-Roadmap proposed for the WHEC2022

Malekahmadi, P., Yazdannik, A., Amouzadeh, M., Yamani, N., & Roberts, T. (2023). Qualitative content analysis of the highly cited articles in medical education: Trends and characteristics associated with citation of published studies in medical education research. *Medical Teacher*, 1-6.

Maltese, V. (2018). Digital Transformation Challenges for Universities: Ensuring Information Consistency Across Digital Services. *Cataloging and Classification Quarterly* 56: 592–606.

Mampota, S., Mokhets'engoane, S. J., & Kurata, L. (2023). Connectivism Theory: Exploring its Relevance in Informing Lesotho's Integrated Curriculum for Effective Learning in the Digital Age. *European Journal of Education and Pedagogy*, 4(4), 6-12.

Mannuru, N. R., Shahriar, S., Teel, Z. A., Wang, T., Lund, B. D., Tijani, S., ... & Vaidya, P. (2023). Artificial intelligence in developing countries: The impact of generative artificial intelligence (AI) technologies for development. *Information Development*, 02666669231200628.

Mansurjonovich, J. M. (2023). Designing an electronic didactic environment to ensure interdisciplinary integration in the teaching of" Informatics and information technologies" during professional education. *Confrencea*, 3(03), 78-82.

Mantello, P., Ho, M. T., Nguyen, M. H., & Vuong, Q. H. (2023). Machines that feel: behavioral determinants of attitude towards affect recognition technology—upgrading

technology acceptance theory with the mind sponge model. *Humanities and Social Sciences Communications*, 10(1), 1-16.

Manu, B .(2018). *Your Guide to Qualitative and Quantitative Data Analysis Methods*. https://humansofdata.atlan.com/2018/09/qualitative-quantitative-data-analysis-methods/

Maphosa, V., & Maphosa, M. (2023). Artificial intelligence in higher education: a bibliometric analysis and topic modeling approach. *Applied Artificial Intelligence*, 37(1), 2261730.

Marek, C. & Kamila, P. (2021). *Multiple case study design: the example of place marketing research*. DOI:10.1057/s41254-020-00159-2

Martin, F., Kumar, S., Ritzhaupt, A. D., & Polly, D. (2023). Bichronous online learning: Award-winning online instructor practices of blending asynchronous and synchronous online modalities. *The Internet and Higher Education*, 56, 100879.

Martinez, C. (2022). Developing 21st century teaching skills: A case study of teaching and learning through project-based curriculum. *Cogent Education*, 9(1), 2024936.

Martins, R. M., & Gresse Von Wangenheim, C. (2023). Findings on teaching machine learning in high school: A ten-year systematic literature review. *Informatics in Education*, 22(3), 421-440.

Mastercard Foundation (2023*). Unlocking the potential of technology for learning: the EdTech landscape in Rwanda. A report for the Mastercard Foundation Centre for Innovative Teaching and Learning in ICT*: Kigali.

Masuku, M. (2023). Library and information science and the positivist paradigm: Some critical reflections. *Journal of Librarianship and Information Science*, 09610006231161324.

Matthews, K. E, Anita A., Sam. L.D., Peter, F., Elizabeth, M., & Lucy, M.M. (2019). Toward theories of partnership praxis: an analysis of interpretive framing in literature on students as partners in teaching and learning. *Higher Education Research & Development*, 38:2, 280-293, DOI: 10.1080/07294360.2018.1530199

Matusov, E. (2023). Sociocultural positivism: Critical evaluation in three research vignettes. *Culture & Psychology*, 29(4), 742-768.

Maxwell, J. D. (2023). *Teachers' Perceptions of the Implementation, Utilization, and Effectiveness of Blended Learning with Students in Grades 9-12 During the COVID-19 Pandemic* (Doctoral dissertation, William Carey University).

McDermott, R. (2023). On the scientific study of small samples: Challenges confronting quantitative and qualitative methodologies. *The Leadership Quarterly*, 34(3), 101675.

McIntosh, A., Bachmann, M., Siedner, M. J., Gareta, D., Seeley, J., & Herbst, K. (2021). Effect of COVID-19 lockdown on hospital admissions and mortality in rural KwaZulu-Natal, South Africa: interrupted time series analysis. *BMJ open*, 11(3), e047961.

McNamee, T. C., & Ganss, K. M. (2023). Rural Students in Higher Education: From College Preparation and Enrolment to Experiences and Persistence. *Peabody Journal of Education*, 98(4), 380-395.

McSweeney B. (2021). Fooling ourselves and others: confirmation bias and the trustworthiness of qualitative research–Part 1 (the threats). *Journal of Organizational Change Management*, 34(5), 1063–1075. https://doi.org/10.1108/JOCM-04-2021-0117

Means, T., Raymond-Hagen, L., Swindell, A., Shellgren, M., Gay, K., Taylor, D. L., ... & Lashley, J. (2023). OLC Blended Learning Symposium, 2022 Report. *Online Learning Consortium.*

Melo-Becerra, L. A., Ramos-Forero, J. E., Rodríguez Arenas, J. L., & Zárate-Solano, H. M. (2023). The impact of an alternation plan between face-to-face and remote education on academic achievement. *Education Economics*, 31(5), 632-648.

Mendoza, A., & Venables, A. (2023). Attributes of Blended Learning Environments Designed to Foster a Sense of Belonging for Higher Education Students. *Journal of Information Technology Education Research*, 22, 129.

Meng, J. H., Wang, J., & Liu, Y. (2023). How is government embedded in innovation process for breakthroughs? A meta-synthesis of qualitative case studies. *Technological Forecasting and Social Change*, 194, 122735.

Menon, S. A. (2019). Designing Online Materials for Blended Learning: Optimizing on Book Widgets. *International Journal of Linguistics, Literature, and Translation (IJLLT)*. 2(3), 166-174

Mercer-Mapstone, L., Marquis, E., & McConnell, C. (2018). The 'partnership identity' in higher education: Moving from 'us' and 'them' to 'we' in student-staff partnership. *Student Engagement in Higher Education Journal*, 2(1).

Mertens, W., & Recker, J. (2023). New guidelines for null hypothesis significance testing in hypothetico-deductive IS research. *In Advancing Information Systems Theories, Volume II: Products and Digitalization* (pp. 385-437). Cham: Springer International Publishing.

Mertler, C. A. (2019). *Introduction to Educational Research. 2nd. ed*. Los Angeles: Sage Publications.

Mestan, K. (2019). Create a fine blend : An examination of institutional transition to blended learning. *Australasian Journal of Educational Technology*, 35(1), 70–84. https://doi.org/https://doi.org/10.14742/ajet.3216 84

Messaoud, K. B., Schroter, S., Richards, M., & Gayet-Ageron, A. (2023). Analysis of peer reviewers' response to invitations by gender and geographical region: cohort study of manuscripts reviewed at 21 biomedical journals before and during covid-19 pandemic. *bmj*, 381.

Meyer, M. S., Shen, Y., & Plucker, J. A. (2023). Reducing Excellence Gaps: A Systematic Review of Research on Equity in Advanced Education. *Review of Educational Research*, 00346543221148461.

McChesney, K., & Aldridge, J. (2019). Weaving an interpretivist stance throughout mixed methods research. *International journal of research & method in education*, 42(3), 225-238.

Mhatre, S. G., & Mehta, N. K. (2023). Review of phenomenological approaches and its scope in human resource management. *Journal of Organizational Effectiveness: People and Performance*, 10(1), 112-131.

Michelle, E. K. & Lara, V. (2020). Thematic analysis of qualitative data. *AMEE Guide* No. 131, Medical Teacher, DOI: 10.1080/0142159X.2020.1755030

Miller, R., Liu, K., Crowley, C. B., & Yu, M. (2023). Critical thinking for transformative praxis in teacher education: Music, media and information literacy, and social studies in the United States. *Educational Philosophy and Theory*, 1-14.

Miñan, V. Á. A., Ramírez, M. A. S., Saavedra, C. L. I., Cabrera, W. F. R., Reaño, R. E. M., & Merino, L. S. G. (2023). Advancements, Challenges, And Prospects Of Artificial Intelligence Integration In Latin American Higher Education. *Journal of Namibian Studies: History Politics Culture*, 34, 2797-2811.

MINEDUC (2020). *Higher Education in Rwanda*. Retrieved from https://www.mineduc.gov.rw/

MINEDUC (2023). *Education Sector Strategic Plan 2018-2024*. Ministry of Education, Government of Rwanda, Kigali: Rwanda.

Ministry of Youth and ICT (2023). *Policies and regulations*. Ministry of youth and ICT, government of Rwanda, Kigali: Rwanda.

Ministry of Youth and ICT (2020). *National Digital Talent Policy*. Kigali: Government of Rwanda.

Ministry of ICT and Innovation (2021). *Rwanda Launches the First Coding Academy*. Press Release.

Minn, S. (2022). AI-assisted knowledge assessment techniques for adaptive learning environments. *Computers and Education*: *Artificial Intelligence* 3: 14–19

Misra, S. K., Sharma, S. K., Gupta, S., & Das, S. (2023). A framework to overcome challenges to the adoption of artificial intelligence in Indian Government Organizations. *Technological Forecasting and Social Change*, 194, 122721.

Mocca, E., Rojon, C., & Hernandez, J. (2019). Great expectations? A systematic review of the relationship between the school-to-higher education transition and social mobility. *Sociological Spectrum*, 39(4), 264-280.

Mohajan, H.K. (2021). Quantitative Research: A Successful Investigation in Natural and Social Sciences. *Journal of Economic Development Environment and People*. 9(4). DOI: 10.26458/jedep.v9i4.679

Molina-Azorin, J. F., & Fetters, M. D. (2021). In This Issue: Integrative Strategies, Philosophical Assumptions, Hierarchical Linear Modeling, Transformative Research for Social Justice, and Longitudinal Studies in Mixed Methods Research. *Journal of Mixed Methods Research*, 15(2), 143-145.

Moorhouse, B. L., & Wong, K. M. (2022). Blending asynchronous and synchronous digital technologies and instructional approaches to facilitate remote learning. *Journal of Computers in Education*, 9(1), 51-70.

Morel, Wendy & Ruz Salmones, Pablo & Robischon, Marcel. (2023). The Handprint Initiative: Identifying learners' attitudes towards the environment. Southern African *Journal of Environmental Education*. 38. 10.4314/sajee.v38i1.09.

Moscarelli, M. (2023). Hypothesis Testing. In Biostatistics With'R': *A Guide for Medical Doctors* (pp. 113-135). Cham: Springer International Publishing.

Mosha, N.F.V. and Luhanga, E.T. (2023), "The Application of Online and Blended Learning During Outbreaks, Epidemics and Pandemics: The Case of Higher Education Institutions (HEIs)", Sengupta, E. (Ed.) Pandemic Pedagogy: Preparedness in Uncertain Times (Innovations in Higher Education Teaching and Learning, Vol. 49), Emerald Publishing Limited, Leeds, pp. 147-161. https://doi.org/10.1108/S2055-364120230000049009

Moshtari, M., & Safarpour, A. (2023). Challenges and strategies for the internationalization of higher education in low-income East African countries. *Higher Education*, 1-21.

