

Effective Technological Response to Teaching and Learning: Blended Learning

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Abstract This study investigated the impact of blended learning in higher institutions using a questionnaire-based approach. Blended learning, which combines face-to-face instruction with online learning components, has gained prominence in higher education. The research aimed to explore the effects of blended learning on tutors and students, gather their perspectives and experiences through a questionnaire, and provide recommendations for improvement. The study utilizes a questionnaire administered to tutors and students at Kumasi Technical University to collect data on their perceptions and experiences with blended learning. The questionnaire covers aspects such as engagement, satisfaction, academic performance, and the effectiveness of blended learning activities. The findings reveal several positive impacts of blended learning on tutors and students. Tutors reported that blended learning enhanced their instructional practices facilitated interactive online discussions, and improved engagement with students (0.5 to 0.6) which shows a moderate positive correlation. Students expressed increased engagement, flexibility, and access to resources, which supported their learning process (0.931) which shows it has a moderate to strong positive correlation. Blended learning positively influences student satisfaction and academic performance. Recommendations for further improvement are proposed. Firstly, comprehensive training and professional development programs should be provided to tutors, equipping them with skills in blended learning pedagogy and technology integration. This will empower tutors to design and deliver effective online learning materials and activities. Secondly, robust technical support and infrastructure should be established to ensure the smooth operation of online platforms and tools. Ongoing monitoring and evaluation of the blended learning implementation should be conducted to identify areas for improvement and address challenges. In conclusion, blended learning has a positive impact on tutors and students at Kumasi Technical University. The questionnaire-based approach provides valuable insights into their perceptions and experiences. Implementing the recommendations for improvement will further enhance the benefits of blended learning at Kumasi Technical University.

Keywords: Blended learning, High Education, Academic Performance, Technology Integration

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1. Introduction

Blended learning, also known as technology-mediated instruction, web-enhanced instruction, or mixed-mode instruction, is an approach to education that combines online educational materials and opportunities for interaction online with physical place-based classroom methods.

It has been determined that blended learning pedagogies can help lecturers use technology in the classroom more effectively [1]. Blended learning is thought to offer several benefits to both instructors and students, including any-time learning, anywhere access, self-paced learning, inquiry-led learning, and collaborative learning [2]. This helps educational institutions foster

desirable learning skills—like critical thinking—during the educational process [3]. Because of its broad use in educational institutions, blended learning as a learning strategy has gained traction [3]. Blended learning is a pedagogical strategy that mixes face-to-face classroom social, cognitive, and educational possibilities with the Internet environment. [4]. According to [5], Blended learning is a learner-centred strategy in which students engage with teachers and content by carefully integrating conventional learning online courses based on science and technology, pedagogies, and content. According to similar research [6] employing technology in learning is a method that mixes face-to-face interactions with technology-based learning. It has been demonstrated that the use of technology in education improves and raises the efficacy and efficiency of teaching and learning in both

instructional and training environments [7]. It uses a variety of instructional strategies and blends traditional with digital activities. [8] stated that in order for learning to take place, the online component must be used to minimize the amount of time spent face-to-face or in traditional classroom learning, that is, to reduce the amount of time spent in the classroom.

As a result, blended learning allows for the use of technology [9]. When using technology in blended learning, teachers can combine synchronous and asynchronous techniques, such as face-to-face learning and technology-based procedures [10]. [11] demonstrates how, by introducing technology into the classroom, students may study at any time while away from home and, at least in part, through online delivery with some student control over time, place, direction, and/or speed. In turn, [12] states that blended learning is a formal education program in students' study in part through the delivery of information and instruction online. According to [13], Students have control over how much time they spend studying. Students' academic performance is likely to increase since they to learn anywhere and at any time. This is due to the learning strategy addressing learner preparedness, which is critical to learner performance. Similar research [6] indicates how the use of blended learning provides for both remedial and collaborative learning opportunities for students.

The usage of technology in the classroom has assisted lecturers in meeting students' particular learning requirements and learning styles [14]. According to [15], the use of technology in the classroom has boosted students' access to and comfort with educational tools. The use of technology in the classroom allows students to study freely and manage the learning process, as well as facilitate cooperative learning [16]. Direct instructing, online communication, self-directed learning, computerized support for performance structures, and learning administration systems are just a few of the instructional content delivery methods used in blended learning [7]. According to [17], The instructional technique includes face-to-face classroom interactions between teachers and students, as well as traditional learning tools such as printed textbooks, workbooks, and e-learning environments. The effectiveness of blended learning is due to more than just the mere integration of ICTs with face-to-face instruction [18]. In instances when there are a large number of students, this form of resource gives more opportunity to absorb and extend the knowledge offered [18]. The use of blended learning resources may cause changes in learning patterns and behaviors. They are often utilized in large-scale classes, such as the first year of undergraduate study courses, which is a critical year in judging students' commitment to university learning [18]. This study focuses on comprehending the specific meaning of the term "blended learning" as well as the implementation of these blended learning strategies in higher education. It also discusses the benefits and drawbacks of blended learning in terms of improving teaching and learning experiences.

2. Introduction

During an uncertain period like pandemics and endemics which lead to lockdowns, teachers and as well as students of higher institution stay home which negatively affect teaching and learning.

The use of blended learning in the classroom to integrate technology is quickly replacing conventional methods of teaching and learning [19]. According to [20], When technology is used to enhance teaching and learning, students' learning experiences and performance can increase. Similarly, it is considered that the use of technology in education works well and improves whenever it is tried. However, in Ghana, the use of technology for teaching using a blended learning approach is still in its infancy stage and has not fully taken shape. However, it has been noted that instructors at the school frequently fail to integrate technology into their curriculum, even though relevant technologies are readily available. Furthermore, if technology is just used in lectures and tutorials and not incorporated into them, students may become unhappy, and any potential benefits will be lost. In this context, the study will assess instructors' perspectives on using technology as an instructional strategy for teaching using a blended learning approach. Questions that guided the research were:

1. What are the key factors influencing the successful implementation of blended learning?
2. What is the view of tutors and learners on blended learning?
3. What was the impact of blended learning on students' academic performance?

The main objective is to find the impact of blended learning in higher institutions. The intents are

1. To identify the key factors influencing the successful implementation of blended learning.
2. To ascertain the view of tutors and learners on blended learning.
3. To assess the impact of blended learning on students' academic performance.

This research aims to determine the impact of blended learning as an instructional technique in higher education institutions that will contribute to current knowledge. It is envisaged that by the end of the project, lecturers' and students' attitudes considering the utilization of integrated learning technologies in teaching, as well as their overall performance gap in teaching, would have improved.

