West African Journal of Open & Flexible Learning
Volume 12, Number 1, 2023

Assessing the Impact of the Blended Learning Model on Student Learning Outcomes: A Case of KNUST MELS-IDL

Évaluation de l'Impact du Modèle d'Apprentissage Hybride sur les Résultats d'Apprentissage des Etudiants : le cas de KNUST MELS-IDL

Seth Wiredu[1*], Eric A. Asante[2] & Hannah Alagbe[3]
[1, 2] Kwame Nkrumah University of Science and Technology Kumasi, Ghana
[3]National Road Safety Authority, Ghana

***Corresponding author:** ✉sethwiredu432@gmail.com

Abstract

The study entails an investigation into the impact of blended model on students' learning outcomes. The study was carried out at the Master of Philosophy (MPhil) Educational Innovations and Leadership Science (MELS) at the Institute of Distance Learning, Kwame Nkrumah University of Science and Technology. The study looked at areas such as identification of the components of the model that makes it helpful in distance learning, assessing the advantages and challenges of the model, and impact of the model on learning outcomes. The theoretical frameworks of the study are the Complex Adaptive Blended Learning System and the Community of Inquiry. The research utilised a mixed method approach, and information was gathered through semi-structured surveys, interviews, and observations. The study involved twenty-five participants consisting of twenty distance learning students and five instructors. The results indicated that the most impactful aspect of the blended approach lies in the integration of both online systems and conventional in-person instruction. It as well has some advantages which include flexibility, recorded videos being available after lectures, with internet connectivity being the main challenge. The impact of the model can be assessed in terms of its ability to help students understand a particular topic, and by comparing it to the conventional in-person instruction.

[1] https://orcid.org/0009-0007-5995-1117 [2] https://orcid.org/0000-0003-0673-8885

The study will help the institution figure out the actual impact of the model on students' learning outcomes, and the research should be replicated on other levels of learning institutions like undergraduate studies.

***Keywords*:** Blended Learning Model, Learning Outcomes, Students, Impact

Résumé

L'étude porte sur une recherche sur l'impact du modèle mixte sur les résultats d'apprentissage des étudiants. Elle a été réalisée dans le cadre du Master of Philosophy (MPhil) Educational Innovations and Leadership Science (MELS) à Institute of Distance Learning, Kwame Nkrumah Université of Science and Technology. L'étude examine des domaines tels que l'identification des composants du modèle qui le rendent utile dans l'enseignement à distance, l'évaluation des avantages et des défis du modèle, et l'impact du modèle sur les résultats d'apprentissage. Les cadres théoriques de l'étude sont le Système d'Apprentissage hybride Adaptatif Complexe et la Communauté de l'Enquête. La recherche a utilisé une approche mixte, et les informations ont été recueillies à travers des études semi-structurées, des entretiens et des observations. L'étude a impliqué vingt-cinq participants, dont vingt étudiants en apprentissage à distance et cinq instructeurs. Les résultats ont indiqué que l'aspect le plus impactant de l'approche hybride réside dans l'intégration des systèmes en ligne et de l'instruction conventionnelle en présentielle. Elle présente également des avantages tels que la flexibilité, la disponibilité des vidéos enregistrées après les cours, avec la connectivité Internet constituant le principal défi. L'impact du modèle peut être évalué en termes de sa capacité à aider les étudiants à comprendre un sujet particulier, en le comparant à l'instruction conventionnelle en personne. L'étude aidera l'institution à déterminer l'impact réel du modèle sur les résultats d'apprentissage des étudiants, et la recherche devrait être reproduite dans d'autres niveaux d'institutions d'apprentissage, comme les études de premier cycle.

***Mots-clés* :** Modèle d'apprentissage hybride, Résultats d'apprentissage, Étudiants, Impact

---

Introduction

It is crucial to acknowledge that education has a role to fulfil in the growth of an individual and the economy. The acquisition of

knowledge, skills, and attitude is one major aim of education to an individual. Two primary categories of education exist: Formal and Informal Education. Education is expressed in all aspects of life; from a daughter observing the mother cook, a father teaching the son to undertake domestic menial jobs in the house to an older sibling teaching the younger to move a vehicle. The Formal Education is carried out basically through teaching and learning. Thus, there is a teacher to teach and a student to learn. This procedure requires teachers to present their lessons by using appropriate methodologies that will help students achieve academic aims or goals. Allen (1971) opines that the intent of education can be "Ultimate and Immediate" as the "ultimate" aim is similar to the self-actualisation goal or need of an individual on the Maslow's hierarchy of needs. When students' academic achievements are not sufficiently motivating, their likelihood of leaving school increases and this leads to the question of "what propels academic success among students." The "Immediate" can be said to be the basic need on the Maslow's hierarchy.