Motulsky, S. L. (2021). Is member checking the gold standard of quality in qualitative research? *Qualitative Psychology, 8*(3), 389–406. https://doi.org/10.1037/qup0000215

Mousavinasab, E., Zarifsanaiey, N., Kalhori, S. R. N., Rakhshan, M., Keikha, L., & Saeedi, M. G. (2021). Intelligent tutoring systems: A systematic review of characteristics, applications, and evaluation methods. *Interactive Learning Environments*, 29(1), 142–163.

Mugiraneza, J.P. (2021). *Digitalization in Teaching and Education in Rwanda. Digitalization, the Future of Work and the Teaching Profession project*. Geneva: ILO.

Muhajirah, M. (2020). Basic of Learning Theory: (Behaviorism, Cognitivism, Constructivism, and Humanism). *International Journal of Asian Education*. 1 (1). DOI: 10.46966/ijae.v1i1.23

Muhria, L., Supriatna, N., & Nurfirdaus, N. (2023). Students' Challenges of Blended Learning Model in Higher Education. *Journal Corner of Education, Linguistics, and Literature*, 2(3), 223-233.

Mukhtaramkhon, K., & Jakhongirovich, E. J. (2022). Advantages and disadvantages of blended learning in higher education. *Journal of Pedagogical Inventions and Practices*, 9, 14-18.

Mulder, L., Akwiwu, E. U., Twisk, J. W., Koster, A. S., Ravesloot, J. H., Croiset, G., ... & Wouters, A. (2023). Inequality of opportunity in selection procedures limits diversity in higher education: An intersectional study of Dutch selective higher education programs. *Plos one*, 18(10), e0292805.

Munro, M., Cook, A. M., & Bogart, K. R. (2022). An inductive qualitative content analysis of stigma experienced by people with rare diseases. *Psychology & health*, 37(8), 948-963.

Muniz, D. H., & Oliveira-Filho, E. C. (2023). Multivariate Statistical Analysis for Water Quality Assessment: A Review of Research Published between 2001 and 2020. *Hydrology*, 10(10), 196.

Munyengabe, S., Zhao, Y., Haiyan, H., & Hitimana, S. (2020). Primary Teachers' Perceptions on ICT Integration for Enhancing Teaching and Learning through the Implementation of One Laptop per Child Program in Primary Schools of Rwanda". *EURASIA Journal of Mathematics, Science and Technology Education*, 13 (11): 7193-7204.

Murodullayevna, J. G. (2023). Modern Teaching Methods-a Priority Direction for the Development of Education. *European Journal of Innovation in Nonformal Education*, 3(5), 10-15.

Muxtorjonovna, A. M. (2020). Significance of Blended Learning in Education System. *The American Journal of Social Science and Education Innovations*, 02(08), 507–511.

Myers, M. (2020). *Qualitative Research in Business Management*. Thousand Oaks: Sage. Nelson J. (2019). Using conceptual depth criteria: addressing the challenge of reaching saturation in qualitative research. *Qualitative Research journal,* 2017; 17(5):554–570. doi: 10.1177/1468794116679873

Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2023). A step-by-step process of thematic analysis to develop a conceptual model in qualitative research. *International Journal of Qualitative Methods*, 22, 16094069231205789.

Napaporn, S., Maneewan, S., Thamwipat, K., & Nittayathammakul, V. (2023). The cloud-powered hybrid learning process to enhance digital natives' analytical reading skills. *International Journal of Advanced Computer Science and Applications*, 14(1).

Narayan, R., Rodriguez, C., Araujo, J., Shaqlaih, A., & Moss, G. (2018). Constructivism—Constructivist learning theory. In B. J. Irby, G. Brown, R. Lara-Alecio, & S. Jackson (Eds.), *The handbook of educational theories* (pp. 169–183). IAP Information Age Publishing.

Naseer, S., & Zahida Perveen, H. (2023). Perspective chapter: Advantages and Disadvantages of Online Learning Courses. *IntechOpen*. doi: 10.5772/intechopen.1001343

Nazara, S. and FAbriana, L. (2018). Students' Attitudes towards Face-to-Face and Blended Learning Instructions in English Class. *The Internet and Higher Education*, 10(1), 53-64.

Ndebu, A. W., Mavua, M. M., & Mukabane, B. G. (2023). *Adaptive Leadership for the Twenty First Century: A Review.*

Nemorin, S., Vlachidis, A., Ayerakwa, H. M., & Andriotis, P. (2023). AI hyped? A horizon scan of discourse on artificial intelligence in education (AIED) and development. *Learning, Media and Technology*, 48(1), 38-51.

Neves, J., & Stephenson, R. (2023). Student Academic Experience Survey, 2023. *Higher Education Policy Institute*.

Newman, R. S. (2023). Adaptive help seeking: A strategy of self-regulated learning. In *Self-regulation of learning and performance* (pp. 283-301). Routledge.

Ng, D. T. K., Lee, M., Tan, R. J. Y., Hu, X., Downie, J. S., & Chu, S. K. W. (2023). A review of AI teaching and learning from 2000 to 2020. *Education and Information Technologies*, 28(7), 8445-8501.

Ngabonzima, E., Isimbi, R., Mwali, M. M., & Pellini, A. (2020). *Leaving no one behind: technology and the education sector response to COVID-19 in Rwanda*. Available at: https://EdTechhub.org/2020/07/10/leaving-no-one-behind-technology-and-the-educationsector-response-to-covid-19-in-rwanda/

Ng'ambi, G., Tembo, M., Benard, S., & Kamtukule, V. (2023). Determinants of Effective Public Finance Management in the Department of Animal Health and Livestock Development, Malawi. *Open Journal of Accounting*, 12(4), 131-141.

Nguyen, A., Ngo, H. N., Hong, Y., Dang, B., & Nguyen, B. P. T. (2023). Ethical principles for artificial intelligence in education. *Education and Information Technologies*, 28(4), 4221-4241.

Nguyen, L. A. T., & Habók, A. (2023). Tools for assessing teacher digital literacy: a review. *Journal of Computers in Education*, 1-42.

Nieuwoudt, J. E., & Pedler, M. L. (2023). Student retention in higher education: Why students choose to remain at university. J*ournal of College Student Retention: Research, Theory & Practice*, 25(2), 326-349.

Nind, M., & Katramadou, A. (2023). Lessons for teaching social science research methods in higher education: Synthesis of the literature 2014-2020. *British journal of educational studies*, 71(3), 241-266.

Niraula, S.R. (2019). A review of research process, data collection and analysis. The Journal of Insights in Biology and Medicine, 3: 001-006. DOI: 10.29328/journal.ibm.1001014

NISR. (2018). Integrated household living conditions survey. Enquête intégrale sur les conditions de vie des ménages (EICV) 2016/17. National Institute of Statistics of Rwanda.

Nkurunziza, M. (2021). *All Public-School Teachers in Rwanda to Get Laptops*. The New Times, 17 April 2021.

Nnaji, C., Awolusi, I., & Gambatese, J. (2023). A systematic review of technology acceptance models and theories in construction research. *Journal of Information Technology in Construction (ITcon)*, 28(3), 39-69.

Nneoma, U. C., Udoka, E. V. H., Nnenna, U. J., Chukwudi, O. F., & Paul-Chima, U. O. (2023). Ethical Publication Issues in the Collection and Analysis of Research Data. *Newport International Journal of Scientific and Experimental Sciences (NIJSES)*, 3(2), 132-140.

Noble, N. & Heale, R. (2019). Triangulation in research, with examples. *British Medical Journal*, 22(3). https://ebn.bmj.com/content/22/3/67

Norbutayev, M. A (2023). Teaching of Specialized Subjects in the Energy Field with the Support of ICT. *Journal of Ethics and Diversity in International Communication*.

Norcott, A., Chiao-Li, C., Nyquist, L., Bynum, J. P., Min, L., Fetters, M. D., & DeJonckheere, M. (2021). Behaviors of older adults and caregivers preparing for elective surgery: a virtually conducted mixed-methods research protocol to improve surgical outcomes. *BMJ open*, 11(10).

Nosirova, D. (2023). Learning Grammar Through Context: Enhancing Language Proficiency. *Modern Science and Research*, 2(7), 349-351.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2020). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, 16(1).

Nurdauletova, B., Aimukhambet, Z., Saparbaikyzy, S., Kamarova, N., & Tolegenuly, B. (2023). The Effect of Traditional and Online Learning Approaches on the Survival and Transmission of the Oral Culture, Students' Attitude and National Values. *International Journal of Education in Mathematics, Science and Technology*, 11(1), 133-155.

Nurjanah, L., Muthoharoh, S., & Nurbatra, L. H. (2023). *A Critical Examination of the Fundamental Distinctions and Practical Implementations of Personalized, Adaptive, Customized Learning, and Individualized Instruction Within the Context of Language Education* (No. 10985). EasyChair.

Nyashanu, M., Mtambo, C., Karonga, T., & Walker, J. (2023). Exploring the impact of covid-19 lockdown on learning among higher education students on the copperbelt province, Zambia. *Cogent Education*, 10(1), 2200631.

Nyirenda, L., Kumar, M.B., Theobald, S. *et al.* (2020). Using research networks to generate trustworthy qualitative public health research findings from multiple contexts. *BMC Med Res Methodol* 20, 13. https://doi.org/10.1186/s12874-019-0895-5

Oakley-Girvan, I., Yunis, R., Fonda, S. J., Longmire, M., Veuthey, T. L., Shieh, J., ... & Neeman, E. (2023). Correlation Between Remote Symptom Reporting by Caregivers and Adverse Clinical Outcomes: Mixed Methods Study. *Journal of Medical Internet Research*, 25, e49100.

Öberg, L,M., Christiana, A.N., Stefan Hrastinski, S., & Mozelius, P. (2019). Interaction and Group Work in Blended Synchronous Higher Education: Exploring Effects on Learning Outcomes, Satisfaction and Retention. *European Conference on E-Learning.* DOI:10.34190/EEL.19.036

OECD (2021). *Supporting the Digital Transformation of Higher Education in Hungary*. Higher Education, OECD Publishing, Paris. https://doi.org/10.1787/d30ab43f-en.

Oehrli, J. A., Peters, A., & Deeke, A. (2023). *Reading Scholarly Articles and the First-Year Student: In-person and Online Instructional Strategies*. https://hdl.handle.net/2142/116989

O'Grady, M. (2023). Transformative education for sustainable development: A faculty perspective. *Environment, Development and Sustainability*, 1-17.

Ohanu, I. B., Shodipe, T. O., Ohanu, C. M., & Anene-Okeakwa, J. E. (2023). System quality, technology acceptance model and theory of planned behavior models: Agents for adopting blended learning tools. *E-Learning and Digital Media*, 20(3), 255-281.

Olusegun, S. (2020). Constructivism Learning Theory: A Paradigm for Teaching and Learning. *Journal of Research & Method in Education*. 5(6), 66-70.

Okagbue, E. F., Ezeachikulo, U. P., Akintunde, T. Y., Tsakuwa, M. B., Ilokanulo, S. N., Obiasoanya, K. M., ... & Ouattara, C. A. T. (2023). A comprehensive overview of artificial intelligence and machine learning in education pedagogy: 21 Years (2000–2021) of research indexed in the scopus database. *Social Sciences & Humanities Open*, 8(1), 100655.

