

**THE EFFECTS OF BLENDED LEARNING OF STEM COURSES AT HIGHER
INSTITUTIONS OF LEARNING. A CASE STUDY AT FACULTY OF SCIENCE AND
EDUCATION, NAGONGERA CAMPUS**

BY

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Declaration

I, **SANDE PATRICK** hereby declare that this report is my original work and has never been submitted to a college, University or other organizations for any award.

Sign. S. Patrick Date 20th Feb/2024

Approval

This dissertation has been submitted for examination with the approval of my university supervisor.

Signature.......... Date 21/6/2024

Fulgensia Kamugisha Mbabazi (PhD)

Dedication

I dedicate this work to my lovely father Woniala Francis, my lovely mother Nabundaga Margaret, brothers Madaya Francis, wodyamboga Sliver, Butege Micheal, Sisters Nafuna Topisita, Grace, Beatrice, Muzaki Allen and Mr. Wogibi Patrick, you were my inspiration, Challenger and cheerleaders during my graduate students.

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ABSTRACT

Students study STEM courses at higher institutions of learning. One method of teaching STEM course is through blended learning. It is where learners are passively given the materials on online and traditional face to face. It is used globally and it enables students to study both online and face to face. Blended learning was introduced at Busitema University in 2019; however it was fully implemented in 2020 during the covid-19 pandemic lockdown, where all modes of teaching were shifted online following covid-19 guidelines by the ministry of health. This investigates the effects of blended learning of STEM courses at higher institutions of learning. Regarding data gathering and analysis, this adopts a quantitative methodology. Data was collected using a self- made questionnaire. This study sampled 65 students in their second and third years.

The findings show that; 16(45%) lack knowledge in video conferencing systems for example zoom, Moodle and Google classroom. 21(50%) had no personal computers and 10(48%) could not open even a website link on their own. 18(66.7%) were relying on traditional face – to – face learning. The results indicate that blended learning is an effective way to improve institutional students' performance compared to traditional face to face learning. Additionally, these findings highlight valuable recommendation for future research and practices related to effective blended learning.

CHAPTER ONE

INTRODUCTION

1.1 Background

One of the fundamental disciplines that calls for a student's comprehension of a range of abilities and lifestyle choices are Science Technology Engineering and Mathematics (STEM) courses. Man's comprehension of the world in which he or she lives are aided by STEM courses, which is also altered by this environment. Different viewpoints on the courses should be known by those who assist students in learning STEM courses (Marjoram, 2008).

The Faculty of Science and Education, Nagongera Campus at Busitema University started offering online courses in 2019 second semester to all Campuses. Following this, complete adoption occurred in 2020. During the Covid-19 pandemic lockdown, all teaching and learning activities were shifted online in accordance with Covid-19 instructions by the ministry of health. A variety of online platforms were used.

There is a substantial increase in interest and popularity for blended learning, which blends traditional face-to-face training with online learning components (Brown, 2012). STEM programs have benefited greatly from this kind of instruction (Council, 2012). The history of the investigation of the effects of blended learning in STEM education dates back to the early 2000s (Baber, 2015). There are a number of reasons why blended learning has become so popular. First of all, new prospects for educational delivery have been made possible by technological improvements (Owens & Sanders, 2009). Online resources and activities can now be incorporated into conventional classroom settings because of the ubiquitous availability of computers and internet connectivity. This has created a new opportunity.

Second, innovative teaching techniques are being investigated by educators and institutions as a result of the increased demand for STEM experts and the need to improve STEM education (Government, 2015). Blended learning offers a flexible methodology that supports various

learning styles and enables tailored training (Ajdiopoulou, 2017). Additionally, it enables students to acquire fundamental digital literacy abilities, which are becoming more and more crucial in today's technology culture.

Early research efforts aimed at comprehending the potential advantages and difficulties of blended learning were the starting point for the study of its effects in STEM education. Researchers looked into the potential benefits of combining online and in-person training for raising student engagement, enhancing learning outcomes, and fostering critical thinking abilities (Yuliati, 2018). There are several different online learning techniques, including blended learning (Means, 2009).

As blended learning gained popularity, later research concentrated on certain facts of its application in STEM education. For instance, researchers looked into the creation of online tools and activities to support in-person instruction. (Miller, 2021).

According to Government Regulation Number 19 for the year 2017, teachers are only required to meet for a minimum of 24 hours per week (Kemendikbud, 2017). To prepare for a lack, one option is to use blended learning to enhance a student's skills and knowledge, as well as to provide an opportunity to incorporate new development and technology through online education (Thorn, 2003).

On the one hand, there are several critical aspects to implementing blended learning, such as providing students with adequate internet facilities and students seem to rely on each other to upload assignments, which suggested that online learning be implemented first, and increasing students' motivation and responsibility in the learning process (Purnawarman, 2016). However, when compared to traditional learning, blended learning can help students improve critical thinking skills (Korkmaz, 2009).

STEM CURRICULUM.