Arnaiz-Sanchez (2020) relate academic performance to teaching methodology, as various methods of teaching are available for sharing knowledge with children of school going age. Some of these teaching methods like lectures and recitations are teacher-centred as others like Problem-Based Learning are student-centred, but education has come of age where teaching and learning are demanded to be more student-centred (Brown, 2008). Student-centred learning is an educational philosophy crafted to address the unique requirements of each student. Its emphasis on granting students a voice, options, progress based on competency, and ongoing assessment of their needs are described by Bouffard (2019) as the four primary attributes of a student-centred learning all of which are evident within the blended learning approach. This approach combines conventional and computer-based classroom methods which is always student centred as described by Subramonian (2015), and the blended learning model has been proven by researchers and scholars to be one of the most useful methods of teaching or methods of imparting knowledge into students as it helps them think creatively and also develop interest in collaborative works (Resien, 2020).

The usefulness of the blended learning model has called for an investigation into this area of study. Many researchers such as Utami (2018), and Khader (2016), used the experimental design approach in looking at the best methodology between the blended and traditional mode of learning. Utilising an experimental design approach, they collectively reached the conclusion that the most effective and appropriate methodology for students is the adoption of the blended model. If the blended learning approach has been established as superior to the traditional learning mode by scholars such as Suk (2023) and Suwannaphisit et al., (2021), evaluating its impact on students' learning outcomes becomes imperative.

Background

The education system has witnessed a massive revolution over the past decade due to the introduction of computers and other computer related programs. Early computers were people who performed complex calculations and not machines (Freeth, 2014). They were basically mathematicians and bookkeepers, and the term "computer" was used to describe that job position or title. Since the introduction of the very first computer which is the Antikythera mechanism (200 BC to 70 BC), the use of computers in education began taking various forms as archaeologist believe that the Antikythera mechanism was used to calculate eclipses and other astronomical events (Freeth, 2014).

Over the years, the concept of learning, involving the acquisition of fresh insights, knowledge, behaviours, skills, values, attitudes, and preferences, has evolved to facilitate the attainment of knowledge. Mia (2017) classified learners into four distinct groups: auditory learners, visual learners, kinesthetic learners, and tactile learners. Auditory learners excel when the subject matter is reinforced with sound. They favour absorbing information by listening to a teacher or lecturer rather than taking notes to formulate their own ideas. Visual learning style is also when learners prefer seeing and observing things. Such students understand things better when it is presented in a visual way like diagrams, pictures, and more. Conversely, kinesthetic learners also acquire knowledge by engaging in hands-on experiences or activities (Rhouma, 2016). Throughout history, cave art or the utilisation of

images for learning has stood as the earliest mode of visual communication recognised by humanity, owing to the inherent human inclination towards colours and visuals (Wright, 2010). The teaching and learning environment has gone through several evolution, and it is currently embracing innovations with technology being at the forefront. This progression commenced with the utilisation of computers, advanced to the incorporation of the internet, and has now evolved into the concept of blended learning, reliant on technology to deliver educational content to learners through efficient methodologies (Khader, 2016).

In accordance with Dangwal (2017), blended learning is elucidated as an instructional technique that merges technology and digital media with conventional instructor-led classroom engagements, affording students enhanced adaptability to personalise their learning journeys. Habib (2018) simply described it as a combination of face-to-face and online learning, and Ismail (2009) additionally portrayed blended learning as the integration of technological advancements to harmonise the two educational modes: in-person and remote education. This integration fosters interaction between educators – whether teachers, lecturers, or mentors – and learners in a face-to-face context through these innovations. Notably, these innovations do not necessitate particular electronic device or predetermined quality standards, but they do necessitate access to curriculum-connected learning resources. Berbesada (2022) also sees the blended learning model as a way of learning which is aimed at helping learners achieve the intended learning outcomes through the blending between the forms of traditional education and e-learning which happens inside and outside the classroom. Blended learning has gradually come to stay as it is regarded as one of the best and most widely used teaching methods especially in Higher Education Institutions (HEI). It became very popular especially within the Sub-Saharan African Region during a surge in the Covid-19 pandemic as it was an alternative used in teaching especially in Higher Education Institutions (HEI), and it is expected to develop problem solving skills, learning motivation, and student engagement (Rachmadtullah et al., 2020).

The emergence of computers and the internet brought about the Electronic Learning (E-Learning) which is sometimes called web-based training, and it is part and parcel of the blended learning model. The e-learning is a structured educational system supported by electronic resources, facilitating formalised instruction (Al Rawashdeh, 2021). It creates an avenue for instructional innovations and make individuals conversant with technological devices and software which provide ubiquitous learning environment as it makes use of mobile devices, web platforms and instructional software (Horton, 2002). These media space or environments also helps students gain digital literacy, digital ethics, and many others needed for effective facilitation to ensure the impact of the blended learning model on students' learning outcomes.

Research Objectives

The specific objectives of the study are;

1. To identify the various components of the blended learning model that make it helpful to KNUST-MELS IDL.
2. To assess the advantages and challenges of the blended learning model in KNUST-MELS IDL.
3. To measure the impact of the blended learning model on students' learning outcomes.