The goal of any research is to fill gaps in our knowledge and add new information to current ones. The study's findings are expected to help Ghanaian officials establish teaching techniques that encourage the use of blended learning technology in order to improve the country's present teaching practices. Identifying the issues that contribute to increased student accomplishment through the use of blended learning technologies in the classroom can give useful insight into methods to improve student achievement. Identifying the best techniques and processes for incorporating technology into teaching at

Kumasi Technical University may pave the road for improved student performance and accomplishment. The findings of this study may assist stakeholders to adapt their educational programs to improve student academic achievement through the use of technology.

This research may also help to raise awareness among policymakers and lecturers about the barriers to integrating blended learning technology in education. A thorough understanding of the barriers will inform educators in deciding how to address them, with the hope that they can be minimized, if not eliminated.

To achieve the best results, it would have been preferable to interview all teachers in Ghana who employ blended learning in their classrooms; unfortunately, the study was confined to just professors at Kumasi Technical University [6]. The seven basic abilities commonly used in practicing and processing blended learning applications include ICT skills, email, spreadsheets, word processing, file navigation, presentation packages, and databases. Only ICT skills were evaluated, while the remaining indicators were ignored.

The limitations of this study merit debate and imply that the results should be interpreted with caution. Because of the sampling strategy used to choose the lecturers and schools, the findings of this study can be extrapolated to all sampled professors at Kumasi Technical University, but not to all technical universities in Ghana. Another drawback of this study was the population, which was limited to lecturers who employed blended learning technology as their major instructional technique. The study experienced various difficulties, including a low response rate, holidays when schools were closed, the fact that tutors may find it difficult to reply to the questionnaire, and instructors' refusal to engage in the study. These uncontrolled factors may have an influence on the overall conclusions of the study. However, by describing the benefits of the research to them, measures were taken to mitigate the influence on the study's final conclusions.

3. Theoretical Framework

The research was supported by a social constructivist perspective, which sees blended learning as a source of collaboration, interaction, and motivation to aid teachers in building a learning environment [6]. According to [21], Social constructivism is an educational theory in which instructors and students collaborate to discover and generate new knowledge using technology. The social constructivist approach, he continued, emphasizes personalized learning within the context of social learning and sees learning as a communally and culturally constructed human output. In the opinion of [6], the use of qualitative research is central to social constructivist theory from an epistemological standpoint. Research on education can also use this approach. According to this approach, the role of the instructor is to act as a facilitator who makes sure that pupils are presented with real-world situations and are actively engaged in their education by using technology [22].

Learning is a social activity that takes place when individuals interact with one another [23]. Learning,

according to them, is an active journey impacted by external forces rather than a passive one. Students may derive meaning from their social interactions with others and their environment. Vygotsky highlighted the importance of social engagement, interaction, and collaboration in learning. Because education is a social process, children can develop and improve based on their dialogues and socializing with others, according to Vygotsky's thesis.

The social constructivist method of this study allowed for an examination of how students were provided with tools to track their performance using modern technologies. Social constructivists examine how professors utilize technology to regulate their students' online presence and how it relates to the course. In line with social constructivism principles, the study allowed teachers to reflect on their active engagement in the blended learning process. Participants were free to experiment with the kind of learning opportunities they offered to students in order to satisfy the learning objectives through reflection, critical thinking, and creativity. Vygotsky believed that students should be directed through the learning process and that teachers should go out of their way to help pupils learn. According to Vygotsky, instructors employ scaffolding strategies to present pupils with essential knowledge and encouragement at the appropriate moment. Vygotsky believed that instructors should be essential to their students' learning in a blended learning environment for cognitive growth. Vygotsky also advocated for direct and focused instruction to help students' cognitive development, as well as the importance of peer interaction and cooperative learning. As a result, the study used the social constructivist framework to explore teachers' perspectives of the use of blended learning as an instructional technique. The theory is relevant to the study because theoretical processes influence educational quality.

Zone of Proximal Development

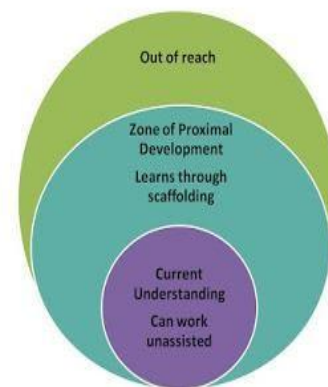


Figure 1. Zone of Proximal Development (ZPD)

3.1. The Concept of Blended Learning

There is no simple definition of blended learning [9]. According to [6], Students who study online and, in a classroom, simultaneously and independently of one another are said to be engaged in blended learning. A related study [6] described blended learning as a training

method that mixes conventional education with digital technology to develop knowledge and skills that students can apply in the business. Similarly, by employing the Internet or computer-based resources, blended learning improves face-to-face communication between professors and students [6]. Blended learning is thought to be a framework that will help teachers integrate technology and employ in-person educational programs to fulfill the different learning needs of their students. [6]. [6] went on to say that blended learning includes effective instructional strategies for teaching using technology both in and out of the classroom. Blended learning will benefit teachers by increasing classroom efficiency, increasing instructional flexibility, and achieving superior learning outcomes through collaboration [24].

The primary goal of introducing blended learning is to promote learner-centered pedagogy and enable more learning [22]. As a result, blended learning activities will necessitate students' access to emails, eBooks, and e-journals, as well as their completion of online tests and participation in discussion forums and chat rooms with colleagues and instructors. [22]. According to [25], the use of blended learning in the classroom will provide kids the opportunity to learn online. [19] says that a well-designed curriculum and a blended learning strategy may increase student involvement in mixed learning. [19] To promote student engagement and learning, it was also suggested that blended learning include the use of emails, discussion forums, and chat rooms. The use of these approaches for introducing technology into the classroom, in conjunction with instructor help, will boost student participation. In addition to [19], the use of learning technologies in blended learning is suggested. [6] spoke about using PowerPoint presentations, video, and audio clips to augment course material or explain tough areas. They also underlined that these tools may be adjusted to allow for group work, making them suitable for both cooperative and autonomous learning. Each of the strategies they suggested has been proved to improve decision-making, comparable study-making, and problem-solving abilities, as well as to provide extra learning opportunities for student performance.

A blended learning environment is characterized as one that combines instructional approaches, delivery methods, media formats, or a mix of all of these [26]. Blended learning, according to [6], is a set of learning approaches or dimensions that integrate multiple event-based activities, such as traditional instructor-led training, synchronous internet conferencing or training, and asynchronous self-paced study. Blended learning, according to [6], mixes learning activities such as online and face-to-face learning.