STEM is a curriculum designed to prepare students with higher order abilities and mental habits to deal positively and productively with global difficulties and complicated problems that they may confront (Hodson, 2020). STEM enhances student involvement and knowledge in an immersive learning setting, preparing them to be scientific and technology leaders (Yang &

Baldwin, 2020). This is thinking through the materials in STEM practices where learners can establish connections between disciplines (Tan, Ong, Ng, & Tan, 2023). STEM education in institutions can be taught in a variety of ways depending on how aspects of the paradigm are integrated. According to (Kolb, 2014), experiential learning occurs through designed feedback, opportunities for pupils to evaluate, apply and solve challenges, and demonstrate learning.

This pedagogy process necessitates integrated knowledge, which has a favorable impact on improving students' learning (Tondeur, Scherer, Siddiq, & Baran, 2020). It enables students' learning to be flexible and differentiated since they can acquire diverse topics based on their interests in a real-life situation (Vargas-Parra, Rodríguez-Orejuela, & Herrera-Mosquera, 2018). Teachers must provide instructional activities framed as continuing inquiry (Molebash, Lee, & Heinecke, 2019) that encourage all students to be self-reflective, independent, and critical thinkers.

Furthermore, because not all students originate from rich households, the setting to study online during blended learning may be unsuitable for some students, affecting their ability to study utilizing online platforms. Many other things must be taken into account when learning online (Jonassen, 2007). As a result, blended learning was expected to have an impact on students' mathematical attitudes and academic ability in mathematics. This research was concentrated on increasing STEM achievement. So that the research can determine whether students can maintain their performance throughout blended learning, which is similar to traditional learning.

The study's goal is to determine the impact of blended learning of STEM courses at higher education institutions on high-achieving students' attitudes toward STEM education and academic accomplishment, as well as how students perceive the impact of learning STEM courses through blended learning. Based on the findings of existing studies, it appears that blended learning has not been widely applied in higher education institutions of learning (Pavla, Hana, & Jan, 2015).

In addition, the data that does exist on STEM experiences from a variety of socio - economic status areas reveals a startling bias toward higher socio - economic institutions (FitzGerald & Hurst, 2017). Several research studies argue that learning experiences in STEM programs that

adopt a traditional hands-on approach help students of higher socio - economic position more than those of lower socio - economic status students (Lieu, 2022). Higher test results on standardized examinations are referred to as advantages in this context. Furthermore, there are few studies that apply a blended learning approach to STEM teaching at low-income schools. Learners from low-income families should benefit from STEM programs just as much as other learners. Beyond typical educational methods, there is very little knowledge regarding the instructional methods used (Cabero-Almenara, Arancibia, & Del Prete, 2019). To better understand the STEM accomplishment of students from disadvantaged socio - economic backgrounds, deeper research of various instructional modalities such as blended learning is required (Paulson, 2020).

1.2 Problem statement of the study

Higher levels of STEM education have traditionally been taught primarily through traditional face-to-face interaction in a physical classroom environment. However, there has been a growing interest in bringing blended learning methodologies into STEM education due to the quick development of technology and the rising desire for flexible and accessible education. Determining the effects of traditional science education and integrated learning in STEM courses at higher levels of learning is therefore necessary.

In order to inform educators and policymakers about the possible advantages and difficulties of integrating blended learning methodologies into STEM curricula at Busitema University, this study gives the evidence that was contributed to the theoretical and methodological aspect.

1.3 Objectives

1.3.1 General objective

(i) To find out the potential benefits and challenges with incorporating blended learning approaches; Traditional face to face learning, online learning, e-learning in the teaching and learning process at Busitema University.

1.3.2 Specific objectives

- (i) To assess the impact of blended learning on students' achievement in STEM courses at Nagongera Campus, Busitema University.
- (ii) To investigate the effects of blended learning on students' engagement and motivation in STEM education at Nagongera Campus, Busitema University.

1.4. Research questions

- (i) Does blended learning enhance student engagement and motivation in STEM courses compared to traditional instruction?
- (ii) What are factors within a blended learning environment that contribute to increased student engagement and motivation?
- (iii) Does blended learning improve student performance in STEM courses compared to traditional face to face instruction?
- (iv) What challenges are faced by both students and the University during blended learning?

1.5 Purpose of the study

To examine how STEM courses at Busitema University are affected by traditional science instruction and blended learning. Additionally, to offer a different approach to teaching STEM courses that would encourage students to study and ease the difficulties brought on by conventional teaching techniques. The results of this research were to provide a better method that persuades the University to further expand its validity and enlighten educators, policymakers about the possible advantages and difficulties with adopting blended learning methodologies in STEM courses.

1.6 The scope of the study

This study is limited to the current second year and third year students at Faculty of Science Education, Nagongera Campus, Busitema University 2020/2021 and 2022/2023 entry year respectively.

1.7 significance of the study

In most cases, STEM courses at higher levels of learning might be challenging (Felder, 2021), in terms of academics, STEM courses are the most significant and important issue in teaching and learning. Other approaches, like blended learning, can be used in innovative technological ways and independently of conventional teaching techniques to solve this issue. In addition, the integrated learning paradigm developed for this study was used to practice other academic fields such as social sciences and among others.