Research Questions

The following are the research questions of the study;

1. What are the various components of the blended learning model that make it helpful to KNUST-MELS IDL?
2. What are the advantages and challenges of the blended learning model in KNUST-MELS IDL?
3. What is the impact of the blended learning model on students' learning outcomes?

Theoretical Frameworks

The theoretical framework of the study is based on the *Complex Adaptive Blended Learning System* and the *Community of Inquiry*.

The *Complex Adaptive Blended Learning System as proposed by* Yuping wang et al., (2015) *is a promising framework comprising of six different elements all with their sub-systems and with the learner at the centre of it all. The elements include the learner, the teacher, the technology, the content, the learning support, and the institution. Having the learner at the centre makes it more student centred like the blended learning model.*

Another theoretical framework upon which the study is built is the Community of Inquiry (COI) which was originally developed by Garrison et al., (2000). This framework in a gradual process has grown to become very useful in blended learning as it is based on the work of John Dewey, vygotsky, and constructivist views on experimental learning (Swan et al., 2009). The Community of Inquiry describes the necessary elements to create deep and meaningful learning. It as well outlines the educational experience happening at the convergence of three presences which are; cognitive presence, teaching presence, and social presence. The social presence is the ability of learners to be seen as real people as they are able to establish relationships, communicate online and offline, and project their emotions as well. Teaching presence is directly related to the facilitations making education meaningful and worthwhile. This ensures effective collaboration between teachers and students for effective facilitation. It is at this level of Community of Inquiry that the teaching is designed online and offline to engage students in collaborative constructivism. Cognitive presence is also related to the extent to which learners can construct and confirm meaning through sustained reflection and discourse. Blended learning using the Community of Inquiry (COI) creates opportunities for self reflection, interaction, and peer teaching as all these help students in their academics.

Methodology

Research Design

This study employs descriptive case study approach, integrated within the framework of mixed methods (qualitative and quantitative) inquiry

to comprehensively address the research questions. The nature of the study necessitated the adoption of mixed methods because it aims to take advantage of the strength of both modes. In terms of the qualitative method, the use of semi-structured questionnaire was adopted to solicit responses from all respondents. The same semi-structured questionnaires were used to extract the quantitative data for processing. The quantitative aspect of this study is simpler in nature as tables were employed, and the Mean and Standard Deviation (SD) was derived from the collected data for analysis.

Data Collection

Information was collected from both primary and secondary sources. The primary source served as first-hand information, and total population sampling technique was employed. The researcher targeted all current MPhil Educational Innovations and Leadership Science (MELS) – Institute of Distance Learning (IDL) students at the Kwame Nkrumah University of Science and Technology (KNUST) who receive tuition via the blended learning model. Lecturers at the Institute of Distance Learning (IDL) facilitating the MPhil Educational Innovations and Leadership Science (MELS) class by means of the blended learning model were also targeted. Semi-structured questionnaires, semi-structured interviews, and observations were used in collecting the primary data. Secondary data were also sourced from specific books, journals, the internet, and pamphlets related to the project's focal theme. Acquiring secondary data through these channels facilitated access to insights from other researchers' efforts and documented articles concerning the subject matter, effectively averting redundancy.

The unstructured observation was targeted at the learning outcomes of students and class participation with the researcher being the observer (participant observation) as he was also a student of the MELS class of which all the participants being observed are coming from. Upon the researcher enrolling in the course with the notion of conducting this study on MELS distance learning students, he acted like a silent investigator and critically observed the engagement of students in both models (online and conventional in-person instruction) and how

students interact with technology. The researcher was very objective in all dealings and noted all observations down in a notebook. This observation lasted for a period of 2 academic years which is approximately 16 calendar months.

Semi-Structured Interview Procedures

Semi-structured interviews were conducted online and in-person after ethics approval from the institution. Prior to the online interviews, participants were emailed or read a document highlighting the aims of the research and the conduct of the interviews. Participants were asked to sign and send back the document indicating that "go ahead" has been given for the conduct of the interview which lasted for not more than 20 minutes. The questions were as follows;

1. Share your experience in the usage of the blended learning model.
2. Comment on how the various components of the model has impacted your performance/delivery as a student/lecturer.
3. What do you think are the advantages and challenges of the model in improving students' learning outcomes?
4. Do you consider the model to be effective in improving students' learning outcomes?
5. What is the impact of the model on students learning outcomes?