In other words, blended learning is a hybrid of e-learning and conventional learning methods [6]. Blended learning, according to [27], blends conventional and web-based educational methodologies. The employment of media and technology in an e-learning environment helps to adopt blended learning pedagogies.

3.1.2. Perceptions of Teachers Towards the Use of Blended Learning

Blended learning must emphasize personalised learning and student interaction via the use of technology [6].

Teachers, according to them, use blended learning as a tool for online evaluations to give frequent engagement and feedback to their students. The teachers addressed using blended learning activities to augment their teaching and inspire their students through the use of electronic media. Teachers believe that by engaging in both locations, they may establish a social and educational presence through the use of technology.

According to [28], students are more likely to succeed in their learning when they take active roles and remain involved in blended learning activities. According to [6], the presence of teachers is an essential issue to consider while promoting blended learning. Blended learning may give students with unrestricted access to a wide choice of learning tools and activities, and the most crucial component for teachers is maintaining the proper balance between face-to-face and online learning. [6].

Another research [6] examined Singaporean teachers' perceptions on blended learning in the classroom. Four factors were used to assess teachers' opinions of blended learning: emotion (liking), perceived usefulness, perceived control, and behavioral intention to use the computer. [29] Teachers' opinions toward using blended learning in the classroom, as well as their desire to use computers, were more positive than their ratings of computer utility and control. Similarly, [6] academics in Tanzania evaluated teachers' perceptions toward using blended learning for teaching, professional development, management, and personal use. [6] said that blended learning was utilized to complete administrative chores such as testing pupils' computing abilities and completing schemes of work. However, he agrees with [6] that instructors used blended learning to maintain their established methods rather than to modify them.

3.1.3. Benefits of Blended Learning

Blended learning pedagogies have been found as an effective technique of increasing student collaboration and academic performance [6]. Blended learning, according to [6], enhances student growth and accomplishment in the classroom. [6] advocated adopting blended learning to enhance collaborative learning, interactive learning, and actual learning by emphasizing the need to go beyond individual needs and concentrate on the social context of learning. Blended learning delivery, according to [6], helps to enhance student learning outcomes by leading in higher grades, more knowledge, and a better understanding of theories and concepts. Similar research [6] discovered that using blended learning in teaching offers students with enough help to increase their levels of engagement and progress. [6] It has been argued that the increased use of blended learning in education will improve student learning and achievement if the emphasis is on the student's social and cognitive presence in the classroom. [6].

Additional evidence for this assertion is that technology-assisted teaching increases student engagement and achievement rates in blended learning. [6] agreed that blended learning types of study are associated with greater levels of student achievement and supported comparative viewpoints. Using blended learning technology in school creates ties among students because of the collaboration, mentoring, and coaching that happens as part of social presence [6]. This [6] shows that

by employing technology to foster social presence in the classroom, kids may learn cooperatively through blended learning. These technological solutions can allow students to talk both asynchronously and synchronously while exploiting the interactive features of blended learning [6].

Researchers established a link between employing Web 2.0 technologies in a blended learning setting and enhanced learning outcomes and final grades. [6]. According to the research's conclusions, students had outstanding success with the LLMS, which boosted their understanding of the course through the exchange of study material. A comparable research [6] Furthermore, research was presented demonstrating that the use of blended learning in the classroom gives students additional opportunities to become active participants in their learning environment. Although studies suggest that this technique enhances student engagement and performance [6] the ability of teachers to adapt and apply blended learning is questionable. According to [6], blended learning benefits students by improving academic achievement, increasing the variety of learning options, and improving the student experience.

According to him, higher education institutions should be encouraged to facilitate the development of a broader range of blended learning resources to support students' learning, especially with the advent of increased, fast, and reliable internet access for students due to the benefits students gain from it. [7] claimed that blended learning might improve learners' comprehension and application of newly gained abilities. Similarly, according to [6] blended learning has grown into a learning mode that is increasingly being employed in educational and training contexts as an effective strategy for boosting learning and training results when compared to online learning alone. Blended learning is being marketed as a teaching and learning instructional tool as a source of collaboration, engagement, and motivation to help both teachers and students create a learning environment. [6]. As with prior curriculum modifications, educational implementers will become concerned and preoccupied with the role instructors play in ensuring the learning platform's efficacy. [6] claimed that blended learning is the most feasible educational technique for improving student performance. Their findings underscored the need to make active efforts to ensure that blended learning experiences provide high levels of student engagement, an instructor-supportive environment, and opportunities to ensure learner satisfaction.

The key findings of the study acknowledged blended learning teaching as the most realistic instructional technique capable of improving student performance. [6] also discovered that students who employed the mixed learning delivery strategy performed better academically. [6] A comparable study found that the benefits of mixed delivery include improved test performance and engagement in a customised online learning environment. Furthermore, universities that employ blended learning had lower student dropout rates and higher success rates, demonstrating that adopting blended learning in teaching increases student academic achievement [6]. Given these facts, we may conclude that secondary schools must prepare their students and, as a result, their instructors for the implementation of blended learning in their

classrooms.

3.1.4. Problems to the Integration of Blended Learning in Education

Some research identified problems in successfully integrating blended learning into tertiary education programs, which deviated from the benefits of employing blended learning. While the preceding studies found that blended learning had numerous advantages, including increased student engagement and performance, some believed that blended learning has a detrimental influence on student performance. For example, [6] created impediments to student progress in the integrated learning setting that were deemed critics. Their research discovered no discernible difference in academic achievement between traditional and technology-assisted training. Despite the strong premise that blended learning reduces student effort, [30] discovered that increasing workload for students who must now go beyond classroom learning to online learning is quite difficult. [31] discovered that when the amount of online and face-to-face work rises, students fall behind on their homework. He also discovered that because a large portion of the content is available online, students may be unable to connect with it, particularly if they are unable to access or comprehend the material offered to them. The novelty of engaging in blended learning perplexes students, who must now master new technologies such as accessing discussion forums and chat rooms [30].

The findings of the [6] research indicated that blended learning teaching allowed for higher outstanding student achievement, however these findings contradicted those of comparable studies in our review. Similarly, the [6] study indicated that blended learning had no effect on student academic achievement. Using different research that contrasted face-to-face with blended learning to support their claim, the authors asserted that student performance and success are unaffected by the delivery mode utilized in the teaching and learning process [6]. They contend that pupils perform equally well in both learning settings. [6] examined some of the challenges that teachers face while teaching in a mixed-learning environment. Some of these challenges revolved around recruiting for relevant training, time limits involved with digitizing and uploading content, and a lack of technical help to efficiently use the platform.