1.8 Operational definitions

Academic performance: This refers to the percentage of scores obtained by a student in any of the class examinations organized by the University.

Undergraduate students: These are University students who have not yet obtained their first degree.

Blended learning: This is a method of learning that combines online and traditional learning.

STEM refers to the study of science, technology, engineering, and mathematics as a group.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Mathematics is one of the basic subjects that require students to have an understanding of STEM courses compared to other subjects provided the student pays attention during the lecture (Felder & Brent, 2016). The willingness of a student to acquire and absorb the knowledge determines his or her capacity to learn mathematics. In other words, students tend to prefer learning mathematics at higher levels of learning if they had positive experiences with the subject; nevertheless, if they had negative experiences with mathematical literature, they tended to dislike learning mathematics at higher levels of learning. (Chapman & Koh, 2023).

A method called blended learning mixes in-person encounters with computer-based learning. On the other hand, blended learning, which is also known as hybrid learning, is based on 40% of technology interactions and 60% of face-to-face interactions. According to the needs of each student, differentiated education can be created via blended learning (Anthony, 2019).

STEM refers to the study of science, technology, engineering, and mathematics as a group. STEM, on the other hand, is not regarded as a distinct topic. It is regarded as a curricular amalgamation of all four subject areas contained within the acronym (Härkki, Vartiainen, Seitamaa-Hakkarainen, & Hakkarainen, 2021). Although STEM is treated as a single concept, it is actually a rich description of an integrated learning experience in which students collaborate in groups, use mathematical measurements or calculations, integrate technology to research scientific principles, and conduct experiments using scientific method. Students use engineering and design methods to create their own solutions. Learning assessments are typically centered on performance activities or final products, which may be graded using a rubric.

These are typical characteristics of STEM learning experiences. In STEM classrooms, teachers and instructors often serve as facilitators of learning (Keiler, 2018). A typical STEM teacher travels throughout the classroom, helping and challenging students to think critically through higher order questioning tactics.

STEM Education

STEM education research is primarily concerned with the effectiveness and overall impact of STEM education programs on student accomplishment in science. STEM education, according to (MacPhee, Farro, & Canetto, 2013), boosted science and mathematics achievement very modestly. Furthermore, STEM education has been investigated to establish its effectiveness on students' holistic learning. STEM education is based on an integrated curriculum approach in which students are often assigned a cognitively challenging assignment of some kind. Several studies have found that the distinction between good and low-quality STEM education is in the task planning and development (Hou & Wu, 2011) did a study to improve STEM education through multiple professional development courses in problem-based learning in order to better fulfill the demands of teachers. Their research was successfully in assisting teachers in developing high-quality STEM curriculum and classroom experiences. STEM education has been proven to provide students with a highly meaningful experience. Although test results may not rise significantly, students and instructors alike have found STEM education to be an effective use of classroom time. Research by (Kelley & Knowles, 2016) found that relevant STEM education did not always have to emerge from any standard curriculum to be effective. Sanders observed that the most effective STEM education was organic, informal, and distinguished by distinct teaching methods while this style of STEM education involves a great deal of flexibility from the teacher and the trust of the institution's administration (Rasheed, Kamsin, & Abdullah, 2020), organic and informal STEM education appears to be possible with the right assistance.

Socio - economic status and STEM

Several studies have examined equity difficulties in STEM learning experiences, linking various accomplishments in high socio - economic areas to low socioeconomic areas (Seage & Türegün, 2020). Recent cuts in STEM education funding have contributed to these findings. Private firms, in particular, were disproportionately involved in minority STEM programs, and in certain cases, minority STEM funding was completely withdrawn (Estrada et al., 2016). This is only one example of how racial and ethnic disparities in STEM education reveal themselves. STEM programs in elementary schools are where learners are organically prepared for STEM degrees at

institutions (Kelley & Knowles, 2016). As a result, the disparities discovered in institutions' STEM programs have had a significant impact on enrollment. The purpose of this literature study is to examine blended learning specifically in the context of STEM courses at higher levels of learning, including its implementation, efficacy, problems, and consideration (Kintu, Zhu, & Kagambe, 2017).

2.2 Blended Learning in STEM Courses

By incorporating technology into conventional classroom environments, blended learning presents a special potential to improve STEM courses (Watson, 2008). It enables a more individualized and flexible learning experience, allowing students to interact with the course contents at their own pace and offering chances for group projects and practical exercises. Blended learning can be especially helpful in STEM classes because it gives students access to and interaction with online tools like simulations, virtual labs, and digital materials that help them better understand difficult scientific concepts.

2.3 Implementation Strategies

In order to apply blended learning in STEM courses at higher levels of learning, several scholars have looked into various implementation methodologies. The "flipped classroom" paradigm is one of the popular strategies, where students are introduced to new concepts using online resources before attending class. However, during class time, these concepts are put into practice through problem-solving exercises, debates, and experiments.