Okoye, K., Hussein, H., Arrona-Palacios, A., Quintero, H. N., Ortega, L. O. P., Sanchez, A. L.,& Hosseini, S. (2023). Impact of digital technologies upon teaching and learning in higher education in Latin America: an outlook on the reach, barriers, and bottlenecks. *Education and Information Technologies*, 28(2), 2291-2360.

Okuzu, Y., Goto, K., Kuroda, Y., Kawai, T., & Matsuda, S. (2024). How Do Spinal Parameters Change in Patients Who Have Improvement of Low Back Pain After Total Hip Arthroplasty? A Propensity Score–Matched Cohort Study. *The Journal of Arthroplasty*, 39(1), 132-137.

Olaniyi, O., Abalaka, A., & Olabanji, S. O. (2023). Utilizing big data analytics and business intelligence for improved decision-making at leading fortune company. *Journal of Scientific Research and Reports*, 29(9), 64-72.

Opara, E., Mfon-Ette Theresa, A., & Aduke, T. C. (2023). ChatGPT for teaching, learning and research: Prospects and challenges. Opara Emmanuel Chinonso, Adalikwu Mfon-Ette Theresa, Tolorunleke Caroline Aduke (2023). ChatGPT for Teaching, Learning and Research: Prospects and Challenges. *Glob Acad J Humanit Soc Sci*, 5.

Ordak, M. (2023). ChatGPT's Skills in Statistical Analysis Using the Example of Allergology: Do We Have Reason for Concern?. *In Healthcare* (Vol. 11, No. 18, p. 2554). MDPI.

Ormerod, R. (2023). Pragmatism as practice theory: The experience of systems and OR scholars. *Systems Research and Behavioral Science*, 41(1), 52-81.

Ouyang, F. and Jiao, P. (2021). Artificial intelligence in education: The three paradigms. *Comput. Educ. Artif. Intell.*, vol. 2, no. March, pp. 2–6, doi: 10.1016/j.caeai.2021.100020.

Ouyang, F., Zheng, L., & Jiao, P. (2022). Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020. *Education and Information Technologies*, 27(6), 7893-7925

Ozdinç, F. (2021). Maya: An artificial intelligence-based smart toy for preschool children. *International Journal of Child-Computer Interaction*, 29, Article 100347. https://doi.org/10.1016/j.ijcci.2021.100347

Öztürk, Ö. T. (2023). *Examination of 21st century skills and technological competences of students of fine arts faculty*. *International Journal of Education in Mathematics Science and Technology*, 11, 1, 115-132. http://dx.doi.org/10.46328/ijemst.2931

Panda, S., & Kaur, N. (2023). Beyond Degrees: Navigating the Digital Frontier in Higher Education Credentialing. *University News*, 61(43), 43-53.

Pakhotina, S. V., Sabaeva, N. I., Kungurova, I. M., Somikova, T. Y., Ermakova, E. V., & Tsalikova, I. K. (2023). An interpretative phenomenological analysis of EFL learning motivation of first-year undergraduates. *Science for Education Today*, 13(3), 143-162.

Pakkan, S., Sudhakar, C., Tripathi, S., & Rao, M. (2023). A correlation study of sustainable development goal (SDG) interactions. *Quality & Quantity*, 57(2), 1937-1956.

Park, Y. and Jo, I. (2018). Development of the learning analytics dashboard to support students' learning performance. *Journal of Universal Computer Science*, 21(1), 110- 133.

Pearson, K., League, R., Kent, M., McDevitt, R., Fuller, M., Jiang, R., ... & Raghunathan, K. (2023). Rogers' diffusion theory of innovation applied to the adoption of sugammadex in a nationwide sample of US hospitals. *British Journal of Anaesthesia*, 131(4), e114-e117.

Paulus, T. M. (2023). Using qualitative data analysis software to support digital research workflows. *Human Resource Development Review*, 22(1), 139-148.

Peeters, J.M and Harpe, S.E. (2019). Updating conceptions of validity and reliability. The *Journal of Research in Social and Administrative Pharmacy*, 16: 8, 1127-1130. https://doi.org/10.1016/j.sapharm.2019.11.017

Peng, R., Razak, R. A., & Halili, S. H. (2023). Investigating the factors affecting ICT integration of in-service teachers in Henan Province, China: structural equation modeling. *Humanities and Social Sciences Communications*, 10(1), 1-11.

Perdana, D., Saptasari, M., & Susanto, H. (2023, January). The effects of inquiry project-based learning on the increasing student's science literacy skills and creative thinking skills. In *AIP Conference Proceedings* (Vol. 2569, No. 1). AIP Publishing.

Perez A., Howell Smith M. C., Babchuk W. A., Lynch-O'Brien L. I. (2022). Advancing quality standards in mixed methods research: Extending the legitimation typology. *Journal of Mixed Methods Research*, 17(1). https://doi.org/10.1177/15586898221093872

Perez, E., Manca, S., Fernández-Pascual, R., & Mc Guckin, C. (2023). A systematic review of social media as a teaching and learning tool in higher education: A theoretical grounding perspective. *Education and Information Technologies*, 1-30.

Perry, N. E. (2023). Introduction: Using qualitative methods to enrich understandings of self-regulated learning. In *Using Qualitative Methods To Enrich Understandings of Self-regulated Learning* (pp. 1-3). Routledge.

Peter, J. A. (2023). Impact of technology integration models on Educators and Learner in the networked world: An Extension of Connectivism and TPACK model. *Quarterly of Iranian Distance Education Journal*, 5(1), 118-127.

Petrillo, Z., Tripaldi, S., Mangiacapra, A., Scippacercola, S., Caliro, S., & Chiodini, G. (2023). Principal component analysis on twenty years (2000–2020) of geochemical and geophysical observations at Campi Flegrei active caldera. *Scientific Reports*, 13(1), 18445.

Petty, J., Whiting, L., Green, J., & Fowler, C. (2023). Parents' views on preparation to care for extremely premature infants at home. *Nursing Children and Young People*, 35(6).

Pietrzykowski, T., Smilowska, K. (2021). The reality of informed consent: empirical studies on patient comprehension—systematic review. *Trials;* 22, 57. https://doi.org/10.1186/s13063-020-04969-w

Pitts, W. J., Heller, D., Smiley-McDonald, H., Weimer, B., Grabenauer, M., Bollinger, K., ... & Pressley, D. (2023). Understanding research methods, limitations, and applications of drug data collected by the National Forensic Laboratory Information System (NFLIS-Drug). *Journal of Forensic Sciences*, 68(4), 1335-1342.

Podsiadlik, A. (2023). The blended learning experiences of students with specific learning difficulties: A qualitative case study located in one British higher education institution. *International Journal of Disability, Development and Education*, 70(3), 366-381.

Poquet, O., Kitto, K., Jovanovic, J., Dawson, S., Siemens, G., & Markauskaite, L. (2021). Computers and education: Artificial intelligence transitions through lifelong learning: Implications for learning analytics. *Comput. Educ.*: Artificial Intelligence, 2, Article 100039. https://doi.org/10.1016/j.caeai.2021.100039

Poth, C., & Munce, S. E. P. (2020). Commentary—Preparing today's researchers for a yet unknown tomorrow: Promising practices for a synergistic and sustainable mentoring approach to mixed methods research learning. *International Journal of Multiple Research Approaches*, 12(1), 56-64. doi:10.29034/ijmra.v12n1commentary

Powell, M. A., Krishnamurthy, S., Chan, L., Tisdall, E. K. M., Rizzini, I., & Nuggehalli, R. K. (2023). Reimagining institutional ethics procedures in research partnerships with young people across Majority/Minority World contexts. *Children's Geographies*, 1-15.

Prasad, Dr. R. (2021). *Blended learning, forgetting curve, and learning styles: What's the connection?* eLearning Industry. https://elearningindustry.com/blended-learning-forgetting-curve-learning-styles-whats-the-connection

Pratama, M. P., Sampelolo, R., & Lura, H. (2023). Revolutionizing education: harnessing the power of artificial intelligence for personalized learning. Klasikal: *Journal of education, language teaching and science*, 5(2), 350-357.

Prather, J., Denny, P., Leinonen, J., Becker, B. A., Albluwi, I., Craig, M., ... & Savelka, J. (2023). The robots are here: Navigating the generative ai revolution in computing education. *In Proceedings of the 2023 Working Group Reports on Innovation and Technology in Computer Science Education* (pp. 108-159).

Purnama, S., & Sriliasta, C. (2023). Independent Learning and Blended Learning Information System Student. *International Transactions on Education Technology*, 1(2), 144-150.

Pyo, J., Lee, W., Choi, E. Y., Jang, S. G., & Ock, M. (2023). Qualitative research in healthcare: necessity and characteristics. *Journal of preventive medicine and public health*, 56(1), 12.

Qamar, F., Soomro, S., & Syed, O. R. (2023). Determining factors to foster educators' pedagogical resilience: test of servant leadership and social cognitive theories in post-pandemic era. *Journal of Economic and Administrative Sciences*.

Qianqian, X. and Sang-Bing, T. (2021). An Empirical Study on Innovation of College Blended Teaching under Big Data Analysis. *Mathematical Problems in Engineering*, (2021), 1-9, DOI: https://doi.org/10.1155/2021/3752037

Quevedo, J. M. D., Uchiyama, Y., & Kohsaka, R. (2023). Progress of blue carbon research: 12 years of global trends based on content analysis of peer-reviewed and 'gray literature'documents. *Ocean & Coastal Management*, 236, 106495.

Quintana, D. S., & Williams, D. R. (2018). Bayesian alternatives for common null-hypothesis significance tests in psychiatry: a non-technical guide using JASP. *BMC psychiatry*, 18, 1-8.

Qureshi, M. A., Khaskheli, A., Qureshi, J. A., Raza, S. A., & Yousufi, S. Q. (2023). Factors affecting students' learning performance through collaborative learning and engagement. *Interactive Learning Environments*, 31(4), 2371-2391.

Radha, R.; Mahalakshmi, K.; Kumar, V.S.; Saravanakumar, A.R. (2020). E-Learning during Lockdown of Covid-19 Pandemic: A Global Perspective. *Int. J. Contr. Autom*, 13, 1088–1099.

Rahman, A., Santosa, T. A., Ilwandri, I., Suharyat, Y., Aprilisia, S., & Suhaimi, S. (2023). The Effectiveness of AI Based Blended Learning on Student Scientific Literacy: Meta-analysis. LITERACY: *International Scientific Journals of Social, Education, Humanities*, 2(1), 141-150.

Raes, A., Detienne, L., Windey, I., & Depaepe, F. (2020). A systematic literature review on synchronous hybrid learning: gaps identified. *Learning Environments Research*, 23, 269-290.

Rahnenführer, J., De Bin, R., Benner, A., Ambrogi, F., Lusa, L., Boulesteix, A. L., ... & topic group "High-dimensional data"(TG9) of the STRATOS initiative. (2023). Statistical analysis of high-dimensional biomedical data: a gentle introduction to analytical goals, common approaches and challenges. *BMC medicine*, 21(1), 182.