More importantly, they emphasized the significance of technical help for instructors in the use of technology. Designing successful blended learning environments will need a consideration of both the teachers' technological skills and the students' learning ability [6]. [6] It was also revealed that instructors saw blended learning as a cognitive and physical challenge because they had to build modules, prepare materials for uploading, provide comments, and grade online tests. Furthermore, their research revealed that substantial effort is required for blended learning to be used effectively. [6] found similar findings in their analysis. Time constraints, a lack of competence, an inadequate support structure, and an increased workload were highlighted as barriers to effectively creating and implementing blended learning strategies to improve student performance in this study. The instructional design, collaborative activities, and learning content structure of the course will all have an

impact on learner pleasure in the online environment [6].

According to [6] the new roles of teachers in blended learning include developing instructional and learning materials, monitoring students' learning processes, coordinating course activities, delivering course content, and protecting learning environments. Despite the increased interest in blended learning, there will be obstacles if instructors are not appropriately qualified to do these jobs [6]. [32] indicated that when instructors struggle with technology, it may lead to a failure to employ technology in the classroom. In turn, [6] finds that if instructors do not have the time to employ blended learning teaching resources, they will find it difficult to use them. Several research in this study expressed similar views on the necessity for both students and teachers to have additional time to prepare content and manage blended learning classroom activities [33]. According to studies, promoting blended learning necessitates the instructor taking an active role. [6] discovered comparable difficulties related to students' ICT competency and instructors' attitudes regarding the use of ICT for teaching and learning. As a result, even when the necessary technologies are readily available, all of these factors may contribute to instructors' inability to integrate technology into their classroom [34]. The most difficult challenge will then be identifying how the instructor can successfully use technology to ensure the student's commitment while taking into account the specific students' learning styles. The repercussions of these discoveries must be addressed by the institution's opportunities for professional advancement and technical help.

Acceptance of new technology may have a substantial impact on the effectiveness of blended learning development. According to [6,] core faculty consider the development of online-based activities to be time-consuming and are more likely to avoid technology-facilitated interactions. A six-month preparation time is advised for blended learning integration, with a heavy emphasis on persuading academics to embrace blended learning methodology and sharing best practices with those who have used blended learning effectively [6]. A key barrier for schools implementing blended learning is the difficulty instructors have in acquiring new learning technology skills to foster an online learning community and maintain online discussion boards [35]. As a result, creating successful blended learning environments will need an analysis of the teachers' technical knowledge as well as the students' learning capacity. While the benefits of blended learning are evident, the key is to be able to use it successfully by combining the advantages of online teaching resources with face-to-face materials while maintaining student motivation and instructor assistance.

3.1.5. Strategies Teachers Can Use To Integrate Blended Learning in Teaching

Blended learning requires access to fully-equipped computer labs, reliable internet, and video conferencing. Infrastructure plays a crucial role in the implementation of blended learning. Schools should have not only competent classrooms, but also well-equipped computer labs, internet access, and sufficient machines to accommodate all students. [6]. The research focuses on the issues that affect the use of blended learning to

improve student achievement. Furthermore, teachers can utilize forums to serve as task reminders, help in completing such assignments, and summarize evaluations of the conversation subject. The blended learning activities called for the use of live discussions and social media as part of the teaching and learning process to increase student academic attainment. As a consequence, the promptness with which academics offer feedback will raise interest and incentive to complete the project, while also clearing up any doubt on the subject matter on the platform for instructors.

Regarding the course format, [6] discovered that the quick speed of class deadlines for tasks, as well as the quality of content offered, significantly impacted students' academic achievement in the online setting. Blended learning also builds a digital community, allowing students to connect socially and cognitively while also participating in reflective practice to retain learning. These aspects work together to create a supportive environment that improves student engagement, performance, and enjoyment in the blended learning setting [6]. When compared to traditional face-to-face education, blended learning gives teachers the option of enhancing student engagement and lowering dropout rates [6].

One of the key aims of a blended learning strategy is to personalize training to the specific needs of each learner. If, on the other hand, the school chooses a technology-based curriculum that lacks scaffolding and adaptive technology, student learning will be no more personalized than traditional "one size fits all" training. As a result, advanced and on-level students may get distracted or bored, while struggling students may become irritated if the task becomes too difficult. [6]. Teachers should make certain that the blended learning approaches they choose encourage rather than discourage pupils from engaging in activities. Instructors' problems in adopting new learning technology skills to establish an online learning community and administer online discussion boards in blended learning is a key hurdle for higher education institutions using blended learning [36].

As a result, creating successful blended learning environments will involve a thorough analysis of both the teachers' technological expertise and the students' learning ability. While there are clear benefits to blended learning, the key is to be able to use it successfully by mixing the benefits of online teaching resources with face-to-face materials while maintaining student motivation and instructor support [6]. Teachers should be well-versed in the notion of blended learning, as well as properly educated and proficient in combining both methodologies and technology [6]. According to [6] instructors should be educated to create digital information that students may access online. They should be well-versed in internet surfing and vocabulary, as well as be aware of all websites that kids can utilize when learning online. Teachers should understand how to use blogs, YouTube, video conferencing software such as Skype and Google, and social networking sites for instructional reasons [37]. According to [38], in order to implement blended learning in their classrooms, teachers must have a scientific mindset. They should be able to observe well, be positive, and solve problems [39]. A scientific mindset can assist instructors in dealing constructively with the failures they

may meet while working on this unique approach, as well as in objectively analyzing the surroundings. According to [6,] the proper attitude will naturally trickle from teachers to pupils. The system, according to [6], should be adaptable, with a flexible schedule system. To make the system more adaptable, provisions should be created for online examinations [40]. When the appropriate technology tools are deployed, students' experiences may be tracked in real time. Teachers may see data that shows which students have finished each skill area and which students have faced an impediment that necessitates individual or small group instruction. These statistics shape instructional planning in the classroom, allowing teachers to be more focused and efficient in focusing on the pupils who need it the most. [6] discovered that teachers who utilize blended learning simply for lesson planning or note sharing will not be able to improve students' cognitive presence. To avoid this, [41] recommended that instructors use the most appropriate teaching strategies that will promote effective results in learning settings for both students and teachers.

3.2. Conceptual Framework

Several models for technology adoption and prediction have been developed; however, the Unified Theory of Acceptance and Use of Technology (UTAUT) was used for this study since it is widely used and well-validated among academics. [42] established the Unified Theory of Acceptance and Use of Technology (UTAUT) based on conceptual and empirical commonalities from numerous technology acceptance models. Performance expectancy, effort expectancy, social influence, and enabling conditions are the four factors that explain user adoption and usage of technology in the model. The degree to which employing a system will increase the student's performance is referred to as performance expectation. This model has been shown to be the most accurate in terms of predicting intentions and behavior. [43]. According to [44], effort expectation refers to how easily individuals feel blended learning can be implemented.