Table 1.1 Semi-Structured Questionnaire Items

1. Students Mode of Study for Current and Previous Academic Level
2. Students Performance Ratings for Current and Previous Academic Level
3. Lecturers Current Teaching Method and Preferred Teaching Method
4. Most Beneficial Components of the Model
5. Overall Satisfaction of the Various Components of the Model
6. Advantages and Challenges of the Model
7. Recalling a Time Where the Blended Learning Model Helped Students Better Understand a Challenging Topic

Table 1.2 Eligibility Criteria

Criteria
1. Students of KNUST
2. Lecturers of KNUST
3. Distance Learning Students
4. Lecturers who use the blended learning model
5. Students who use the blended learning model

Recruiting Respondents/Sampling Frame

The study recruited respondents using the stratified and purposive sampling technique. Stratified sampling is a probabilistic sampling method in which the researcher categorises subjects into distinct strata or groups based on shared characteristics or attributes such as age or gender (Arnab, 2017). After dividing the entire population into strata (Accra and Kumasi Campus), the researcher further randomly selects respondents proportionally from the different strata. Purposive sampling technique on the other hand is also a non-probability sampling technique that helps the researcher to select respondents suitable for the study. These two approaches were suitable for the study considering the nature of it. The construction of the sampling frame was influenced by both the research questions and the study's theoretical frameworks. A respondent's map was devised to create the sampling frame. In using the stratified sampling technique, the student respondents were divided into strata or groups based on the campus they find themselves (Accra and Kumasi Campus). The Kumasi campus was selected for the purpose of the study as the researcher had easy access to the respondents.

Table 1.3: List of Respondents and Number of Individuals Interviewed

Respondents	Number of Participants
KNUST MELS-IDL Students	20
KNUST MELS-IDL Lecturers	5
Total	25

Results

Analysis of Research Findings

Findings for Objective 1: Components of the Blended Learning Model that Make it Helpful to KNUST-MELS IDL.

Table 1.4: Components and Most Beneficial Component of the Model

	Online Lecture	Face-To-Face	Interactive Multimedia	Online And Face to Face	Total
Teachers	1 (20%)	-	1 (20%)	3 (60%)	5 (100%)
Students	1 (5%)	1 (5%)	5 (25%)	13 (65%)	20 (100%)

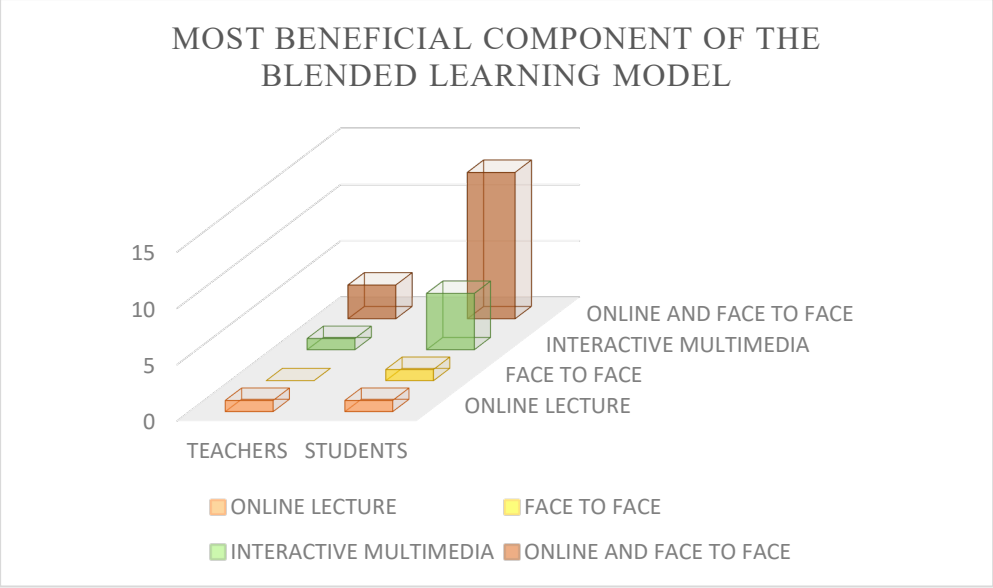
Source: Author's Field Work, June 2023

Table 1.4 revealed the components of the blended learning model that makes it helpful, and the most beneficial component of the model. The components of the model that makes it helpful are the online learning, face-to-face learning, and the interactive multimedia, but the most beneficial component of the model is the combined use of both online learning and conventional in-person instruction. 13 students representing 65% believe that the online and face to face aspect of the model have been beneficial to their distance learning, 5 of the respondents representing 25% selected the interactive multimedia as the most beneficial component of the model, and the remaining 2 student respondents selected the online (5%) and face-to-face (5%) individually. On the part of the teacher respondents, 3 of them representing 60% believe the online and face to face component of the model have been very beneficial to their teaching of distance learning students, 1 lecturer respondent representing 20% selected the interactive multimedia, and the remaining 1 respondent also selected the online component of the model.

The researcher noted that the respondents displayed a distinct preference for online classes over traditional in-person instruction. Interviews revealed that the flexibility offered by online learning made it their preferred choice. On average, approximately 15 students

attended conventional in-person classes, while around 40 students consistently participated in online lectures.