Rane, N., Choudhary, S., & Rane, J. (2023). Education 4.0 and 5.0: Integrating Artificial Intelligence (AI) for personalized and adaptive learning. *Available at SSRN* 4638365.

Rangineni, S. (2023). An Analysis of Data Quality Requirements for Machine Learning Development Pipelines Frameworks. *International Journal of Computer Trends and Technology*, 71(9), 16-27.

Rankapola, M. E., & Zuva, T. (2023, April). A Constructivist Approach to Enhance Student's Learning in Hybrid Learning Environments. In *Computer Science On-line Conference* (pp. 654-663). Cham: Springer International Publishing.

Rao, C.S. (2019). Blended Learning: A New Hybrid Teaching Methodology. *Journal of Research Scholars and Professionals of English Language Teaching*. Issue 13, Vol. 3, 2019, www.jrspelt.com

Rashid, Y, Rashid, A, Warraich, MA, Sabir, SS, Waseem, A. (2019). Case study method: a step-by-step guide for business researchers. *International Journal of Qualitative Methods*.18:1–13.

Rasul, T., Nair, S., Kalendra, D., Robin, M., de Oliveira Santini, F., Ladeira, W. J., ... & Heathcote, L. (2023). The role of ChatGPT in higher education: Benefits, challenges, and future research directions. *Journal of Applied Learning and Teaching*, 6(1).

Ratten, V. (2023). The post COVID-19 pandemic era: Changes in teaching and learning methods for management educators. *The International Journal of Management Education*, 21(2), 100777.

Reed, M. S., Ferré, M., Martin-Ortega, J., Blanche, R., Lawford-Rolfe, R., Dallimer, M., & Holden, J. (2021). Evaluating impact from research: A methodological framework. *Research Policy*, 50(4), 104147.

Rejali, S., Aghabayk, K., Esmaeli, S., & Shiwakoti, N. (2023). Comparison of technology acceptance model, theory of planned behavior, and unified theory of acceptance and use of technology to assess a priori acceptance of fully automated vehicles. *Transportation research part A: policy and practice*, 168, 103565.

Revuelta, D.F.I., Sosa-Díaz, M.J. (2021). The educational integration of digital technologies preCovid-19: Lessons for teacher education. *PLoS ONE* 16(8): e0256283. https://doi.org/10.1371/journal.pone.0256283

Riazi, A. M., Rezvani, R., & Ghanbar, H. (2023). Trustworthiness in L2 writing research: A review and analysis of qualitative articles in the Journal of Second Language Writing. *Research Methods in Applied Linguistics*, 2(3), 100065.

Ribeiro S.E, Amorim, C., Aparicio, J., & Batista, P. (2022). Trends of Active Learning in Higher Education and Students' Well-Being: A Literature Review. *Frontiers in Psychology*. 13. 844236. 10.3389/fpsyg.2022.844236.

Ridgway, M., & Langinier, H. (2023). The evolving field of global mobility: responses to global volatility (2013–2022). *Journal of Global Mobility: The Home of Expatriate Management Research*.

Rjab, A. B., Mellouli, S., & Corbett, J. (2023). Barriers to artificial intelligence adoption in smart cities: A systematic literature review and research agenda. *Government Information Quarterly*, 101814.

Rizvi, S., Rienties, B., Rogaten, J., & Kizilcec, R. F. (2022). Beyond one-size-fits-all in MOOCs: Variation in learning design and persistence of learners in different cultural and socioeconomic contexts. *Computers in Human Behavior*, 126, 106973.

Røddesnes S, Faber HC, Jensen MR (2019). NVivo courses in the library: working to create the library services of tomorrow. *Nordic Journal of Information Literacy in Higher Education*. 2019; 11(1):27–38. DOI: 10.15845/noril.v11i1.2762.

Rodr, I., & Shirvanizadeh, N. (2021). *Applications of artificial intelligence, machine learning, big data and the internet of things to the COVID-19 pandemic : A scientometric review using text mining*.

Rodríguez-Abitia, G. & Graciela B.C. (2021). Assessing Digital Transformation in Universities. *Future Internet* 13: 52.

Rodríguez-Sabiote, C. (2019). Diagnostic evaluation of needs in an environmental education center through data multiple triangulation. *Educação e Pesquisa*, 45.

Rohr, D. (2022). *A Plea for Mixed Methods Research in the Field of Counseling*. DOI:10.5772/intechopen.104781

Rose J., Johnson J. W. (2020). Contextualizing reliability and validity in qualitative research: Toward more rigorous and trustworthy qualitative social science in leisure research. *Journal of Leisure Research,* 5(4), 432–451. https://doi.org/10.1080/00222216.2020.1722042

Rose, H., McKinley, J., and Baffoe-Djan, J. B. (2020). *Data Collection Research Methods in Applied Linguistics*. London: Bloomsbury Academic.

Rosenberg, B. (2023). *Whatever It Is, I'm Against It: Resistance to Change in Higher Education*. Harvard Education Press.

Rubio, Doris & Berg-Weger, M. (2023). Objectifying content validity: Conducting a content validity study in social work research. *The journal of Social Work Research*, 27: 94-104. DOI: 10.1093/swr/27.2.94.

Rwanda Basic Education Board (2021). "*Specific Procurement Notice", Quality Basic Education for Human Capital Development Project/Supply of ICT-Equipment.* 7 May 2021. Annual Report for the Fiscal Year 2020-21. Kigali: Government of Rwanda.

Rwanda ICT Chamber. (2020). *EdTech Startups Program*. PowerPoint Presentation shared by the ICT Chamber.

Rwanda Education Board (2022). *Education sector strategic plan 2018-2024*. Kigali-Rwanda

Rwanda Ministry of Education (2020). *Keeping the Doors Open for Learning: Response Plan of Ministry of Education to the COVID-19 Outbreak*. Kigali, Rwanda.

Rwanda Ministry of Education (2020). *Education Sector Strategic Plan 2018/2019 to 2023/2024*. Kigali, Rwanda.

Rwanda Ministry of Education (2021). *2020/2021 Education Statistical Yearbook*. Kigali, Rwanda.

Rwanda Technical and Vocational Education Board (2021). *Brochure 2021: Employable Skills for Sustainable Job Creation*. Kigali: Government of Rwanda.

Ryan, B., and Gross, N. (1950). *Acceptance and diffusion of hybrid corn seed in two Iowa communities.* Ames: Iowa Agricultural Experiment Station Research Bulletin 372.

Saastamoinen, U., Eronen, L., Juvonen, A., & Vahimaa, P. (2023). Wellbeing at the 21st century innovative learning environment called learning ground. *Journal of Research in Innovative Teaching & Learning*, 16(2), 239-252.

Sabnis, S. V., & Wolgemuth, J. R. (2023). Validity practices in qualitative research in school psychology. *School Psychology International*, 01430343231194731.

Sacre, H., Akel, M., Haddad, C., Zeenny, R. M., Hajj, A., & Salameh, P. (2023). The effect of research on the perceived quality of teaching: a cross-sectional study among university students in Lebanon. *BMC Medical Education*, 23(1), 1-14.

Sah, LK, Singh, D.R & Sah, R.K. (2020). *Conducting Qualitative Interviews using Virtual Communication Tools amid COVID-19 Pandemic: A Learning Opportunity for Future Research*. doi: 10.31729/jnma.5738

Saldaña, J., & Omasta, M. (2018). *Qualitative research: Analyzing life.* Los Angeles, CA: Sage.

Salter, M. B., Mutlu, C. E., & Frowd, P. M. (Eds.). (2023). *Research methods in critical security studies: An introduction*. Taylor & Francis.

Sanabria-Z, J., Cruz-Sandoval, M., Moreno-Romo, A., Gómez, S. B., & Ramírez-Montoya, M. S. (2023). Research foresight in bridging open science and open innovation: Overview based on the complex thinking paradigm. *International Journal of Innovation Studies*.

Sánchez-Caballé, A., Gisbert-Cervera, M., & Esteve-Mon, F. (2020). The digital competence of University Students: A Systematic Literature Review. *Aloma: Revista de Psicologia, Ciències de l'Educació i de l'Esport*, *38*(1), 63–74. https://doi.org/10.51698/aloma.2020.38.1.63-74

Sanchez, J. I., Bonache, J., Paz-Aparicio, C., & Oberty, C. Z. (2023). Combining interpretivism and positivism in international business research: the example of the expatriate role. *Journal of World Business*, 58(2), 101419.

Sanches de Oliveira, G. (2023). Pragmatism. In *The Palgrave Encyclopedia of the Possible* (pp. 1341-1349). Cham: Springer International Publishing.

Sanga, P. (2023). *The Right to Higher Education in Africa: Briefing note compendium*. UNESCO Report

Santosa, M. H. (2019). Introduction to Core Skills and its best practices in the Indonesian classrooms. In M. H. Santosa (Ed.), *Penerapan Core Skills di kelas-kelas di Indonesia* (1st ed., Vol. 1, pp. 07–23)

Saunders, M.N.K., Lewis, P. & Thornhill, A. (2019). *Understanding research philosophy and approaches to theory development.* https://www.researchgate.net/publication/330760964_Research_Methods_for_Business_Students_Chapter_4_Understanding_research_philosophy_and_approaches_to_theory_development

Saunders, M., Lewis, P. & Thornhill, A. (2019). *Research Methods for Business Students*. 8th. ed. Harlow, Essex: Pearson.

Saunders, C. H., Sierpe, A., von Plessen, C., Kennedy, A. M., Leviton, L. C., Bernstein, S. L., ... & Leyenaar, J. K. (2023). Practical thematic analysis: a guide for multidisciplinary health services research teams engaging in qualitative analysis. *bmj*, 381.

Savin-Baden, M., & Major, C. (2023). *Qualitative research: The essential guide to theory and practice*. Routledge.

Sheikhan, N. Y., Kuluski, K., McKee, S., Hiebert, M., & Hawke, L. D. (2023). Exploring the impact of engagement in mental health and substance use research: A scoping review and thematic analysis. *Health Expectations*.

Schmitt, N. (2021). *Inspiration for creating a good learning environment in online seminars*. University of Copenhagen. Retrieved from https://cobl.ku.dk/news/2021/inspiration-for-creating-a-good-learning-environment-in-online-seminars

Schmidt, J. T., & Tang, M. (2020). Digitalization in education: challenges, trends and transformative potential. *Führen und Managen in der digitalen Transformation: Trends, Best Practices und Herausforderungen*, 287-312.

Schroedler, T., Rosner-Blumenthal, H., & Böning, C. (2023). A mixed-methods approach to analyzing interdependencies and predictors of pre-service teachers' beliefs about multilingualism. *International Journal of Multilingualism*, 20(1), 11-30.

Schüll, A., & Brocksieper, L. (2022). Distance Digital Learning for Adult Learners: Self-paced e-Learning on Business Information Systems. In *International Conference on Enterprise Information Systems* (pp. 313-337). Cham: Springer Nature Switzerland.

Schiff, D. (2021). Education for AI, not AI for Education: The Role of Education and Ethics in National AI Policy Strategies. *International Journal of Artificial Intelligence in Education* 32: 527–63.