The degree to which a user feels that significant individuals should utilize the system is referred to as social influence [45]. According to research, social impact is favorably associated to one's inclination to utilize technology. The amount to which employees perceive support for blended learning from corporate policies, procedures, and technical infrastructure facilitates this relationship.

The literature review included data that, when combined, demonstrates approaches used by instructors to build and sustain student successes and academic performance in a blended learning situation. The authors represented a diverse population as well as those who shared traits with the technical and vocational institutions under consideration. Their many research' conclusions gave detailed summaries of the consequences of blended learning experiments done using constructivist theory. While each study presented was applied to a distinct context, real and practical examples of using a blended learning method demonstrated the promise and challenges that are applicable to best practices.

In the literature, several authors handled the research

issues in various ways, but each included a discussion of the numerous challenges and advantages those tertiary institutions faced when employing blended learning as a solution. Another common argument raised by most writers is that, when correctly implemented, blended learning is an excellent strategy for developing and sustaining student achievement and academic success in a mixed-learning setting.

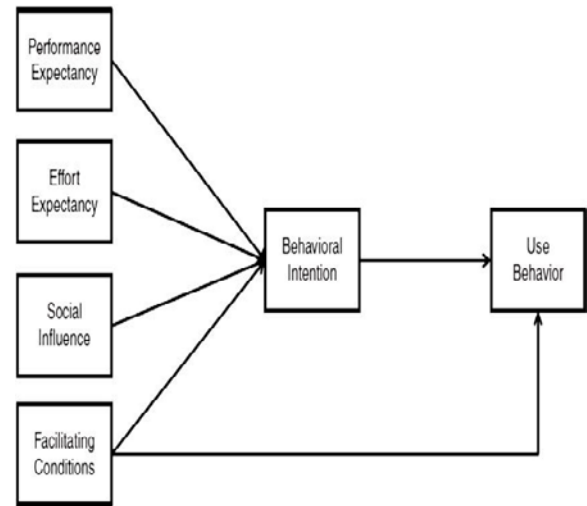


Figure 2. Model of Unified Theory of Acceptance and Use of Technology

4. Methodology

A researcher's methods for a study have significant implications for the outcome. This chapter looks at the research procedure we will use to collect and present field data. The research methods encapsulate the research approach, research design, population and unit of analysis, sample size estimation, sample selection, sources of data, data collection instruments, data collection methods, and data analysis.

4.1. Research Design

This study adopted a mixed-methods research approach. Questionnaires were employed as data collecting techniques for the study in order to obtain in-depth and precise information. In terms of statistics, the mixed methods approach combines quantitative and qualitative research methodologies and concepts in a single study to provide a logical and practical option for reaching the study's goal. A concurrent mixed-method approach was utilized in the study to collect diverse but complimentary data on the sample in order to better examine the research topic. This approach was chosen to combine the distinct strengths and non-overlapping shortcomings of quantitative techniques (big sample size, trends, and generalization) and qualitative methods (small sample size, details, and in-depth) [46]. [47] discusses some of the method's advantages, such as obtaining detailed and reliable information from respondents because the questionnaire was employed for the study. [48] emphasizes the reasons why researchers choose the mixed approach, which is to get a comprehensive knowledge by

combining qualitative and quantitative research. The mixed-methods approach has its own set of difficulties, such as the requirement for significant data gathering and the time-consuming nature of evaluating both textual and numerical data.

The mixed method technique was used for this research to obtain in-depth and reliable information on the impact of blended learning in higher learning institutions: a case study from Kumasi Technical University.

4.2. Research Methods

The study included descriptive and analytical research approaches based on a mixed-method methodology. Analytical research also allows the researcher to use previously known facts or information and evaluate them in order to produce a critical evaluation of the material. It entails a thorough examination and review of available data in an attempt to explain a complicated event. Analytical research, on the other hand, was used to provide vivid and detailed knowledge and information on the impact of blended learning in higher learning institutions: a case study of Kumasi Technical University. In the words of [49], "descriptive research may be characterized as simply the attempt to determine, describe, or identify what is, while analytical research attempts to establish why it is that way or how it came into being." Descriptive research, according to [50], aims to shed light on existing challenges or problems through the process of data gathering, which enables them to explain the circumstance in greater detail than was previously feasible without using a method. It is possible to say that descriptive methods or study are employed to characterize different facets of the phenomenon. It's employed to characterize a sample population's traits or behavior. When it comes to the administration and analysis of data, the descriptive research approach is typically quick and affordable. Descriptive research is primarily used to describe, clarify, and validate research findings. The descriptive method's ability to combine qualitative and quantitative data collection techniques is a significant benefit. The descriptive research technique was used by the researcher because it gave her the chance to use both qualitative and quantitative data to examine the effects of blended learning in higher education institutions: a case study from Kumasi Technical University.

4.3. Population for the Study

The population is the aggregate of all cases conforming to some designated specifications set [51]. The term population refers to the complete set of individuals (subjects), objects, or events that have common observable characteristics that the researcher is interested in studying. [52] also described the population as the total collection of elements about which some inferences can be made. The population for the study was made up of lecturers and students at Kumasi Technical University. The population of the study was twenty (20) lecturers and hundreds (100) students of Kumasi Technical University, which will sum up to 120 people.

4.4. Sample and Sampling Techniques

A sample is a subset or a portion of the broader population being researched for the purpose of gathering data in a research study. It is the percentage of a study's population from which data are gathered for analysis. He makes the argument that gathering data from a sample that accurately represents the full population is just as valuable as gathering data from the entire population.

4.5. Sampling Design

Probability and non-probability sampling are the two categories of sample designs utilized in research. The researcher is familiar with and employs probability sampling, and each participant in the study has an equal chance of being chosen. However, simple random sampling and purposive sampling methods were used.

4.6. Simple Random and Sampling Techniques

Simple random sampling is a probability sampling technique that ensures that every member of the target population and every prospective sample with the appropriate size has an equal chance of being chosen. To choose participants for the investigation, the researcher used a straightforward random selection procedure. According to a straightforward random selection procedure that happens at random, without any kind of prejudice and offers each student an equal chance of being chosen, the researcher chose the study's participants from among the students. This sample method was applied for the sake of convenience and served to provide students with an accurate picture of the population.