Figure 1.1: Components and Most Beneficial Component of the Model



Source: Field Survey Data, 2023

Figure 1.1 represents field data collected on the components of the blended learning model that makes it helpful, and the most beneficial component of the model. Observations revealed that online learning is the most beneficial component. However, during interviews, respondents highlighted both online and traditional in-person instruction as the most beneficial components, significantly enhancing their learning outcomes. Secondary sources of data collection failed to definitively identify the most beneficial component as this determination is contingent upon various factors including student needs and the specific academic program.

Table 1.5: Overall Satisfaction of the Various Components of the Blended Learning Model

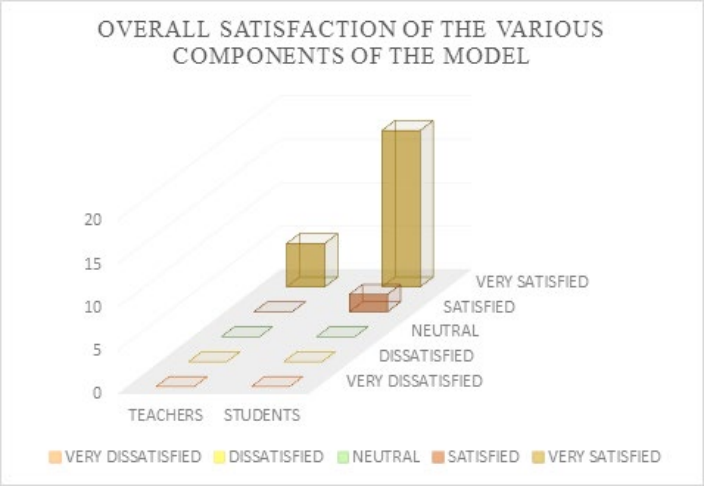
	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied	Total
Teachers					5 (100%)	5 (100%)
Students				2 (10%)	18 (90%)	20 (100%)

Source: Author's Field Work, June 2023

Table 1.5 revealed the overall satisfaction of respondents on the various component of the model, and they are very satisfied with the results on the various components of the model on their learning outcomes.

In an interview, a respondent disclosed that he has the internet at his disposal to improve understanding if he finds anything challenging. The researcher furthermore observed active discussions and collaborations in the online and conventional in-person discussions.

Figure 1.2: Overall Satisfaction of the Various Component of the Model



Source: Field Survey Data, 2023

Figure 1.2 represents data collected on the field on the overall satisfaction of the various components of the model. This chart is to ensure understanding of the results to all and sundry.

Findings for Objective 2: Advantages and Challenges of the Blended Learning Model

Table 1.6 Advantages and Challenges of the Model

ADVANTAGES AND CHALLENGES
Advantages
Flexibility
Recorded Videos after Lectures
Time and Money Management
Opportunity to Research Over the Network
Challenges
Network Challenge/Poor Network
Unlimited Time per Session
Poor Attention from Lecturers

Source: Author's Field Work, June 2023

Table 1.6 provides a summary of the benefit and difficulties associated with the blended model as perceived by respondents. Respondents believe the model has some advantages which have helped in making it successful while some believe it has failed to achieve its success due to the challenges around it. Some of the advantages of the model according to the respondents include its flexibility, availability of recorded videos after lectures, management of time and money, and opportunity to research over the internet.

The challenges listed by respondents include poor network, unlimited time per session, and poor attention from lecturers. It was confirmed through interviews and observations that the advantages outweigh the challenges and for that matter has been helpful in the learning outcome of students.

Findings for Objective 3: Measuring the Impact of the Blended Learning Model on Students' Learning Outcomes.

The impact can be measured in terms of how the model helped respondents to better understand a challenging topic and by comparing it to the traditional face to face.

Recalling a Time Where the Blended Learning Model Helped Respondents to Better Understand a Challenging Topic

The respondents registered for about twelve courses in their MELS program for a period of two years, and almost all the respondents could recall a time where the blended model aided in their understanding of a particular topic to improve their learning outcomes. The MELS program is related to educational leadership and all the responses from respondents have been coded by the researcher and expressed in simple terms.

The topic at hand was related to leadership and it aimed to find out if "Leaders are Born or Made." This is a challenging topic or question that even the most adept minds can find challenging. The blended model became a solution in understanding this hard nut to crack as the respondents embarked of this intellectual journey seeking understanding.

The online component of the model allowed respondents to submerge themselves with interactive simulations and useful videos. Videos were played on the life or journey of two great African leaders; Osagyefo Dr Kwame Nkrumah and Nelson Mandela for respondents to decide if great leaders are indeed born or made. The flexibility to make use of the online component at one's favourable pace created an opportune moment for respondents to keep researching until they find the answers they seek.

The in-person component of the model also created a platform for discussion and interaction. Here, the respondents could put the question they find challenging before the class, engage in collaborated problem solving under the guidance of a lecturer for students to find the needed answers. The topic which posed as a hard nut to crack became understandable to all students thereby improving their learning outcomes.