Scott, J., Pryce, J., Reinke, N. B., Li, D., Shuker, M. A., Singleton, R., ... & Parkinson, A. L. (2023). Towards a 'Community for Practice'—A Narrative Analysis of the Evolution of Higher Education Scholars. *Education Sciences*, 13(12), 1239.

Schutte, T., Fasel, M. E., Fokkens, J. T., & Wouters, A. (2023). The reporting of ethical review and ethical considerations in articles published in medical education journals: A literature review. *Medical Education*.

Selvanathan, M., Hussin, N. A. M., & Azazi, N. A. N. (2023). Students learning experiences during COVID-19: Work from home period in Malaysian Higher Learning Institutions. *Teaching Public Administration*, 41(1), 13-22.

Sen, A. (2022). Innovation beyond Artificial Intelligence and Automation. *Journal of Pharmacovigilance and Drug Research* 3: 1–2.

Serafini, F., & Reid, S. F. (2023). Multimodal content analysis: expanding analytical approaches to content analysis. *Visual Communication*, 22(4), 623-649.

Seskir, Z. C., & Kelvin W. W.(2023). Global innovation and competition in quantum technology, viewed through the lens of patents and artificial intelligence. *International Journal of Intellectual Property Management* 13: 40–61.

Setiawan, B., & Wardani, N. E. (2023). The Effectiveness of a Textbook Based on Multicultural and Contextual Understanding as a Learning Material for Scientific Writing. *International Journal of Instruction*, 16(2).

Sghir, N., Adadi, A., & Lahmer, M. (2023). Recent advances in Predictive Learning Analytics: A decade systematic review (2012–2022). *Education and Information Technologies,* 28(7), 8299-8333.

Shahabidinovna, J. K. (2023). To achieve more efficiency in the organization of lessons based on the new generation of textbooks based on the national curriculum. *Modern Educational System and Innovative Teaching Solutions*, 6(6), 231-234.

Shahzad, K., & Khan, S. A. (2023). Effects of e-learning technologies on university librarians and libraries: A systematic literature review. *The Electronic Library*, 41(4), 528-554.

Shesha, L. S. (2023). Blended Learning as the Baseline for Post-COVID-19 Higher Education. In *Active and Transformative Learning in STEAM Disciplines* (pp. 229-245). Emerald Publishing Limited.

Sheydayi, A., & Dadashpoor, H. (2023). Conducting qualitative content analysis in urban planning research and urban studies. *Habitat International*, 139, 102878.

Shin, M., & Enomae, T. (2023). Multivariate statistical analysis on Japanese traditional papers, washi, for evaluation of DNA presence and quality. *Heritage Science*, 11(1), 225.

Shorey S., Kowitlawakul Y., Devi M.K., Chen H.-C., Soong S.K.A., Ang E. (2019). Blended learning pedagogy designed for communication module among undergraduate nursing students: A quasi-experimental study. *Nurse Education Today*, 61, pp. 120-126.

Shreffler, M. B., Murfree, J. R., Huecker, M. R., & Shreffler, J. R. (2023). The impostor phenomenon and work–family conflict: An assessment of higher education. *Management in Education*, 37(1), 5-12.

Shukla, S. (2020). *Research Methodology and Statistics*. Ahmedabad: Rishit Publications.

Siddiqi, K., Elsey, H., Khokhar, M. A., Marshall, A., Pokhrel, S., Arora, M., ... & Fong, G. (2023). FCTC 2030-a program to accelerate the implementation of WHO Framework Convention for Tobacco Control in low-and middle-income countries: A mixed-methods evaluation. *Nicotine & tobacco research*.

Siirtola, P.& Juha, R. (2019). Incremental Learning to Personalize Human Activity Recognition Models: The Importance of Human AI Collaboration. *Sensors* 19: 5151.

Silverman, M. J., Levy, E., Neidorf, J., Neppl, J., & Venzke, M. (2023). A Descriptive Analysis of Collaboration and Funding of Articles in the Journal of Music Therapy, 1998–2021. *Journal of Music Therapy*, thad003.

Silvestri, S., Islam, S., Papastergiou, S., Tzagkarakis, C., & Ciampi, M. (2023). A Machine Learning Approach for the NLP-Based Analysis of Cyber Threats and Vulnerabilities of the Healthcare Ecosystem. *Sensors*, 23(2), 651.

Simanjuntak, E., Hia, Y., & Manurung, N. (2020). The differences in students learning motivation based on gender using blended learning models of mathematics learning. *Journal of Physics: Conference Series*, *1462*, 012–040. https://doi.org/10.1088/1742-6596/1462/1/012040

Singh, H., Singh, P., & Sharma, D. (2022). Faculty acceptance of virtual teaching platforms for online teaching: Moderating role of resistance to change. *Australasian Journal of Educational Technology*, 33-50.

Sinha-Ray, R., & Goel, S. (2023). Impact of ESG score on financial performance of Indian firms: static and dynamic panel regression analyses. *Applied Economics*, 55(15), 1742-1755.

Smith, A. & Melissa S. (2022). An Overview of Continuous Learning Artificial Intelligence-Enabled Medical Devices. *Canadian Journal of Health Technologies* 2: 36–43.

Smolentseva, A. (2023). The contributions of higher education to society: a conceptual approach. *Studies in Higher Education*, 48(1), 232-247.

Snezhana, D. (2023). *Hybrid, Blended, and Hyflex Learning as Future Models for Education*. Available at SSRN 4463580.

Soghomonyan, Z., & Karapetyan, A. (2023). Teaching Strategies of the 21st Century Skills Adapted to the Local Needs. *European Journal of Teaching and Education*, 5(3), 48-69.

Staff, S. (2020). *Blended Learning and Business Change - Chief Learning Officer - CLO Media*. Chief Learning Officer - CLO Media. Retrieved from: https://www.chieflearningofficer.com/2004/01/02/blended-learning-and-business-change/

Stahl N. A., King J. R. (2020). Expanding approaches for research: Understanding and using trustworthiness in qualitative research. *Journal of Developmental Education*, 44(1), 26–29.

Stantcheva, S. (2023). How to run surveys: A guide to creating your own identifying variation and revealing the invisible. *Annual Review of Economics*, *15*(1). https://doi.org/10.1146/annurev-economics-091622-010157

Stauffer, B. (2022). *What Are 21st Century Skills?* https://www.aeseducation.com/blog/what-are-21st-century-skills

Stefani, Y., Simanjuntak, R. A., & Petrus, I. (2023). Differentiated Learning Approach for Improving Report Text Learning Outcomes for Tenth Graders. *Didascein: Journal of English Education*, 4(2), 83-96.

Stenalt, M. H., & Lassesen, B. (2022). Does student agency benefit student learning? A systematic review of higher education research. *Assessment & Evaluation in Higher Education*, 47(5), 653-669.

Stephen C. L. (2021). *Basic Statistics: Reaching Decisions with Data*. https://doi.org/10.1016/C2019-0-02466-1

Šubrt, J. (2023). The Legacy of Positivism, or How to Make a Sociological Theory. In *The Sociological Inheritance of the 1960s: Historical Reflections on a Decade of Changing Thought* (pp. 13-23). Emerald Publishing Limited.

Suharno, S., Suherdi, D., & Gunawan, W. (2023). Implementation of a community of inquiry in teaching English as a foreign language in secondary schools: A literature review. *Journal of Education and Learning (EduLearn)*, 17(4), 685-695.

Suhonen, T. D. M. H. T. (2023). The Causal Effects of Education on Family Health: Evidence from Expanding Access to Higher Education. https://www.aeaweb.org/journals

Sukmanasa, E., Suryanti, Y., Gusnadi, G., & Aisyah, S. (2023). Relevance of 21st Century Skills in Dealing With Sustainable Development Goals Through The Independent Campus Learning Program. *Jurnal Pendidikan dan Pengajaran Guru Sekolah Dasar (JPPGuseda)*, 6(1), 125-128.

Sullivan, M., Kelly, A., & McLaughlan, P. (2023). ChatGPT in higher education: Considerations for academic integrity and student learning. *Journal of Applied Learning & Teaching*, 6(1), 1-10. https://doi.org/10.37074/jalt.2023.6.1.17

Sunde, O. S., Alteren, J., & Ytrehus, S. (2023). Caring for a home-dwelling older parent with mental health problems: a narrative analysis of family caregivers' experiences. *International Journal of Qualitative Studies on Health and Well-being*, 18(1), 2236373.

Supsermpol, P., Thajchayapong, S., & Chiadamrong, N. (2023). Predicting financial performance for listed companies in Thailand during the transition period: A class-based

approach using logistic regression and random forest algorithm. *Journal of Open Innovation: Technology, Market, and Complexity*, 9(3), 100130.

Sürücü, L. & Maslakci, A. (2020). Validity and Reliability in Quantitative Research. *An International Journal of Business and Management Studies* 8(3):2694-2726. DOI:10.15295/bmij.v8i3.1540

Surucu, S. & Maslakci, A. (2020). *Validity and Reliability in Quantitative Research*. 8. 2694-2726. Doi: 10.15295/bmij.v8i3.1540.

Suryono, W., Haryanto, B. B., Santosa, T. A., Rahman, A., & Sappaile, B. I. (2023). The effect of the blended learning model on student critical thinking skill: Meta-analysis. *Edumaspul: Jurnal Pendidikan*, 7(1), 1386-1397.

Sutton J, Austin Z. (2022). Qualitative research: data collection, analysis, and management. *The Canadian Journal of Hospital Pharmacy*. 2022; 68(3):226-231.

Suwannaphisit, S., Anusitviwat, C., Tuntarattanapong, P., & Chuaychoosakoon, C. (2021). Comparing the effectiveness of blended learning and traditional learning in an orthopedics course. *Annals of Medicine and Surgery*, 72, 103037.

Swindell, A., & Gay, K. (2020). Communities of Practice in the Higher Education Landscape. *Communities of practice in the higher education landscape: A literature review. Every Learner Everywhere.* https://www.everylearnereverywhere.org/resources/communities-of-practice-in-the-higher-education-landscape-a-literature-review

Talaat, F. M., & Gamel, S. A. (2023). Predicting the impact of no. Of authors on no. Of citations of research publications based on neural networks. *Journal of Ambient Intelligence and Humanized Computing*, 14(7), 8499-8508.

Talbert R. (2021). *Flipped Learning Can Be a Key to Transforming Teaching and Learning Post-Pandemic*. https://www.edsurge.com/news/2021-04-02-flipped-learning-can-be-a-key-to-transforming-teaching-and-learning-post-pandemic

Takahashi, C. K., de Figueiredo, J. C. B., & Scornavacca, E. (2023). Investigating the diffusion of innovation: A comprehensive study of successive diffusion processes through analysis of search trends, patent records, and academic publications. *Technological Forecasting and Social Change*, 198, 122991.

Tandon, H., Ranjan, P., Chakraborty, T., & Suhag, V. (2022). Coronavirus (COVID-19): ARIMA-based time-series analysis to forecast near future and the effect of school reopening in India. *Journal of Health Management*, 24(3), 373-388.

Tang, T., Abuhmaid, A. M., Olaimat, M., Oudat, D. M., Aldhaeebi, M., & Bamanger, E. (2023). Efficiency of flipped classroom with online-based teaching under COVID-19. *Interactive Learning Environments*, 31(2), 1077-1088.