Higher levels of learning have shown that this strategy increases student achievement and engagement in STEM courses. A different approach entails incorporating online courses or modules with conventional in-person courses (Lockyer, & Moule, 2011). These online components can offer extra materials, engaging simulations, and digital labs to support classroom learning. According to the research, this blended learning strategy can help students better understand difficult STEM courses and develop their problem-solving abilities at more advanced learning levels (Ardianti, Sulisworo, Pramudya, & Raharjo, 2020).

In addition, the project looks at the application of adaptive learning technologies in mixed STEM courses (Wu, Lee, Wang, Lin, & Huang, 2023). Based on the requirements and abilities of each

individual student, these technologies use algorithms to tailor the learning experience. Adaptive learning systems can assist students in overcoming certain difficulties they might experience in STEM courses at higher levels of learning by offering customized content and feedback.

2.4 Effectiveness of Blended Learning in STEM Education

Numerous studies have been conducted on the efficiency of blended learning in STEM courses, and most of them have found it to be effective (Ma & Lee, 2021). In comparison to conventional face-to-face training, a meta-analysis indicated that blended learning settings had a moderately beneficial impact on student achievement. They also emphasized how crucial it is to give students advice and assistance so they can use the online components efficiently. Blended learning exhibits an increase in active participation and teamwork among students in terms of student engagement (Nortvig, Petersen, & Balle, 2018). Students have more opportunity to communicate with their peers and participate in more in-depth learning experiences when online conversations, group projects, and interactive activities are included in the curriculum.

Additionally, blended learning is an advantageous in terms of accessibility and flexibility. Access to course materials and resources at any time enables self-paced learning and supports a variety of learning preferences. For non-traditional students who might have obligations to their families or the workplace, this flexibility is very helpful (Siivonen & Filander, 2020).

2.5 Challenges and Considerations

At higher levels of learning, blended learning shows potential in STEM courses, but there are a number of issues and factors that must be considered for successful implementation. Making sure instructors are tech savvy, supportive of the design, and provide efficient blended learning in STEM courses at higher levels of learning is the major problem. Instructors can get past this hurdle with the help of professional development programs and continued support (Margot & Kettler, 2019). The requirement for proper infrastructure and resources to support blended learning efforts is another factor. In order to provide smooth integration between online and face-to-face components, institutions must offer dependable internet connectivity, suitable hardware, and software platforms (Jiang et al., 2021).

When implementing blended learning in STEM courses at higher levels of learning, it is also critical to take equity concerns into account (Vo, Zhu, & Diep, 2017). Access to technology and dependable internet connections may differ across students, potentially leading to discrepancies in learning experiences. Institutions should make effort to give all students at higher levels of learning equal access to resources and support (Reimers, 2000).

Furthermore, using technology in the classroom motivates instructors to make the most of the technology that is provided to them and to apply what works in their classroom with students (Pitler, Hubbell, & Kuhn, 2012). This is comparable to Barshay's views about introducing technology to children at an early age to prepare them for the future (Tran, 2018). Many teachers have also started using flipped learning. A flipped classroom combines in-class activities with an online component based from home. This strategy is comparable to Levin and Heibschis concepts for engaging students through blended learning. According to the article, a flipped classroom's online component often consists of a video lesson sent home with students (Lopes & Soares, 2016). The students would finish their homework at their homes and bring it to class the following day to discuss.

In conclusion, the important theme of blended learning of STEM courses at higher institutions' is the use of technology using scholastic equipment's such as computers, smart phones among others which enhance students learning and improve in their performance of STEM courses at higher levels of education with the increasing availability of digital resources to ease the teaching and learning process and also provide immediate feedback to students even allows lecturers to track their progress over time and also discover the challenges faced by higher institutions' of learning such as poor internet, electricity, limited resource and expensive gadgets that can hinders the teaching and learning provide at higher institutions.

CHAPTER THREE

METHODOLOGY

This chapter explores the research design, source of data, study setting, study variables, data collection technique, and data collection instruments.

Introduction

This chapter describes the techniques and strategies for data collection and analysis. It will concentrate on research design, variables, study location, target population, sampling techniques and sample size, description of research instruments, pilot project description, and an outline of methods and techniques used to gather, analyze, and display data.

3.1 Research design

According to (Varpio, Paradis, Uijtdehaage, & Young, 2020), research design is the conceptual framework within which the research is carried out. He says that a research design serves as a broad framework for data collection, measurement, and analysis. In other words, he defines a study design as a strategy used by the researcher to identify new resources to address the topic under examination. (Anderson, Leahy, DelValle, Sherman, & Tansey, 2014) and that a research design is a detailed blueprint for how the research study was to be conducted. The study used a quantitative method for data collection and analysis due to its ability to use samples to solve challenges related to blended learning of STEM courses at higher institutions (Bawa, 2020).

3.2 Source of data

Both primary and secondary sources of data were used to support the study.

3.2.1 Primary data

Primary data is data generated by the research for the first time and collected via questionnaires. These surveys were used to collect information directly from respondents.