Learning outcomes are measurable statements used to articulate what students should know at the outset of a course, and this was stated at the beginning by the lecturer. The respondents confirmed in the interview to have achieved all learning outcomes that was expressed at the beginning, and this was also confirmed by the researcher through observations.

Using the Mean (M) and Standard Deviation (SD) of Respondents Using the Traditional Face to Face in their Previous Level of Education and the Blended Learning Model in their Current Level of Education to Determine the Most Impactful Model Among the Two

Table 1.7: Performance Rating of Respondents in their Previous and Current Level

VARIABLES	PERFORMANCE RATINGS	M	SD	FREQUENCY
Performance Ratings (Current Program)	3 4 5	4.0	0.795	6 (30%) 8 (40%) 6 (30%)
Performance Ratings (Previous Program)	3 4 5	4.10	0.852	6 (30%) 6 (30%) 8 (40%)

Table 1.8: Using Mean (M) and Standard Deviation (SD) to Determine the Most Impactful Model Between the Blended Learning and the Conventional In-Person Instruction.

PREVIOUS LEVEL OF EDUCATION (UNDERGRADUATE)	CURRENT LEVEL OF EDUCATION (POSTGRADUATE - MPHIL)
MEAN = 4.10 STANDARD DEVIATION = 0.852	MEAN = 4.0 STANDARD DEVIATION = 0.795
ANALYSIS 1 (MEAN) Mean represents the average value. A higher mean indicates better performance. It can be said that the students performed well in this level of education.	ANALYSIS 1 (MEAN) Mean represents the average value. A higher mean indicates better performance. It can be said that the students performed poorly in this level of education.
ANALYSIS 2 (SD) A smaller SD signifies a more consistent performance, and vice versa. It can be said that the students performed poorly in this level of education.	ANALYSIS 2 (SD) A smaller SD signifies a more consistent performance, and vice versa. It can be said that the students performed well in this level of education.

Discussions

The study provides evidence on the impact of the blended model on students' learning outcomes. It aimed to guide the Kwame Nkrumah University of Science and Technology and other tertiary institutions to invest in the model for its utmost benefit as it has proven useful over the years in terms of students' learning outcomes.

Investigations on the components of the blended model that makes it helpful to KNUST-MELS IDL revealed that online learning, face to face, and interactive multimedia (videos, simulations, and quizzes) are all components of the model but using both the online and traditional face to face system was found to be the most beneficial component. Likewise, it is reported in the related literature that the component of the model is an embodiment of conventional in-person and online

learning (Habib, 2018; Dangwal, 2017). A study by Olejarczuk (2013) shows that students exhibit positive attitudes to a combination of online and conventional in-person approach. This is in direct response to the "Complex Adaptive Blended Learning System" which is one of the theoretical frameworks of the study. In a Complex Adaptive Blended Learning System, the integration of online learning, face-to-face lectures, and interactive multimedia creates a dynamic and adaptive learning environment. Each component can respond to student progress and needs which is a key characteristic of complex adaptive systems.

An investigation into the advantages and challenges of the blended model in improving students' learning outcomes revealed that issues like flexibility in the use of the model, recorded videos being available, time management, and opportunity to research over the network are some of the advantages, and these advantages influenced the success of the blended model. Network challenges, unlimited time, and poor attention from lecturers are also some of the challenges of the model, and these challenges act as a stumbling block to the model in achieving its aims. Blended learning enables students to gain the needed digital literacy which is an advantage in a world of technological advancement as elaborated in the literature (Horton, 2002). Scholars like (Caulfield, 2011; Glazer, 2011) also speak on the flexibility conferred on students in the blended learning environment as expressed in the literature. The community of inquiry which emphasises on three presences which are social, cognitive, and teaching presence is more aligned with the advantages of the blended learning model in terms of building collaborative learning which is the hallmark of blended learning.

Furthermore, in measuring the impact of the model on students' learning outcomes, the study found out that the blended model helped students to better understand topics they found difficult as expressed in the literature. It is for this reason that Shannon Tabaldo who is a Digital Curricula and Instruction expert predicted the blended model to be a very good teacher (Akai, 2022).

Feedback from one of the students suggest that she had issues in understanding a topic under a course named "Management of Pre-

Tertiary Education." The blended learning model was able to improve her understanding by seeking explanation from colleagues through the "zoom" platform which is an online component of the model. During the discussion, she resorted to the internet to watch some videos and read a few articles to improve her understanding. Colleagues also sent her links to useful videos and articles through the online platform used for the discussion. A face-to-face lecture was scheduled the following week, and during that session, she had the opportunity to present some few challenges faced to the lecturer, and the entire class deliberated upon it for her to have the needed understanding.