Tangwe, A. T., Ntakirutimana, E., & Niyibizi, E. (2023). Education for Women Empowerment: Perceptions and Experiences of Female University Graduates in Rwanda. *Advances in Social Sciences Research Journal*, 10(9).

Tarde, G. (1969). *On Communication and Social Influence*, ed. Terry N. Clark. Chicago: The University of Chicago Press.

Tashiro, J. S., & Hartman, Q. (2023, July). Key Complexities Inhibiting Design and Implementation of Adaptive-Inclusive Learning Environments. In *International Conference on Blended Learning* (pp. 174-188). Cham: Springer Nature Switzerland.

Tarozzi, M. (2021). 'Educating for global citizenship in diverse and unequal societies'. In E. Bosio (ed.) *Conversations of Global Citizenship Education: Perspectives on research, teaching, and learning in higher education*. New York: Routledge, 89–102.

Tarozzi, M. (2023). Futures and hope of global citizenship education. *International Journal of Development Education and Global Learning*, 15 (1), 44–55.

Teker, S., Dilek, T. & Basak, T. (2022). Digital Transformation and Universities. *Pressacademia* 14: 8–19.

Teodoro, A. (2020). *Contesting the Global Development of Sustainable and Inclusive Education: Education reform and the challenges of neoliberal globalization*. London: Routledge

Thahir, N. (2021). 21st century skills - through Problem Based Learning. https://www.slideshare.net/Isra86/21st-century-skills-through-problem-based-learning

Thomas, S. P., & Sohn, B. K. (2023). From uncomfortable squirm to self-discovery: a phenomenological analysis of the bracketing experience. *International Journal of Qualitative Methods*, 22, 16094069231191635.

Tim Y., Cui L., Sheng Z. (2021). Digital resilience: How rural communities leapfrogged into sustainable development. *Information Systems Journal*, 31(2), 323–345.

Timmermans, J., & Blok, V. (2021). A critical hermeneutic reflection on the paradigm-level assumptions underlying responsible innovation. *Synthese*, 198(Suppl 19), 4635-4666.

Timming, A. R., & Macneil, J. (2023). Bridging human resource management theory and practice: Implications for industry-engaged academic research. *Human Resource Management Journal*, 33(3), 592-605.

Timotheou, S., Miliou, O., Dimitriadis, Y., Sobrino, S. V., Giannoutsou, N., Cachia, R., ... & Ioannou, A. (2023). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. *Education and Information Technologies*, 28(6), 6695-6726.

Tonbuloğlu, B., & Tonbuloğlu, İ. (2023). Trends and patterns in blended learning research (1965–2022). *Education and Information Technologies*, 1-32.

Topping, K. J., Douglas, W., Robertson, D., & Ferguson, N. (2022). Effectiveness of online and blended learning from schools: A systematic review. *Review of Education*, 10(2), e3353.

Toyirovna, Y. S. (2023). Innovative Activity of a Modern Teacher. *Amaliy va tibbiyot fanlari ilmiy jurnali*, 2(2), 194-200.

Trangbæk, A., & Cecchini, M. (2023). Using the interpretivist methodology. *Handbook on Ministerial and Political Advisers*, 123.

Tratnik, A.; Urh, M.; Jereb, E. (2019). Student satisfaction with an online and a face-to-face Business English course in a higher education context. Innov. *Educ. Teach. Intern.*, 56, 36–45.

Treagust, D. F., & Won, M. (2023). Paradigms in science education research. In *Handbook of research on science education* (pp. 3-27). Routledge.

Truss, A., & Anderson, V. (2023). The navigational challenges of a blended learning approach to teaching in business and management. *The International Journal of Management Education*, 21(1), 100733.

Tubagus, M., Haerudin, H., Fathurohman, A., Adiyono, A., & Aslan, A. (2023). The impact of technology on Islamic pesantren education and the learning outcomes of santri: new trends and possibilities. *Indonesian Journal of Education (INJOE)*, 3(3), 443-450.

Tulasi, B. & Suchithra, R. (2020). Blended Learning Effectiveness in Higher Education. *International Journal of Engineering and Advanced Technology*, 9(3), 105–108.

Tutkova, I., Kudaiberdieva, G., & Kozhobekov, K. (2024). Training of pedagogical staff in the context of digital didactics. *Revista Conrado*, 20(96), 279-283.

Turnbull, D., Chugh, R., & Luck, J. (2023). Systematic-narrative hybrid literature review: A strategy for integrating a concise methodology into a manuscript. *Social Sciences & Humanities Open*, 7(1), 100381.

Twagilimana, I. & Sirkku, M.B. (2021). ICT in Education Policy in Rwanda: Current Situation, Challenges and Prospects. In *"ACRID 2017: Proceedings of EAI International Conference for Research, Innovation and Development for Africa*", European Alliance for Innovation.

Tzagkarakis, S.I., Kritas, D. (2022). Mixed research methods in political science and governance: approaches and applications. *International journal of Quality and Quantity*. https://doi.org/10.1007/s11135-022-01384-y

Udupa, P. (2022). Application of artificial intelligence for university information system. *Engineering Applications of Artificial Intelligence* 114: 20–35.

Ufitiwabo, A.T. (2021). *Over 1,800 Science Teachers to be Given Laptops in August*. The New Times, 3 August 2021.

Uiboleht, K., Karm, M., & Postaref, L. (2018). The interplay between teachers' approaches to teaching, students' approaches to learning and learning outcomes: A qualitative multi-case study. *Learning Environments Research*, 21(3), 321–347. https://doi.org/10.1007/s10984-018-9257-1

Uiboleht, K., Karm, M., & Postaref, L. (2018). The interplay between teachers' approaches to teaching, students' approaches to learning and learning outcomes: A qualitative multi-case study. *Learning Environments Research*, 21(3), 321–347. https://doi.org/10.1007/s10984-018-9257-1

Ulferts, H. (ed.) (2021). *Teaching as a Knowledge Profession: Studying Pedagogical Knowledge across Education Systems*. Educational Research and Innovation, OECD Publishing, Paris, https://doi.org/10.1787/e823ef6e-en.

Ulkhaq, M. M. (2023). *The role of ICT in education: an efficiency analysis*. https://hdl.handle.net/11379/568944

Umair, M. (2019). Research Fundamentals: Study Design, Population, and Sample Size. *URNCST Journal (2)*. DOI: 10.26685/urncst.16

UNICEF (2022). *Teachers endorse TMIS: System marks 'a fresh start'*. Available at: https://www.unicef.org/rwanda/stories/teachers-endorse-tmis-system-marks-fresh-start.

UNESCO (2022). *Beyond Limits.* New Ways to Reinvent Higher Education. Working document for the World Higher Education Conference. 18-20 May 2022.

UNESCO (2020). Global Education Monitoring Report: Inclusion and Education: All means all. *Prospects*, 49, 103-109.

Uwizeyimana, D. E. (2022). Analyzing the importance of e-government in times of disruption: The case of public education in Rwanda during Covid-19 lockdown. *Evaluation and program planning*, 91, 102064.

Uwizeyimana, V. (2021). The University of Rwanda response to COVID-19. In N. Radić, A. Atabekova, M. Freddi & J. Schmied (Eds), *The world universities' response to COVID-19: remote online language teaching*. https://doi.org/10.14705/rpnet.2021.52.1266

Uzumcu, O. & Acilmis, H. (2023). Do Innovative Teachers use AI-powered Tools More Interactively? A Study in the Context of Diffusion of Innovation Theory. *Technology, Knowledge and Learning*, 1-20.

Vabø, A., & Schmidt, E. K. (2023). Emerging Geopolitical Barriers to the Realization of International Policies for Collaboration in Higher Education and Research: The Case of Scandinavia. *Annual Review of Comparative and International Education* 2022, 163-181.

Valencia-Mazzanti, C., & Freeman, M. (2023). The borders of theory: Towards an artful ontology of knowing in qualitative research. *Qualitative Research*, 23(5), 1359-1377.

Valverde-Berrocoso J, Fernández-Sánchez MR, Vanslambrouck S., Zhu C., Tondeur J., Lombaerts K. (2018). Adult learners' motivation to participate and perception of online and blended environments. In Novotná, J., & Jancarík, A. (Ed.). *Proceedings of the 15th European Conference on e-learning* (pp. 750 – 757). England: Academic Conferences and Publishing International Limited.

Van der Westhuizen, M., & Hlatshwayo, L. (2023). Towards flexible learning and teaching: Lessons learned for blended learning and teaching post COVID-19 pandemic. *Perspectives in Education*, 41(2).

Van Haute. E. (2021). *Research Methods in the Social Sciences*. Oxford University Press. London

Van Laar, E., Van Deursen, A. J., Van Dijk, J. A., & de Haan, J. (2020). *Determinants of 21st-century skills and 21st-century digital skills for workers: A systematic literature review*. Sage Open, 10(1), 2158244019900176.

Van-Noordt, C., Medaglia, R., & Tangi, L. (2023). Policy initiatives for Artificial Intelligence-enabled government: An analysis of national strategies in Europe. *Public Policy and Administration*, 09520767231198411.

Varaei, S., & Karami, F. (2023). Lived experience of the patient's families with Covid-19 admitted to the hospital: A phenomenological study. *Journal of Family Relations Studies*, 3(11), 48-57.

Varagur, K., Murphy, J., Skolnick, G. B., Naidoo, S. D., McEvoy, S. D., Strahle, J. M., & Patel, K. B. (2023). Family Experiences with Diagnosis of Craniosynostosis: Thematic Analysis of Online Discussion Boards. *The Cleft Palate Craniofacial Journal*, 10556656231190043.

Verd, J. M. (2023). Using a hybrid data collection tool: Analysis of youth labor market trajectories integrating quantitative, qualitative and social network data. *International Journal of Social Welfare*, 32(1), 9-19.

Verdú, E., Regueras, L. M., Gal, E., et al. (2019). Integration of an intelligent tutoring system in a course of computer network design. *Educational Technology Research and Development*, 65, 653–677.

Versteijlen, M. (2023). *Blended learning in higher education from a sustainability perspective* (Doctoral dissertation, Wageningen University).

Viinikka, K., & Ubani, M. (2019). The expectations of Finnish RE student teachers of their professional development in their academic studies in the light of twenty-first-century skills. *Journal of Beliefs & Values*, 40(4), 447-463.

Vimbelo, S., & Bayaga, A. (2023). Current pedagogical practices employed by a technical vocational education and training college's mathematics lecturers. *South African Journal of Higher Education*, 37(4), 305-321.

Vo, V., Chen, G., Aquino, Y. S. J., Carter, S., Do, Q., & Woode, M. E. (2023). Multi-stakeholder preferences for the use of artificial intelligence in healthcare: A systematic review and thematic analysis. *Social Science & Medicine*, 116357.

Wallace, J., Scanlon, D., & Calderón, A. (2023). Digital technology and teacher digital competency in physical education: a holistic view of teacher and student perspectives. *Curriculum Studies in Health and Physical Education*, 14(3), 271-287.

Wallet, P., Kimenyi, E., Miao, F., & Domiter, A. (2019). Improving quality and relevance of education through mobile learning in Rwanda: A promise to deliver. UNESCO. Paris.