3.2.2 Secondary data

Secondary data is information that has already been gathered. Secondary data was obtained by gathering information about the study aims from recognized studies. These mostly included electronic journals and books, library books, research dissertations, and learning websites.

3.3 Study setting

This study was carried out at Busitema University, Faculty of Science and Education, Nagongera campus. The study is limited to students in second year and third year.

3.3.1 Location of the study

This study was carried out at Busitema University in Eastern part of the country Uganda. At Nagongera campus Tororo district due to the vastness of the area. The place was particularly selected due continued dismal performance in STEM courses at higher institutions of learning.

3.3.2 Target population

This study was carried out at Busitema university specifically Nagongera campus in Eastern part of the country Uganda. Therefore, in one campus selected, there were about 450 students' population where 65 students were selected as participants. The year two and year three were targeted due to the fact that at that level, they had been exposed to the greater extent of the STEM courses and experience which could have developed and stabilized their attitudes towards STEM courses.

3.4 Sampling technique

The sampling process has been defined as the process of picking a sample from a large population. A sample, according to (Buchstaller & Khattab, 2013), is a part of the overall targeted group that accurately reflects the characteristics of the population. It could be chosen using either non-probability or probability sampling. In this research, a sample of 65 respondents participated in the survey.

3.5 Study Variables

3.5.1 Independent Variables

One variable that causes another is referred to as an independent variable. The issues affecting students' performance in STEM courses during blended learning were recognized as student-related and institution-related challenges in the study.

3.5.2 Dependent Variables

A dependent variable is one that is caused by another; it is dependent on an independent variable. The academic performance of undergraduate mathematics students is the dependent variable in this study.

3.6 Data collection techniques

Questionnaires was utilized as the primary data collection instrument for this research study to acquire information about attitudes, beliefs, behaviors, and experiences. They will be administered in paper based and face to face forms, with a mix of open - ended and closed - ended questions. The goal of employing questionnaires was to collect vast amounts of data in a systematic and consistent manner. The questionnaire was carefully constructed by the researcher to ensure the quality and reliability of the data obtained while accounting for potential biases such as social desirability bias.

Overall, questionnaires proved to be an effective research tool for probing study issues and generating insights that influenced policy and practice.

3.6.1 Data collection tools

The questionnaire was aimed to gather broad information from Busitema University, Nagongera campus students on their blended learning perspectives, knowledge, and attitudes. The questionnaire was divided into five sections: A, B, C, D and E. Section A included three closed-ended questions about the respondents' personal issues during blended learning. Section B included five closed-ended questions about students' attitude and their interaction in STEM courses at higher institutions of learning. Section C included five open-ended questions about students' attitude and their performance in STEM courses at higher institutions of learning. Section D included five questions about students' attitude towards STEM teaching methods.

Section E included two questions about strategies used to enhance the teaching and learning of STEM courses at higher institutions of learning.

The questionnaire contained two open - ended questions and 18 closed - ended questions. Each domain was measured with many items on a 4 like scale of strongly agree, Agree, Not Sure and Disagree.

3.6.2 Data analysis

The information gathered was examined both qualitatively and quantitatively. The open-ended items in both the student and teacher questionnaires yielded qualitative data. The data were classified into distinct categories in accordance with the research objectives, and deductions and generalizations were made based on patterns and trends in replies.

Closed ended items in the student, teacher instruments yielded quantitative data. They were coded and entered into the SPSS application on the computer. The data was evaluated specifically using simple descriptive statistics such as percentages, means, and frequencies. Tables and graphs were used to present the data.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the findings of the study based on the data collected from the students in relation to the objectives of the study. The data was interpreted with the use of the statistical packages for social science (SPSS). The data was analyzed using Frequency Tables, Pie charts and Bar graphs in line with the themes and objectives of the study.

4.1 Profile of respondents

A total of 65 questionnaires were successfully filled and collected for this study. The 65 respondents formed 20% of the year two and 80% of the year three of the populations were considered. Majority of the respondents were male's forming 64% while the female respondents were 36%.

4.2 Perception of students towards STEM courses

The study sought to determine the perception of students in STEM courses at higher institutions of learning whether favorable or unfavorable. The items from the questionnaires were summarized with learner's responses as Yes, No and Not sure.

Table 1; Places of origin of respondents

| Region of respondents | Frequency | Percentages (%) |
|-----------------------|-----------|-----------------|
| North | 15 | 15 |
| East | 35 | 55 |
| Central | 10 | 27 |
| West | 5 | 3 |