Finally, in measuring the impact of the blended model by using the mean and standard deviation from their current (employing the blended learning model) and previous (employed the traditional face to face) level of education. The study found that the mean and standard deviation of the academic performance from their previous level of education stands at 4.10 and 0.852 respectively, and the mean and standard deviation of the performance for their current level of education is 4.0 and 0.795 respectively. Mean represents the average value of academic performance for each group (current and previous) and the standard deviation quantifies the extent to which data points deviate or diverge from the mean value. Since the mean represents the average value, a higher mean indicates better performance so it can be said that the students performed better in their previous level of education (Mean: 4.10) compared to their current level of education (Mean: 4.0). Given that the disparity in "Mean" alone may not offer a comprehensive understanding of students' academic performance, the study also examines the standard deviation values. A smaller standard deviation signifies that the data points are closely clustered around the mean, implying a more consistent performance. Conversely, a larger standard deviation indicates greater variability in performance or less consistent. Since the standard deviation of the current performance (0.795) is smaller than the standard deviation of the previous performance (0.852), it suggests that students' current performance is more consistent compared to their previous performance or their current performance is better than their previous academic performance. A study by Feiler et al., (2016) also measured the effect of blended learning by using a test of understanding in Economics.

Respondents were divided into two groups with one group using the conventional In-Person instruction and the other using blended learning. It was concluded that students in the blended learning class improved more than those in the traditional face-to-face class.

Conclusion

The study concludes that the component of the model includes online learning, conventional in-person, and interactive multimedia but the most beneficial component of the blended model is the combined use of online and traditional face to face.

The study furthermore concludes that there are factors that influence the success of the blended model as other factors do inhibit its success. Challenges of the model include poor network, unlimited time for studies and poor attention from lecturers. The advantages on the other hand include its flexibility, opportunity to research over the internet, and the availability of recorded videos.

The study finally concludes that the impact of the blended model can be measured with how the model helps students understand difficult topics, and by comparing it to the conventional in-person instruction. In comparing both models, it can be inferred that the blended model and the conventional in-person instruction contribute to enhancing students' learning outcomes. Nevertheless, the blended learning model appears to exhibit a greater level of effectiveness when compared to the conventional in-person instruction considering the range attained by the blended model when the standard deviation was used in assessing the most impactful model between the two methodologies. When the current academic performance of the student respondents was compared to the academic performance of their previous level of education by using the mean, the researcher observed that the students performed well in their previous level of education which employed the traditional face to face than their current level of education employing the blended learning model.

The same comparison was done a second time by using the standard deviation, and this time the students performed better in their current

level of education employing the blended learning model than their previous level of education which employed the conventional in-person instruction. The range used by the blended learning model in being successful than the traditional mode when standard deviation was used supersedes the range used by the conventional in-person instruction in being successful than the blended learning model when the mean mark was used. This simply leads to a conclusion that the blended learning model impacts more on student's learning outcomes than the conventional in-person instruction.

Recommendations

The study recommends that the school conducts a baseline assessment of teachers and students' ICT skills to gauge their current proficiency levels since the blended learning requires some basic level of technological competency. This can be done through surveys, or practical assessments that evaluate their familiarity and competence with basic ICT tools such as word processing, presentation software, and communication tools (video and audio platforms). It furthermore recommends that the school provides opportunities for students and teachers to have hands-on practice with the ICT tools relevant to the blended model. This can include practical exercises, projects, or assignments that require the use of specific tools.

The study recommends the introduction of the blended model in Senior High Schools due to its impact. It has been observed that the model is only used in tertiary institutions. Students using it at an early stage of their academic life will help build their capacity in the use of the model by the time they advance to tertiary, and this will in the long run help improve their learning outcomes.

Currently, the Ghanaian education has been structured in a manner that Senior High School students sometimes spend more than a month home during vacation. As it stands, teachers can engage their students during long breaks as such by using the blended model.

Regarding the components of the model, the study recommends that special attention should be given to both the online system and the

traditional face-to-face aspect of the model as this is the most beneficial component of the model. It has been observed in recent times that many facilitators do pay much attention to the online aspect of the model without putting the conventional in-person instruction into consideration. However, this diminishes its efficacy and shifts it away from being a true blended model, which relies on the amalgamation of both conventional in-person instruction and online teaching methods.

Poor internet connectivity is a major challenge for the model. The student respondents expressed in the interviews that the school has provided them with sim cards of which they get a monthly allocated data bundle, but this is not a solution to the internet connectivity issues at hand. Challenges related to internet connectivity pose a concern for numerous students across the country. Many students voice their dissatisfaction with distance learning due to the lack of a dependable internet connection, especially for synchronous courses.

Solving this major problem will contribute to the impact of the blended learning model, so the study recommends "speedify" as the solution to distance learning challenges for students and teachers. Speedify is a software application that can be installed on a device for online classes. It is a bonding Virtual Private Network (VPN) that allows users to use all their internet connections at once to help get a fast and reliable internet connection. "Speedify" uses a technology called channel bonding, and this technology allows you to stay online even if one of the connections drops. Aside from the monthly allocation of data, the school's management can invest in "Speedify" to help reduce the problem of internet connectivity in distance learning.