However, simple random sampling has the benefit of being straightforward, as its name suggests, and accurate. Simple random sampling has a significant advantage over other sample techniques for studying a bigger population due to these two features. The benefits of using a basic random sample also include its simplicity and accuracy of depiction. There is no simpler way than simple random sampling to select a study sample from a bigger population. There is no need to separate the population into subpopulations or go beyond randomly selecting the required number of research subjects from the broader group. Once more, the only requirements are that the selection process be random and that every member of the larger population have an equal chance of being chosen.

4.6.1. Purposive Sampling

Purposive sampling is a sampling technique that is not based on probability; instead, the researcher chooses participants for a study on the basis of their expert knowledge that would be of great value to it and their willingness to refrain from participating in the study. To pick the workers for the study, the researcher used the purposive sampling method. To help with gathering in-depth information for the study, it was once more employed to choose the Technical University. The purposive sampling method, on the other hand, has a

significant drawback and can be extremely vulnerable to researcher bias, regardless of the sort of purposive sample employed. Because of this, it could be challenging to persuade the reader that research using purposive sampling results in theoretical, analytical, or logical conclusions.

We will employ a purposive sampling strategy in this study since the instructors and students are expected to have knowledge that will be useful to the investigation.

4.7. Data Collection Instruments

Data collection is the process of gathering and measuring information on targeted variables in an established system, which then enables one to answer relevant questions and evaluate outcomes. While methods vary by discipline, the emphasis on ensuring accurate and honest collection remains the same. The goal of all data collection is to capture quality evidence that allows analysis to lead to the formulation of convincing and credible answers to the questions that have been posed. Examples of data collection instruments are informal and formal surveys, direct and participatory observation, focus groups, expert opinion, case studies, questionnaires, and literature searches. Two data collection techniques that are commonly used in mixed-method approaches are interviews and questionnaires. The research instrument that was employed for the study is a questionnaire.

4.8. Questionnaire

A questionnaire is a research tool made up of inquiries and directives intended to elicit responses [53]. A questionnaire is a simple survey method that enables researchers to examine substantial population samples that are dispersed across enormous geographic areas. The cost of using questionnaires for the study was significantly lower. The likelihood of bias in the study is limited via questionnaires. Again, using questionnaires makes it possible for more objective results to be achieved because responses are gathered in a consistent manner. Despite the importance of using questionnaires in the study, Dornyei asserts that many people have questioned its validity. According to Dornyei's summary of the obstacles to authenticity, one of these issues is the presumption that people don't always share truthful information about themselves. Furthermore, according to Dornyei, some respondents will make a "good guess" regarding the preferred, accepted, or anticipated response, and some will do so even if the response is untrue.

There were three sets of questionnaires given. Each of the questionnaire's four sections was created to elicit answers on the research constructs. On the questionnaire, the demographic data for both tutors and students was listed first. Three demographic data points about the participants' ages, genders, and educational backgrounds

were requested by the study. As moderators for respondents, three of them—respondents' ages, genders, and educational backgrounds—were chosen. The second section similarly used an importance scale, using a four-point scale with 1 denoting "not important," 2 denoting "least important," 3 denoting "important," and 4 denoting "strongly important" in order to identify the variables influencing the effective implementation of blended learning. Section three was also based on the Likert scale, which adopted a four-point scale ranging from 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree to know the perspectives of instructors and students regarding the study. The focus of section four was how blended learning affected the academic achievement of the students.

The questionnaire is thought to be the most adaptable data collecting instrument and speeds up data collection considerably. A questionnaire can be used to give members the chance to share their opinions, most of which are unknown, thereby energizing receptivity and trustworthiness.

4.9. Type of Data

Primary data was the source of information gathered for the investigation. All the data gathered from survey participants at Kumasi Technical University served as the study's main data sources. Surveys sent to students and teachers at Kumasi Technical University provided the majority of the data collected. As a result of coming from a source and being specifically gathered for the study, primary source data gathering has the major benefit of being exceptionally dependable for researchers.

4.10. Data Analysis Plan

Data analysis entails a researcher's effort to get a deeper meaning and comprehension of the information gathered, as well as to interpret it in a way that is understandable to everybody. The techniques of the statistical analysis software package known as the Statistical Package for Social Sciences 28.0 were used to alter the data obtained from the questionnaires distributed via Google Forms. First, the information collected from the respondents was organized for editing. Following alteration, they were coded using numerical values for SPSS Version 28.0's variable view. The keying process was then finished by entering the data into the data view. The information gathered was then explained and organized in a table. For the debate and presentation in the following chapter, it was further extracted. To make the data more understandable and clearer, tables were employed to convey it. The information gathered was also statistically explained using frequencies and percentages to explain the information pertaining to respondents' qualifications and years of teaching, as well as their sex, age, and experience, among other things.