Wan, S., Jin, B., Kpordoxah, M. R., Issah, A. N., Yeboah, D., Aballo, J., & Boah, M. (2023). A descriptive analysis of the coverage of newborn care services among women who

delivered in health facilities in 17 sub-Saharan African countries. *BMC Pregnancy and Childbirth*, 23(1), 1-9.

Wang, H., and Quek, M. (2018). Students' perspectives on the design and implementation of a blended synchronous learning environment. *Australasian Journal of Educational Technology* 34(1):1-13. DOI:10.14742/ajet.3404

Wang, L., Omar, M. K., Zakaria, N. S., & Zulkifli, N. N. (2023). Constructing a Relationship Model of Influencing Factors to Optimize the Implementation of Blended Learning: An Exploratory Sequential Design. *Eurasian Journal of Educational Research*, 103(103), 215-235.

Wanti, M., Wesselink, R., Biemans, H., & Brok, P. den. (2022). Determining factors of access and equity in higher education: A systematic review. *Equity in Education & Society*, 1(2), 279-296.

Webb, M. E., Fluck, A., Magenheim, J., Malyn, J., Waters, J., Deschˆenes, M., et al. (2020). Machine learning for human learners : Opportunities, issues, tensions, and threats. *Educational Technology Research and Development*, Article 0123456789. https:// doi.org/10.1007/s11423-020-09858-2

Weidner, K., Lowman, J., Fleischer, A., Kosik, K., Goodbread, P., Chen, B., & Kavuluru, R. (2021). Twitter, telepractice, and the COVID-19 pandemic: a social media content analysis. *American Journal of Speech-Language Pathology*, 30(6), 2561-2571.

Weitzel, A. (2021). *Advantages of Blended Learning Programs*.https://coursekey.com/blog/7-advantages-of-blended-learning-programs/#:~:text=Blended%20learning%20increases%20student%20engagement&tex

t=By%20providing%20digital%20opportunities%20for,of%20their%20peers%20in%2Dperson.

Wen, Q., Sun, L., Yang, F., Song, X., Gao, J., Wang, X., & Xu, H. (2020). Time series data augmentation for deep learning: A survey. *arXiv preprint arXiv*:2002.12478.

White, J. (2019). 3 secrets to successful station rotations [Web log post]. Retrieved from https://www.blendedlearning.org/3-secrets-to-successful-station-rotations/

Whiteside, A. L., Dikkers, A. G., & Swan, K. (Eds.). (2023). *Social presence in online learning: Multiple perspectives on practice and research*. Taylor & Francis.

Wilkinson, I. A. G., & Staley, B. (2019). On the pitfalls and promises of using mixed methods in literacy research: Perceptions of reviewers. *Research Papers in Education*, 34(1), 61-83. https://doi.org/10.1080/02671522.2017.1402081

Winarni, R. (2023). The Effect of Project Based Learning on Creative Writing Skills in Elementary School Students: Multivariate Analysis of Variance on Themes, Diction, Imagination. *Jurnal Iqra': Kajian Ilmu Pendidikan*, 8(2), 120-129.

Wong, R. (2023). When no one can go to school: does online learning meet students' basic learning needs?. *Interactive learning environments*, 31(1), 434-450.

Woodruff, K., Hutson, J., & Arnone, K. (2023). *Perceptions and barriers to adopting artificial intelligence in K-12 education: A survey of educators in fifty states*.

World Economic Forum (2021). *Report on Global Growth in Online Learning*. Retrieved from https://www.weforum.org/agenda/2022/01/online-learning-courses-reskill-skills-

gap/#:~:text=The%20upward%20trend%20in%20online%20learning&text=But%20the%20switch%20to%20remote,and%2092%20million%20in%202021.

Xiao, G., & Zhang, M. (2024). Knowledge Mapping of Blended Learning Classroom Environment Studies (1996-2023): A Bibliometric Analysis. International Journal of Emerging Technologies in Learning (Online), 19(1), 68.

Xu, A., Baysari, M.T., Stocker, S.L. et al. (2020). Researchers' views on, and experiences with, the requirement to obtain informed consent in research involving human participants: a qualitative study. *BMC Med Ethics*; 21, 93. https://doi.org/10.1186/s12910-020-00538-7

Xu, Y., Peng, J., Zhu, J., Li, Y., & Zhu, Y. (2023). The Application of Modern Educational Technology in College Physical Education under the Background of Informatization. *Adult and Higher Education*, 5(1), 141-146.

Yadav, D. (2022). Criteria for Good Qualitative Research: A Comprehensive Review. *Asia-Pacific Education Research;* 31, 679–689 (2022). https://doi.org/10.1007/s40299-021-00619-0

Yan, H., Lin, F., & Kinshuk. (2021). Including learning analytics in the loop of self-paced online course learning design. *International Journal of Artificial Intelligence in Education*, 31, 878-895.

Yan, C., He, C., & Zhang, L. (2023). Obstacles to foreign language teacher educators' research development: a phenomenological study from China. *Asia-Pacific Journal of Teacher Education*, 51(5), 423-439.

Yarbrough, J. R. W. (2023). Applying diffusion of innovation theory to examine providers' perceptions of rural telehealth application and competencies. *Rural Society*, 1-19.

Yashodha, Dr. (2023). BLENDED LEARNING IN HIGHER EDUCATION. 05. 51-58.

Yekta, Z., Zamani, A. R., Mehdizade, M., & Farajzadegan, Z. (2023). Pattern of complementary and alternative medicine use in urban population. *Journal of research in health sciences*, 7(1), 24-31.

Yende, S. J., & Mthombeni, Z. M. (2023). *The cost of equality: analyzing the unforeseen financial strains of fee-free higher education in South Africa*.

Yende, S. J., & Mthombeni, Z. M. (2023). The Cost of Equality: Analyzing the Unforeseen Financial Strains of Fee-Free Higher Education in South Africa. E-*Journal of Humanities, Arts and Social Sciences (EHASS)*, 4(11), 1380-1390.

Yonchai, P., Worakham, P., & Panya, P. (2023). The Development of the Blended Learning Model Using Rotating Stations (BLRS) in the Case of a Small Elementary School. *Eurasian Journal of Educational Research*, 103(103), 33-61.

Young, A., & Khalfani, R. (2023). From Barriers to Bridges: Expanding Access to Higher Education and Workforce Training in Georgia. *Georgia Budget and Policy Institute*. Retrieved September 22, 2023.

Youssef, N., Saleeb, M., Gebreal, A., & Ghazy, R. M. (2023, July). The internal reliability and construct validity of the evidence-based practice questionnaire (EBPQ): Evidence from healthcare professionals in the Eastern Mediterranean Region. *In Healthcare* (Vol. 11, No. 15, p. 2168). MDPI.

Yu, T., Dai, J., & Wang, C. (2023). Adoption of blended learning: Chinese university students' perspectives. *Humanities and Social Sciences Communications*, 10(1), 1-16.

Yun, G., Ravi, R. V., & Jumani, A. K. (2023). Analysis of the teaching quality on deep learning-based innovative ideological political education platform. *Progress in Artificial* Intelligence, 12(2), 175-186.

Yurt, E. (2023). 21st-century skills as predictors of pre-service teachers' professional qualifications: A cross-sectional study. *International Journal of Education in Mathematics, Science and Technology*, 11(5), 1328-1345.

Zarestky, J. (2023). Navigating multiple approaches to qualitative research in HRD. *Human Resource Development Review*, 22(1), 126-138.

Zawacki-Richter, O., & Bozkurt, A. (2023). Digital Education. *Handbook of open, distance and digital education*, 199.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). A systematic review of research on artificial intelligence applications in higher education – where are the educators? *Int. J. Educ. Technol*. Higher Educ., 16(1). https://doi.org/ 10.1186/s41239-019-0171-0

Zhang, B., Velmayil, V., & Sivakumar, V. (2023). A deep learning model for innovative evaluation of ideological and political learning. *Progress in Artificial Intelligence*, 12(2), 119-131.

Zhang, Q., Tang, X., Zhao, Y., & Wang, Z. (2023). Team-based learning vs. lecture-based learning in nursing: A systematic review of randomized controlled trials. *Frontiers in Public Health*, 10, 1044014.

Zhang, X. (2023). Exploring Academically Transitioning Students' Ongoing Experiences with Textbook-Based Learning: A Semester-Long Study. *Journal of Psycholinguistic Research*, 1-15.

Zhang Y. (2021). Book Review: Data Collection Research Methods in Applied Linguistics. *Frontiers in Psychology Journal*, 12:668712. doi: 10.3389/fpsyg.2021.668712

Zhang, Z., & Xu, L. (2022). Student engagement with automated feedback on academic writing: A study on Uyghur ethnic minority students in China. *Journal of Multilingual and Multicultural Development*. https://doi.org/10.1080/01434632.2022.2102175

Zhang, C., Schießl, J., Plößl, L., Hofmann, F., & Gläser-Zikuda, M. (2023). Acceptance of artificial intelligence among pre-service teachers: a multigroup analysis. *International Journal of Educational Technology in Higher Education*, 20(1), 49.

Zhang, A., Fu, H., Wang, J., Chen, Z., & Fan, J. (2023). Establishing a nomogram to predict refracture after percutaneous kyphoplasty by logistic regression. *Frontiers in Neuroinformatics*, 17.

Ziafati-Bafarasat, A. (2021) *Collecting and Validating Data: A Simple Guide for Researchers. Advance*. Doi.org/10.31124/advance.13637864.v1

Zin, K. S. L. T., Kim, S., Kim, H. S., & Feyissa, I. F. (2023). A Study on Technology Acceptance of Digital Healthcare among Older Korean Adults Using Extended Tam (Extended Technology Acceptance Model). *Administrative Sciences*, 13(2), 42.

Zinchenko, V., Dorosheva, A., & Mosiy, I. (2023). Innovative and cultural transformations of educational environment of the future: digitalization, barriers for traditional learning. *Futurity Education*, 3(1), 41-57.

Zohrabi, M. (2020). Mixed Method Research: Instruments, Validity, Reliability and Reporting Findings. *Theory and Practice in Language Studies*, Vol. 3, No. 2, pp. 254-262.

APPENDICES

Appendix A: UREC Provisional Approval

UNICAF UNIVERSITY

UREC Division, Version 2.0

Unicaf University Research Ethics Committee Decision

Student's Name: Vivens Hitiyaremye

Student's ID #: R1912D10028591

Supervisor's Name: Dr Trevor Gerhardt

Program of Study: UU-EDUD-900-1-ZM

Offer ID /Group ID: O26681G27453

Dissertation Stage: DS 1

Research Project Title: INVESTIGATING THE IMPACT OF THE BLENDED LEARNING MODEL ON THE ACCESS TO HIGHER EDUCATION IN RWANDA

Comments: No comments

Decision*: A. Provisionally approved without revision or comments

Date: 22-Jul-2021

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3. The student is allowed to proceed to data collection following the final approval.