Figure 1; Places of origin of respondents

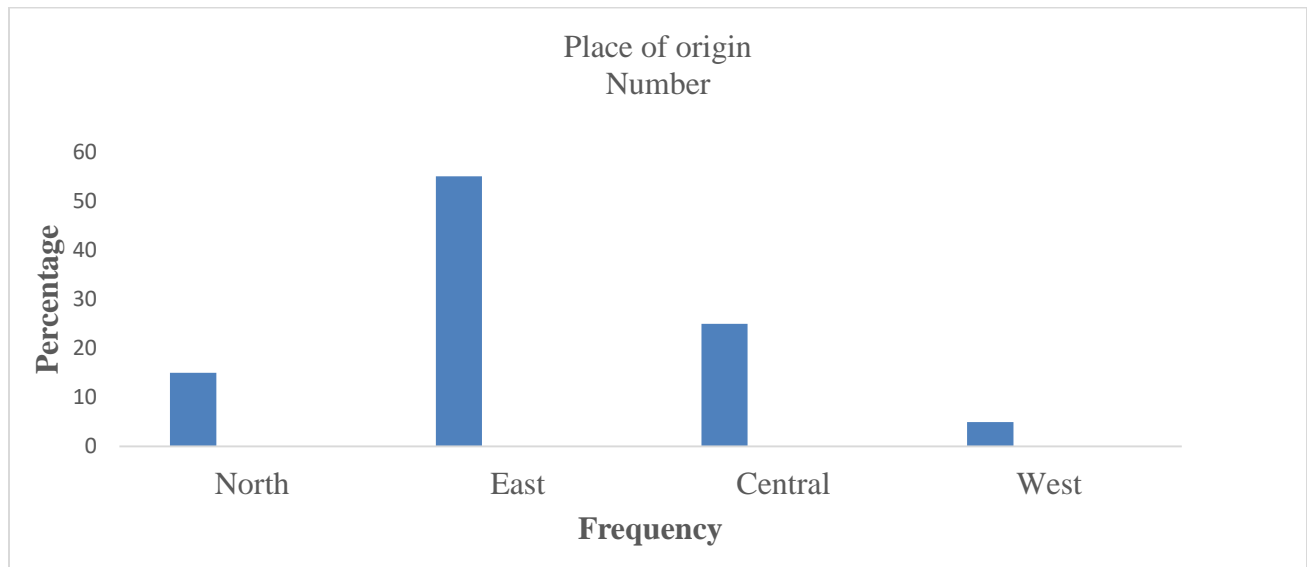


Figure 1 representation of places of origin of respondents. Out of the 65 respondents that participated in the study, 35 (70%) were from Eastern Uganda, 10 (15%) from Central, 15 (12%) from Northern Uganda and 5 (3%) from Western Uganda.

Table 2; Attitudes of students towards STEM courses at higher institutions

| Attitudes | Yes | | No | | Not Sure | |
|------------------------------------|------------|----------|-----------|----------|-----------------|----------|
| | No | % | No | % | No | % |
| Do you like STEM courses? | 120 | 84 | 14 | 10 | 12 | 6 |
| Do you enjoy learning STEM course? | 118 | 83 | 20 | 12 | 15 | 7 |
| Is STEM course boring you? | 24 | 18 | 100 | 75 | 10 | 8 |

Table 2 indicates that 84% of the respondents said that they like STEM courses, while only 10% did not like STEM courses and 6% were not sure. Those who enjoyed learning STEM courses were 83% compared to 12% who did not enjoy STEM courses and 7% were not sure. In addition, 75% of the students felt that STEM courses were not boring compared to 18% who felt that STEM courses were boring and 8% were not sure. It can be noted from the analysis in Table 2 above that students had a positive attitude towards STEM courses and therefore they are expected to perform better in STEM courses at higher institutions of learning.

4.3 Perceptions and beliefs of students towards STEM courses

The study investigated the perceptions and beliefs of the students towards STEM courses by assessing the level of agreement of the students on various statements on perceptions and beliefs. The students' perceptions and beliefs towards STEM courses at higher institutions are summarized in the Table 3 below.

Table 3; Perceptions and beliefs of students towards STEM courses at higher institutions

| Perceptions and beliefs | Yes | | No | | Not Sure | |
|---|-----|----|-----|----|----------|----|
| | No | % | No | % | No | % |
| Is STEM course applicable in any other areas? | 125 | 92 | 5 | 6 | 10 | 6 |
| Is STEM course useful for career growth? | 115 | 82 | 25 | 17 | 8 | 4 |
| It is possible to perform well in STEM course? | 135 | 95 | 6 | 4 | 7 | 5 |
| Do your belief that STEM course is difficult? | 18 | 15 | 105 | 75 | 22 | 15 |
| Would you avoid STEM course if it was optional? | 41 | 35 | 79 | 60 | 18 | 12 |

The information in Table 3 shows that 95% of the respondents agreed that it was important to do well in STEM while 92% of the respondents agreed to the fact that STEM courses were applicable in other areas. Those who thought they needed STEM courses for their career were 82%, while 75% of the respondents believe that STEM courses are difficult. 60% of the respondents would not avoid STEM courses if it was an optional course while 35% would avoid. These findings confirm that there is a positive belief and the right perceptions exhibited by the student's which are hoped would enhance achievement in STEM courses.

If students think that STEM courses are important, useful and contribute towards success in other areas due to its applicability, they will not avoid STEM courses whose performance depends on programs. They also know that careers are built from the good performances in STEM courses and related areas which would require their efforts in order to perform and qualify for the various

fields. Where the effort does not yield any success, the student may give up or feel that STEM courses should be optional as they believe that STEM courses are difficult for them.