References

Akai, G. (2022, June 16). Edutopia. Retrieved October 25, 2023, from www.edutopia.org: https://www.edutopia.org/article/using-blended-learning-explore-multifaceted-topics/

Alaa Zuhir Al Rawashdeh, E. Y. (2021). Advantages and disadvantages of using e-learning in university education: Analysing students' perspectives. *The Electronic Journal of E-Learning*, 19(3), 107-117.

Allen, A. F. (1971). Perspectives on quality education. *Educational Horizones*, 49(4), 100-107.

Arnab, R. (2017). Survey sampling theory and applications. Amsterdam: Elsevier Limited.

Arnaiz-Sanchez, P. (2020). Schools that promote the improvement of academic performance and the success of all students. *Journal of Education Psychology*.

Bouffard, S. (2019). What does personalised learning mean? Experts weigh in. *The Learning Professional*, 40(4), 28-31.

Brown, J. (2008, May). Student-Centreed instruction: Involving students in their own education. *Music Educators Journal*, 94(5), 30-35.

Caulfield, J. (2011). *How to design and teach a hybrid course: Achieving student-Centreed learning through blended classroom, online and experiential activities*. Sterling VA: Stylus Publishing.

Dangwal, L. a. (2017). Blended learning: An innovative approach. *Universal Journal of Educational Research*, 129-136. https://doi.org/10.13189/ujer.2017.050116

Feiler, A. S. (2016). Measuring the effect of blended learning: Evidence from a selective Liberal Arts College. *American Economic Review*, 106(5), 368-372.

Freeth, T. (2014). Eclipse prediction on the ancient Greek astronomical calculating machine known as the Antikythera Mechanism. *Plos One*, 9(7), 1-15.

Garrison, A. a. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, 2(2), 87-105.

Glazer, F. (2011). Blended learning: Across the disciplines, across the Academy. *New Pedagogies and Practices for Teaching in Higher Education*. Sterling VA: Stylus Publishing, LLC.

Habib, H. (2018). Effect of blended learning on student achievement. *Journal of Multidisciplinary Subjects*, 2(3), 1-5.

Helen A. Berbesada, J. Q. (2022). Blended instructions in the new normal and students learning gains in Mathematics. *American Journal of Educational Research*, 10(6), 398-400.

Horton, W. (2002). Designing web-based training (2nd ed.). New York: Wiley.

Ismail, A.-G. Z. (2009). *E- learning from application to professionalism* (2nd ed.). Cairo: Alam Al-Kutob.

Swan, K., Garrison, D. R., & Richardson, J. C. (2009). A constructivist approach to online learning: The Community of Inquiry framework. In Payne, C. R. (Ed.) *Information Technology and Constructivism in Higher Education: Progressive Learning Frameworks*. Hershey, PA: IGI Global, 43-57.

Khader, N. S. (2016). The effectiveness of blended learning in improving students' achievement in third grade's science in Bani Kenana. *Journal of Education and Practice*, 7(35), 1-8.

Newton, P. M., & Miah, M. (2017). Evidence-based higher education – Is the learning styles 'myth' important? *Frontiers in Psychology*, Vol 8. https://doi.org/10.3389/fpsyg.2017.00444

Olejarczuk, E. (2013). The e-learning component of a blended learning course. *Teaching English with Technology,* 14(3), 56-68.

Resien, H. S. (2020). The Effect of blended learning strategy and creative thinking of students on the results of learning information and communication technology by controlling prior knowledge. *Birle Journal*, 879-893.

Rhouma, W. B. (2016). Perceptual learning styles preferences and academic. *International Journal of Arts and Sciences*, 479-490.

Seuring. (2008). Assessing the rigor of case study research in supply chain management. *Supply Chain Management*, 13, 128–137.

Subramonian, S. (2015). Blended Learning Approach for Enhancing Students Learning Experiences in a Knowledge Society. *i-mamager's Journal of Educational Technology*, 11 (4), 1-7

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.

Subandowo, R. a. (2020). Use of blended learning with moodle: Study effectiveness in elementary school teacher education students during the COVID-19 pandemic. *International Journal of Advanced Science and Technology*, 29(7), 3272-3277.

Suk, J. (2023, September 4). Hurix digital. Retrieved October 19, 2023, from www.hurix.com: https://www.hurix.com/blended-learning-vs-traditional-learning-whats-the-difference/

Utami, I. S. (2018). The effect of blended learning model on senior high school students' achievement. *SHS Web of Conferences*, 42(2), 1-6.

Wright, T. S. (2010). *Information literacy in the digital age*. Sawston, United Kingdom: Woodhead Publishing Limited.

Yuping wang, X. H. (2015). Revisiting the blended learning literature: Using a complex adaptive systems framework. *Education, Technology, and Society*, 18(2), 380-393.