Appendix B: UREC Final Approval

UNICAF UNIVERSITY

UREC Decision, Version 2.0

Unicaf University Research Ethics Committee Decision

Student's Name:	Vivens Hitiyaremye
Student's ID #:	R1912D10028591
Supervisor's Name:	Dr Trevor Gerhardt
Program of Study:	UUZ: EdD Doctoral of Education
Offer ID /Group ID:	O43519G44321
Dissertation Stage:	3
Research Project Title:	INVESTIGATING THE IMPACT OF THE BLENDED LEARNING MODEL ON THE ACCESS TO HIGHER EDUCATION IN RWANDA
Comments:	No comments
Decision*:	A. Approved without revision or comments
Date:	14-Sep-2022

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3. The student is allowed to proceed to data collection following the final approval.

Appendix C: Sample of Non-completed Informed Consent Form

UNICAF UNIVERSITY

UU_IC - Version 2.1

Informed Consent Form

Part 1: Debriefing of Participants

Student's Name: Vivens Hitiyaremye

Student's E-mail Address: hitiyaremyevivens@yahoo.fr

Student ID #: R1912D10028591

Supervisor's Name: Dr. Trevor Gerhardt

University Campus: Unicaf University Zambia (UUZ)

Program of Study: UUZ: EdD Doctoral of Education

Research Project Title: INVESTIGATING THE IMPACT OF THE BLENDED LEARNING MODEL ON THE ACCESS TO HIGHER EDUCATION IN RWANDA

Date: 02-Sep-2022

Provide a short description (purpose, aim and significance) of the research project, and explain why and how you have chosen this person to participate in this research (maximum 150 words).

The purpose of this study is to investigate the impact of blended learning model on the access to higher education. The study intends to investigate if this innovative teaching and learning model is addressing many of the key challenges faced by many higher education institutions including expansion of access to education. The study is conducted in 10 selected higher education institutions in Rwanda having the blended learning model in their academic programs. The research population consists of university students, lecturers and administrative staff. It is in this regard you have been chosen among the participants of this research.

The above named Student is committed in ensuring participant's voluntarily participation in the research project and guaranteeing there are no potential risks and/or harms to the participants.

Participants have the right to withdraw at any stage (prior or post the completion) of the research without any consequences and without providing any explanation. In these cases, data collected will be deleted.

All data and information collected will be coded and will not be accessible to anyone outside this research. Data described and included in dissemination activities will only refer to coded information ensuring beyond the bounds of possibility participant identification.

I, Vivens Hitiyaremye, **ensure that all information stated above is true and that all conditions have been met.**

Student's Signature: _____

UU_IC - Version 2.1

Informed Consent Form

Part 2: Certificate of Consent

This section is mandatory and should to be signed by the participant(s)

Student's Name: Vivens Hitiyaremye

Student's E-mail Address: hitiyaremyevivens@yahoo.fr

Student ID #: R1912D10028591

Supervisor's Name: Dr. Trevor Gerhardt

University Campus: Unicaf University Zambia (UUZ)

Program of Study: UUZ: EdD Doctoral of Education

Research Project Title: INVESTIGATING THE IMPACT OF THE BLENDED LEARNING MODEL ON THE ACCESS TO HIGHER EDUCATION IN RWANDA

I have read the foregoing information about this study, or it has been read to me. I have had the opportunity to ask questions and discuss about it. I have received satisfactory answers to all my questions and I have received enough information about this study. I understand that I am free to withdraw from this study at any time without giving a reason for withdrawing and without negative consequences. I consent to the use of multimedia (e.g. audio recordings, video recordings) for the purposes of my participation to this study. I understand that my data will remain anonymous and confidential, unless stated otherwise. I consent voluntarily to be a participant in this study.

Participant's Print name:

Participant's Signature: _____

Date:

If the Participant is illiterate:

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had an opportunity to ask questions. I confirm that the aforementioned individual has given consent freely.

Witness's Print name:

Witness's Signature: _____

Date:

Appendix D: Gatekeeper Letter

UNICAF UNIVERSITY

UU_GL - Version 2.0

Gatekeeper letter

Address: Kigali, Rwanda

Date: 05-Sep-2022

Subject: Request for institutional permission

Dear University Principal,

I am a doctoral student at Unicaf University, Zambia (UUZ).As part of my degree, I am carrying out a study on INVESTIGATING THE IMPACT OF THE BLENDED LEARNING MODEL ON THE ACCESS TO HIGHER EDUCATION IN RWANDA.

I am writing to ask for permission to involve your academic and administrative staff in this research.

Subject to approval by Unicaf Research Ethics Committee (UREC), this study will be using an online questionnaire for the selected academic staff and face to face interviews for the selected administrative staff.

My research project is entitled INVESTIGATING THE IMPACT OF THE BLENDED LEARNING MODEL ON THE ACCESS TO HIGHER EDUCATION IN RWANDA, and it is conducted under the supervision of Dr. Trevor Gerhardt. The purpose of this study is to investigate the impact of blended learning model on the access to higher education. The study intends to investigate if this innovative teaching and learning model is addressing many of the key challenges faced by many higher education institutions including expansion of access to education. The study is conducted in 10 selected higher education institutions in Rwanda having the blended learning model in their academic programs.

For the successful completion of this research, I would like to request for permission to give questionnaire and to hold interviews with the selected staff from your university. Personal data and research data collected from participants will be securely stored for five years, and they will only be used for the research purpose.

Thank you in advance for your time and for your consideration of this project. Kindly please let me know if you require any further information or need any further clarifications

Yours Sincerely,

Student's Name: Vivens Hitiyaremye
Student's E-mail: hitiyaremyevivens@yahoo.fr
Student's Address and Telephone: Kigali, Rwanda. Phone: +250788574529
Supervisor's Title and Name: Dr. Trevor Gerhardt
Supervisor's Position: University Lecturer
Supervisor's E-mail: t.gerhardt@unicaf.org

Appendix E: A Copy of Data Collection Tools

My name is Vivens Hitiyaremye, a doctoral student at Unicaf University, Zambia (UUZ). As part of my degree, I am conducting a study on INVESTIGATING THE IMPACT OF THE BLENDED LEARNING MODEL ON THE ACCESS TO HIGHER EDUCATION IN RWANDA, and it is conducted under the supervision of Dr. Trevor Gerhardt.

The purpose of this study is to investigate the impact of the blended learning model on the access to higher education. The study intends to investigate if this teaching and learning model is addressing many of the key challenges faced by many higher learning institutions including expansion of access to education.

The purpose of this survey is to gather respondent's responses that will help investigate the impact of the blended learning model on the access to higher education in Rwanda. The Unicaf University Research Ethics Committee (UREC) has approved this research study. Participation in this survey is voluntary and your responses will be kept confidential and anonymous, and the results will only be used for this research purpose.

A. Online Survey Questions for students (distributed in goofle form)

1. Year of program: First Year _ Second Year _ Third Year _ Fourth Year _

2. Student status: Full Time _ Part Time _

3. Place of residence: On-campus residency _ off-campus _

4. Age: _____

5. Gender: Female: _____ Male: _____ Other: _____ No wish to state: _____

6. How do you feel about the blended learning model? (Tick the best option from the list below)

Very comfortable: _____

Comfortable: _____

Somehow comfortable: _____

Not comfortable: _____

7. Explain the answer you provided in question 6 using the reserved space here.

---

8. Which of the following best describes your motivation to join university programs in the blended learning model?

____Convenience of not having to come to campus as often

____Flexibility of being able to complete assignments from anywhere at anytime

____It was the only available option that fits into my timetable

____Job responsibilities make it difficult for me to attend face-to-face classes

____I have a disability that makes travel inconvenient

____Other (please specify)

9. Why would you recommend other students to join university programs in the blended learning model?

---

10. Why wouldn't you recommend other students to join university programs in the blended learning model?

---

11. How would you describe the level of students' enrolment in your institution after the adoption of the blended learning model?

____Increased

____Somewhat increased

____No difference

____Somewhat decreased

____Decreased

12. What are the advantages of the blended learning model in higher learning institutions? (List at most 5 advantages

1. ----------
2. ----------
3. ----------
4. ----------

5. ----------

13. What are the disadvantages of the blended learning model in higher learning institutions? (List at most 5 disadvantages)

1. ----------

2. ----------

3. ----------

4. ----------

5. ----------

14. As a student, what are the key challenges you face in your academic program in the blended learning model? (List at most 5 challenges)

1. ----------

2. ----------

3. ----------

4. ----------

5. ----------

15. What suggestions can you provide to help strengthen the blended learning model in higher learning institutions? (Use the space below for your recommendations)

B. Online Survey Questions for Teachers (distributed in goofle form)

1. Teacher's status: Full Time_____ Part Time _____

2. Age: _____

3. Gender: Female: _____ Male: _____ Other: _____ No wish to state: _____

4. How do you feel about the blended learning/teaching model? (Tick the best option from the list below)

Very comfortable: _____

Comfortable: _____

Somehow comfortable: _____

Not comfortable: _____

5. Explain the answer you provided in question 4 using the reserved space here.

---

6. Between traditional face-to-face model and the newly blended learning model, which one do you think can attract more students? (Tick the best option)

Face-to-face learning model: _____

Blended learning model_____

7. As a teacher, which of the following do you think it best describes how the blended learning model helps students in their academic programs?

____It helps them not to come to campus as often

____It helps them complete their class assignments from anywhere at any time

____It is flexible to students with other job responsibilities

____It helps them navigate the course resources from different sources

____It provides students with enough time to go through the course material prior to the face-to-face

____Other (please specify)

8. Why would you recommend students to join university programs in the blended learning model?

---

9. Why wouldn't you recommend students to join university programs in the blended learning model?

---

10. How do you see the level of students' enrolment in your institution after the adoption of the blended learning model?

____Increased

____Somewhat increased

____No difference

____Somewhat decreased

____Decreased

11. What are the advantages of the blended learning model in higher learning institutions? (List at most 5 advantages

1. ----------

2. ----------

3. ----------

4. ----------

5. ----------

12. What are the disadvantages of the blended learning model in higher learning institutions? (List at most 5 disadvantages)

1. ----------

2. ----------

3. ----------

4. ----------

5. ----------

13. As a university teacher, what are the key challenges you face in your teaching duties in the blended learning model? (List at most 5 challenges)

1. ----------

2. ----------

3. ----------

4. ----------

5. ----------

14. What suggestions can you provide to help strengthen the blended learning model in higher learning institutions? (Use the space below for your recommendations)

C. Interview Guide for Academic Registrars

1. When did the institution you work for start using the blended learning model in its academic programs?
2. Has the level of students' enrolment increased or decreased in your institution after the adoption of the blended learning model?
3. What are the students' enrolment statistics before and after the adoption of the blended learning model in your institution?
4. What advantages does your institutions gain from the blended learning model?
5. What challenges does the institution face in the implementation of the blended learning model?
6. What should be done to strengthen the blended learning model in higher learning institutions?

D. Interview Guide for IT Senior Staff

1. What technical support do you provide to both students and teachers to facilitate their teaching and learning activities in the blended learning model?
2. What are the resources available for both teachers and students to facilitate their learning and teaching activities in the blended learning model?
3. Are they friendly user for both students and teachers?
4. What advantages does your institutions gain from the blended learning model?
5. What challenges do students and teachers face when implementing the blended learning model, and how do you help them to overcome those challenges?
6. What challenges does the institution face in the implementation of the blended learning model?
7. What should be done to strengthen the blended learning model in higher learning institutions?