This may lead to dismal performance in STEM courses and consequently in other related areas which will curtail them of their future careers.

This is in line with the findings that considering student's opinions and beliefs regarding STEM courses; how much they value and like it and what they forecast in their own future education (Breiner, Harkness, Johnson, & Koehler, 2012). Students with higher self-concepts are those who thought that doing well in STEM courses was not so difficult and who valued the importance of STEM courses more than their peers with low self-concepts to attain higher STEM achievement (Seo, Shen, & Alfaro, 2019). The students should be guided to realize the importance of STEM courses through all aspects of lives so as to embrace STEM courses and acquire the necessary skills which would enhance their performance in STEM courses and other related areas at higher levels.

Table 4; Findings on the challenges affecting both students and the institution regarding blended learning

| Gender of the respondents | Frequency |
|----------------------------------|------------------|
| Male | 40 |
| Female | 25 |

Figure 2; Gender of the respondents

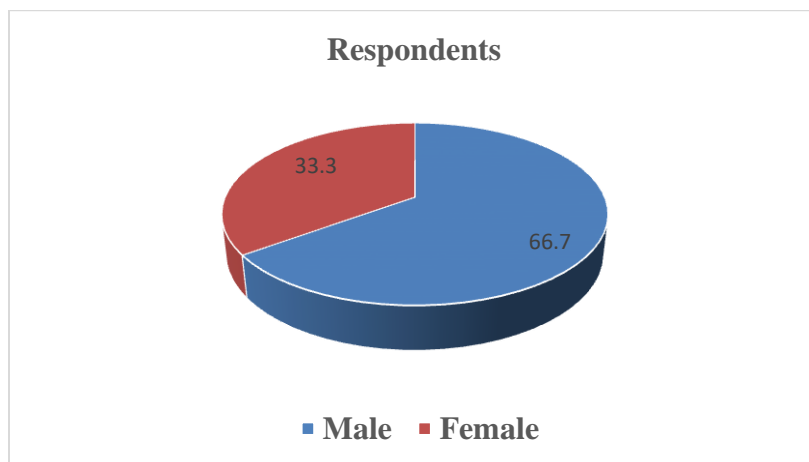


Figure 2 representation of gender distribution of respondents. Out of the 65 respondents that participated in the study, 40 (66.7%) were male's while 25 (33.3%) were females.

Table 1; Student challenges regarding blended learning of STEM courses at higher institutions

| Indicator | SA | A | NS | D | Percentage |
|--|-------|-------|-----|-------|------------|
| I have been trained on how to attend online and face- to-face. | 28.3% | 11.7% | 10% | 50% | 100% |
| I have a personal computer that helps me to study online and face- to- face. | 11% | 34% | 0% | 55% | 100% |
| I use my smart phone for studying online and face- to- face. | 46% | 50% | 0% | 4% | 100% |
| I can open a website address directly without help. | 16% | 32% | 0% | 52% | 100% |
| I have access to internet and also able to buy data bundle to attend both online and face – to face. | 15% | 31.7% | 0% | 63.3% | 100% |

Table 5. Student challenges regarding blended learning of STEM courses at higher levels. Majority 30 (50%) of the respondents had no knowledge on computer use while 20 (35%) had knowledge in computer use and 10 (3%) were not sure of their skills, which implied that most of the respondents did not know how to use computer to retrieve information regarding blended learning of STEM courses at higher levels, so they missed some information and hence a negative impact on their performance while 5 (12%) never had access to computer completely so they did not access any online resources apart from relying on face to face learning hence leading to failure.

40 (40%) of the 65 respondents had personal computers while 20 (50%) never had personal computers and 5 (10%) rely on face-to-face learning. This implied that most of the respondents did not have personal computers which limit them from accessing online resources with ease some even missed online lessons, this greatly deteriorated their performance because it left them struggling to capture concepts in a hard way which wastes time.

Those with computers are more likely to perform better because they had access to information whenever they wanted compared to those who rely on traditional face to face learning which was similar to a study by (Susan & Ssengabi, 2016).

Majority 55 (96.7%) used smart phones for studying online while 10 (3.3%) did not have smartphones to study online and they rely on hard copy given by their lecturers. This implied that most students had smartphones and would use them to study which was not a challenge.

There were 47(52%) of the respondents who could open a website address directly without help while 18(48%) of the respondents could not open a website address. However, they rely on lecture materials hence leading to a decline in their performance because some would shy off to ask for help and probably no one would be available at that material time. Majorities 50(63.3%) of the respondents had access to Internet and also were able to buy data bundles while 15(46.7%) of the respondents did not have access to Internet & also could not buy bundles and they could rely on hard copy given by their lecturers which is line with a study by (Banda & Muma, 2021).