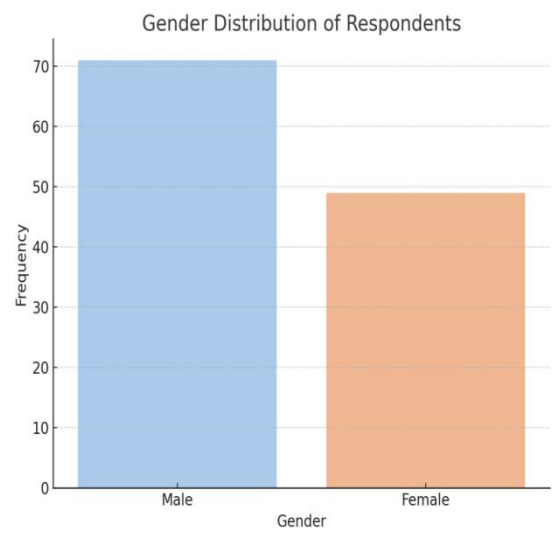


Figure 3. Demographic InformationGender Distribution

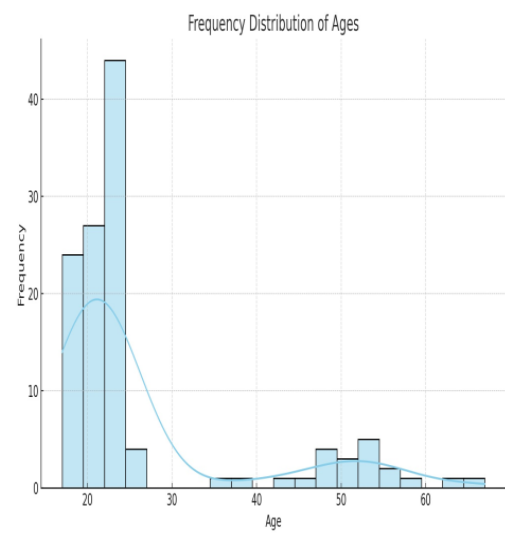


Figure 4. Age Distribution

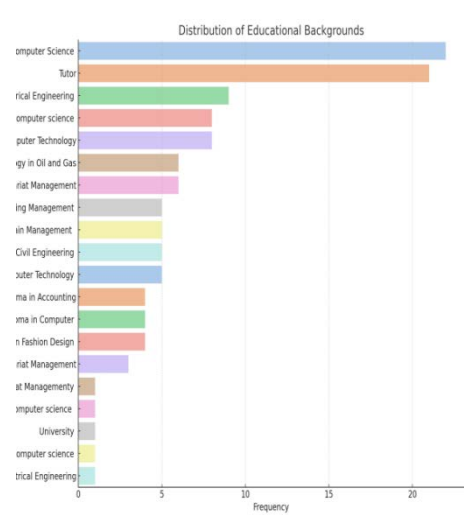


Figure 5. Educational Background Education Background

- **Male:** The number of male respondents is noticeably higher than that of females.
- **Female:** Fewer female respondents participated in the survey compared to males.
- The majority of respondents are between the ages of 20 and 25.
- The distribution appears to be slightly right-skewed, indicating a few older respondents.

The horizontal bar chart above provides insights into the variety and frequency of educational backgrounds among the respondents:

- A diverse range of educational backgrounds are represented, including Higher National Diplomas, Bachelors of Technology, and even Tutors.
- The most frequent educational background is "Higher National Diploma in Computer Science," followed by "Tutor."
- Some educational backgrounds appear only a few times, indicating that they are less common among the respondents.

This diversity in educational backgrounds could provide a rich perspective on the impact and implementation of blended learning, as different educational programs might have different requirements and outcomes.

4.10.1. Implementation Factors

The table below shows factors based on their importance in the successful implementation of blended learning (on a scale of 1 to 4, where 1 is least important and 4 is highly important).

Table 1. Benchmark for blended learning

Statement	Highly Important	Important	Least Important
Availability of technological infrastructure and resources	56 46.67%	48 40.00%	11 9.17%
Adequate training and support for instructors	41 34.17%	61 50.83%	18 15.00%
Well-designed learning materials and resources	74 61.67%	32 26.67%	12 26.67%
Effective communication and collaboration tools	47 39.17%	62 51.67%	11 9.17%
Opinions on Clear Guidelines and Expectations for Students	68 56.67%	41 34.17%	11 9.17%
Continuous monitoring and evaluation of the blended learning process.	58 48.33%	51 42.50%	11 9.17%

The table below shows the level of agreement with the following statements regarding blended learning (on a scale of 1 to 4, where 1 is strongly disagree and 4 is strongly agree).

Table 2. Tutors' Perspective On Blended Learning

Statement	Strongly Agree	Agree	Dis-agree	Strongly Disagree
Blended Learning Enhancing Student Engagement and Participation	80 66.67%	34 28.33%	6 5.00%	
Blended Learning Allowing for Personalized and Self-Paced Learning	59 49.17%	55 45.83%		6 5.00%
Blended Learning Improving Interaction and Collaboration Among Students	86 71.67%	16 13.33%	12 10%	6 5%
Blended Learning Facilitating the Integration of Multimedia and Interactive Content	65 54.17%	38 31.67%	6 5.00%	11 9.17%
Blended Learning Providing Flexibility in Terms of Time and Location	97 80.83%	11 9.17%	-	12 10%

Table 3. Learners Perspectives on Blended Learning

Statement	Strongly Agree	Agree	Dis-agree	Strongly Disagree
Whether Blended Learning Has Increased Motivation to Learn	75 62.5%	17 14.17%	11 9.17%	17 14.17%
Whether Blended Learning Has Improved Understanding and Retention of Course Materials	54 45%	38 31.67%		28 23.33%
Blended Learning Provides Opportunities for Active Learning and Practical Application	69 57.50%	18 15%	16 13.33%	17 14.17%
Blended Learning Allows Access to Resources Outside Traditional Hours	64 53.33%	22 18.33%	17 14.17%	17 14.17%
Blended Learning Enhances Ability to Collaborate and Communicate with Peers	75 62.50%	17 14.17%	11 9.17%	17 14.17%

4.10.2. Correlation Analysis

The values range from -1 to 1, with positive values indicating a positive correlation and negative values indicating a negative correlation. A value close to 0 indicates little to no correlation.

Learner's Perspective Variables

1. Blended learning enhances student engagement and participation:

- This variable shows a strong positive correlation with all other learner perspective variables, particularly with "Blended learning has enhanced my ability to collaborate and communicate with peers" (0.978). This implies that students who find blended learning to enhance their

engagement are also likely to find it beneficial for communication and collaboration.

2. Blended learning allows for personalized and self-paced learning:

- It is also strongly correlated with other learner perspective variables, particularly "Blended learning enhances student engagement and participation" (0.918). This suggests that students who appreciate the personalization aspects of blended learning are also more likely to find it engaging.

3. Blended learning improves interaction and collaboration among students:

- Exhibits a moderate to strong positive correlation with all the learner's perspective variables, notably "Blended learning enhances student engagement and participation" (0.936). This suggests that when students find blended learning to be interactive, they are also likely to find it engaging.

4. Blended learning has allowed me to access learning resources and support outside of traditional classroom hours:

- Has a moderate to strong positive correlation with all other learner perspective variables except "Continuous monitoring and evaluation of the blended learning process" (0.931). This indicates that the flexibility to access resources is often accompanied by benefits in other areas of blended learning but not necessarily in monitoring and evaluation.

5. Blended learning has enhanced my ability to collaborate and communicate with peers:

- Strongly correlated with all other learner perspective variables, especially "Blended learning enhances student engagement and participation" (0.978). This implies that effective communication and collaboration are closely tied to student engagement in a blended learning environment.

Implementation Factors

1. Adequate training and support for instructors:

- It shows a moderately positive correlation with "Blended learning has allowed me to access learning resources and support outside of traditional classroom hours" (0.673) and "Blended learning improves interaction and collaboration among students" (0.5).

2. Effective communication and collaboration tools:

- Strongly correlated with "Clear guidelines and expectations for students" (0.771) and "Continuous monitoring and evaluation of the blended learning process" (0.74). This suggests that effective communication tools are crucial for setting clear guidelines and for the monitoring and evaluation process.

3. Clear guidelines and expectations for students:

- Has a strong correlation with "Continuous monitoring and evaluation of the blended learning process" (0.821) and "Effective communication and collaboration tools" (0.771).