4.4 Respondents' views on faculty challenges

Majorities of the respondents listed some of the challenges that the faculty of science and education, Nagongera Campus, Busitema University faced are;

Poor internet, Limited resource, No training, Electricity, Expensive gadgets, Power

Table 2; Students view on institutional challenges

| Challenges | Percentage (%) |
|----------------------|----------------|
| Limited resources | 15 |
| No training | 10 |
| Unstable electricity | 25 |
| Expensive gadgets | 16 |
| Power | 35 |

Figure 1; Students view on institutional challenges

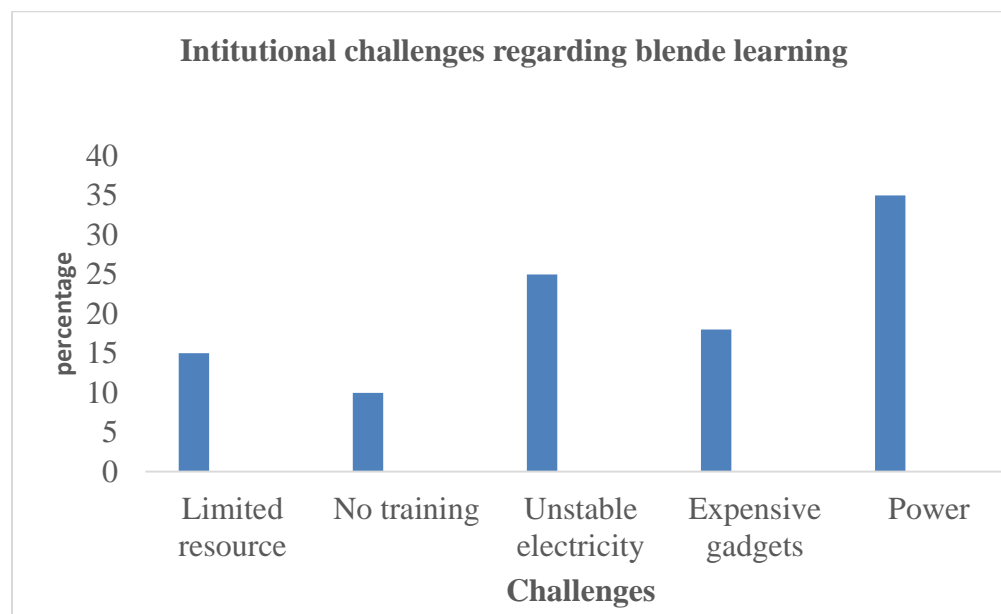


Figure 3. The views of the respondents regarding the challenges faced by the faculty of Science and Education, Nagongera Campus, Busitema University are summarized on the graph above.

Poor internet

For the adoption of blended learning of STEM courses at Busitema University, Nagongera Campus. Low or no internet connectivity was cited by fifty respondents as a major obstacle.

Electricity

According to the respondents, one of the major challenges Nagongera Campus encountered when implementing the blended learning process at Busitema University was power outages. One of them stated that one of the biggest obstacles to blended learning was electricity and internet. Due to the appalling quality of national energy, even with dedicated generators, there is no electricity and the internet for 24 hours, particularly in towns and villages. As a result, the online process failed. For a very long time, Nagongera has struggled with inadequate electrical supply.

In particular during the rainy season, people frequently lose power. In general, the region's major cities have stronger energy connections than its smaller towns and villages, which make it challenging for Nagongera campus to implement blended learning practices.

Limited resource

Thirty of the respondents said the campus had limited computers that would cater for all student's if they needed to use it at the same time during online learning and even some computers would not be functioning well hence hinders blended learning practices at Nagongera campus.

Expensive gadgets

Twenty of the respondents reported that the campus did not have enough money to buy enough computers to serve all students hence limits blended learning practices at Nagongera campus.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

Introduction

This chapter presents a summary of the finding's conclusions and recommendations of the study.

5.1 Conclusion

The study examined students and Institutional challenges that affected the academic performance of STEM courses at Busitema University, Nagongera campus in Eastern Uganda. The study employed 65 respondents. Students' challenges included. No training on how to use computers, never had personal computers, no internet access, no data bundles and cannot open a website. However, they rely on face-to-face learning. This implied that most of students neither had computers nor enough knowledge to use them while the campus never had enough computers and internet enabling students perform well in STEM courses at higher institutions of learning as far as blended learning is concerned.

5.2 Recommendations

5.2.1 University administration

The campus needs to encourage students with computer skills to enroll in blended learning studies, since this make it easier for them and allocate more time for it to be effective.

Nagongera campus needs to purchase more computers in sufficient numbers so that all students can access them whenever they need. This can support blended learning of STEM courses.

Finally, Nagongera Campus need to partner with reputable internet service providers to ensure that students always have access to the internet such that they can fully attend online learning

rather than over relying on face-to-face learning. Therefore, this can make it earlier for blended learning of STEM courses to be effective.

5.2.2 Ministry of Education and Sports

The Ministry of Education and Sports should allocate more resources to government aided institutions and also engage in private public partnership for the private institutions so that they access education and scholastic equipment's such as computers to ease blended learning of STEM courses at higher levels.

Finally, I recommended other researchers to continue with this research at campuses in different places.

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