4. Continuous monitoring and evaluation of the blended learning process:

- Strongly correlated with "Clear guidelines and expectations for students" (0.821) and "Effective communication and collaboration tools" (0.74), suggesting these factors are often considered together.

Correlation Between Tutor's Perspective And Implementation

- **Strong Positive Correlations:** Some aspects of "Tutor's Perspective," such as "Blended learning provides flexibility in terms of time and location for both students and instructors," show strong positive correlations (greater than 0.6) with "Adequate training and support for instructors" under "Implementation Factors."
- **Moderate Positive Correlations:** Other aspects like blended learning, which improves interaction and collaboration among students," also have moderate positive correlations (around 0.5 to 0.6) with adequate training and support for instructors."
- **Weak Positive Correlations:** There are some weak positive correlations (less than 0.3) between various aspects of "Tutor's Perspective" and "Availability of technological infrastructure and resources" under "Implementation Factors."
- **Weak to No Correlations:** Some aspects like "Effective communication and collaboration tools" under "Implementation Factors" show weak to no correlations (closer to 0) with various aspects of "Tutor's Perspective."

5. Discussion

5.1. Correlational Analysis ($\rho(X,Y) = \text{cov}(X,Y) / \sigma_X \sigma_Y$)

The Correlation Analysis aims to understand the relationships between various aspects of the learner's perspective and implementation factors in blended learning environments. The results indicate several strong correlations among these variables, suggesting the interconnectedness of various elements that contribute to the success or failure of blended learning.

5.1.1. Correlation Between Learners' Perspective and Implementation

Strong Correlations among Learner's Perspective Variables

Several variables from the learner's perspective, such as "Blended learning enhances student engagement and participation," "Blended learning allows for personalized and self-paced learning," and "Blended learning has enhanced my ability to collaborate and communicate with peers," show strong positive correlations. These findings align with the literature emphasizing student engagement's importance in blended learning environments. For instance, Garrison and Kanuka (2004) posit that blended learning can be instrumental in promoting an integrated learning experience, thus enhancing student engagement.

Additionally, the positive correlation between variables like "blended learning allows for personalized and self-paced learning" and "blended learning enhances student engagement and participation" [54] argues that personalized learning can significantly impact student engagement. The personalization of learning materials and pace can cater to different learning styles, thereby increasing engagement and, in turn, academic performance.

5.1.2. Implementation Factors and Their Correlations

The study also explores several implementation factors, such as "Adequate training and support for instructors," "Effective communication and collaboration tools," and "Clear guidelines and expectations for students." These variables show moderate to strong correlations with each other but not as much with the learner's perspective variables. This finding suggests that while these factors are crucial for implementing a successful blended learning environment, they may operate more at the administrative and operational levels rather than directly impacting the student's learning experience.

This observation aligns with [55], who stresses that implementation factors often act as the backbone of blended learning but may not be explicitly recognized by students. They indicate that successful blended learning implementation requires a well-thought-out strategy that involves instructor training, technological support, and clear guidelines, among other factors.

5.1.3. The Interconnectedness of Blended Learning Elements

The various elements of blended learning—from student engagement to instructor support—are interconnected. Improvements in one area could potentially lead to benefits in other areas, and challenges in one area could indicate broader issues that need to be addressed. This extensive interconnectivity implies that a comprehensive approach is crucial for the successful implementation and experience of blended learning. This notion is supported by Alammery et al. (2014), who argue that blended learning is a complex ecosystem that involves various stakeholders, including students, instructors, administrators, and even policymakers.

5.1.4. Correlation Between Tutor's Perspective and Implementation

Strong Positive Correlations (> 0.6):

The aspect of blended learning providing flexibility in terms of time and location for both students and instructors shows strong positive correlations with adequate training and support for instructors. This is consistent with literature that emphasizes the importance of instructor training in the effective implementation of blended learning [56].

Moderate Positive Correlations (0.5 to 0.6):

Aspects like 'Blended learning improves interaction and collaboration among students' also have moderately positive correlations with 'Adequate training and support for instructors'. This aligns with studies that highlight the role of faculty development in fostering student engagement [57].

Weak Positive Correlations (< 0.3):

There are weak positive correlations between various aspects of 'Tutor's Perspective' and 'Availability of technological infrastructure and resources'. While infrastructure is a necessary component, its impact on blended learning outcomes may be less direct, as suggested by some studies [58].

Weak to No Correlations (0):

Some aspects, like effective communication and collaboration tools, show weak to no correlations. This

could imply that the quality of communication tools alone may not be a significant factor in shaping tutors' perspectives, a notion supported by research that stresses the importance of pedagogical strategies over tools (Graham, 2006; Oliver & Trigwell, 2005).

5.1.5. Conclusion and Recommendation

Evidence from Kumasi Technical University was used in the study to examine the impact of blended learning. Purposive sampling was used to get information from both tutors and students about the impact of blended learning on campus. Conclusions from relevant related literature were captured to authenticate the findings of the study. The summary of the findings is presented as follows:

- Based on the study's goal of finding key factors impacting effective implementation, data was evaluated and presented using bar graphs.
- With a slightly right-skewed distribution displaying a few older respondents, the bulk of respondents are between the ages of 20 and 25.
- There is a diverse range of educational backgrounds represented, including Higher National Diplomas, Bachelor of Technology, and even tutors.
- Important factors include technological infrastructure, adequate training and support for instructors, well-designed learning materials and resources, effective communication and collaboration tools, clear guidelines and expectations for students, and continuous monitoring and evaluation of the blended learning process.

The level of agreement with statements regarding blended learning is strong, with enhancing student engagement and participation, allowing for personalized and self-paced learning, and improving interaction and collaboration among students being the most agreed-upon.

5.1.6. Recommendation

The following recommendations are hereby presented; A similar study must be conducted on a larger group of subjects to determine if the following findings will be established;

- Research should be conducted to identify the key factors influencing the successful implementation of blended learning at Kumasi Technical University.
- Research should be conducted to ascertain the views of tutors and learners on blended learning at Kumasi Technical University.
- Research should be done to assess the impact of blended learning on students' academic performance at Kumasi Technical University.

6. Conclusion

It can be concluded that blended learning has impacted the majority of students' academic performance. However, they noted how they think Blended learning has positively impacted students' academic performance. Such academic performance includes; Allowing them to engage with course materials in multiple ways. The flexibility to access resources and review lectures at their own pace has improved understanding and retention. Moreover, the

interactive elements in the online components have made learning more enjoyable and effective. Students are also able to collaborate and discuss ideas with peers, enhancing their critical thinking skills. Overall, blended learning has led to better academic outcomes and increased student motivation

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