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## SOCIOLOGY | RESEARCH ARTICLE

# Gender dimensions of emerging technologies for learning in a University

Desire Mawuko Komla Ayite<sup>1</sup>, Simon-Peter Kafui Aheto<sup>2</sup> and Paul Nyagorme<sup>3</sup>

**Abstract:** The paper sought to find out whether gender influences the use of emerging technologies among higher education students at the University of Cape Coast. A data set of 357 respondents was used. It was found that more than half of the respondents were accustomed to the use of emerging technologies which translated in the improvement of their understanding of unclear concepts in their learning. However, the study showed no statistically significant difference in students' academic performance and their use of emerging technologies. The respondents indicated that they learn best when emerging technologies are available during the learning period ( $p = 0.017$ ). Further, there was improvement in performance when respondents use emerging technologies to enhance learning. This study concludes that one should be circumspect when using emerging technologies in learning as they can contribute positively and negatively depending on the nature of usage.

**Subjects:** Technology; Education - Social Sciences; Gender Studies -Soc Sci; Adult Education and Lifelong Learning; Educational Research; Education Studies; Higher Education; Open & Distance Education and eLearning; Teachers & Teacher Education; Information Technology

**Keywords:** academic achievement; Emerging Technologies; gender dimensions; learning; students

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### PUBLIC INTEREST STATEMENT

The aim of this study is to distinguish between male and female use of technological tools and how they influence academic performance.

There is a general but erroneous idea by people regarding users of technological tools. Within academic institutions people have long held the notion that effective handling of technology is for males as opposed to females. However, our study proved that the use of technological tools like smartphones, computers and other devices to enhance understanding of concepts taught as well as academic performance is the same for males and females. This study shows that the academic performance of male and female students who use technology to access information for better understanding is at par. Therefore, it is imperative to say that the use of technology to complement teaching and learning experiences can be positive or negative depending on usage. It is important to effectively use technological tools to enhance better academic performance by both males and females.

## 1. Introduction

Countries all over the world have started giving some attention to the use of emerging technologies to solve various problems across fields. Over the years, teachers have used different technologies in their teaching delivery. Likewise, students have also adopted various learning styles to internalise contents taught them. Alves et al. (2017) point out that many tertiary educational institutions are employing online and virtual learning environments to enhance their teaching and learning processes. Ferriman (2019) also indicates that digital learning platforms provide flexible and conducive learning environments that meet the learning needs of students. Furthermore, about 63 million teachers and students took to online learning platforms to bridge the gap created between teachers and students by the deadly Coronavirus (COVID-19; UNESCO, 2020). Therefore, the use of emerging technologies continues to affect the means of educating and ways of acquiring knowledge by modifying the processes. The COVID-19 pandemic has also revealed how nations around the world, through strategic communication with key stakeholders, have become biased towards the use of emerging technologies to alter educational processes without spreading the pandemic (McMillan, 2020). The situation is not different for African countries. Many governments in Sub-Saharan Africa are investing in emerging technologies that can be used in educational institutions to elevate the rate of students' comprehension and understanding. For instance, a report from the Ethiopian Ministry of Education (MoE) indicates that the adoption of emerging technologies by educational institutions and organisations has grown exponentially (MoE, 2014). Research by Geta and Tadesse (2015) which examines efforts made by the Ethiopian government in the area of educational technologies reveals that 90% of students performed better in their studies. Their study attributes this improved performance to technological use and support. The students relied on the use of technological gadgets such as computer aided instruction, projectors and video clips for their academic successes. The attainment arising from integrating emerging technologies in schools has also seen appreciable level of positive influence on students as in the case of Serbia (Ivanović et al., 2018).

The Ethiopian example is not an isolated case for Africa regarding this technological development. In the context of South Africa, Bester and Brand (2013) indicate that the use of technology has a major advantage of not only maintaining students' attention in class but always arousing students' motivation and concentration. Earlier, Shelly, Shelly et al. (2004) established that technology has the potential to increase motivation and class attendance of students. They further indicate that emerging technologies could increase students' access to education even from the remotest areas which naturally would have been problematic. In addition, Bester and Brand's (2013) findings on the sustenance of students' attention due to technology buttress Shelly et al.'s (2004) position. Empirical evidence from the work of Bester and Brand show that there was a significant difference between students taught using emerging technology and those taught using the conventional approach. Based on the findings and analyses from researchers afore discussed, there is evidence of gradual integration of emerging technologies into the African educational system.

Over the years, gender has played a substantial part in the achievement of academic work. In academia, there are gender disparities leading to males dominating in most departments. For instance, Acker (2006) opines that gender disparity is dominant in most universities; a phenomenon that has become a natural event and resulted in gender gaps. Concurrently, results from Boateng's (2018) study show that male students outnumbered their female counterparts. The extent of. This imbalance is that, in a class of 26 students, only one female is enrolled. Acker's (2006), and Boateng's (2018) studies support the positions of Assie-Lumumba (2005) that gender disparity continued to exist for about two decades after independence. Mama (2003), Tamale and Oloka-Onyango (1997), and Tsikata (2007) among others have all shown that gender disparity in African universities has existed from decades after independence. This reality is part of the colonial

legacy of higher education in Sub-Saharan Africa. Instead of African leaders and tertiary university management breaking this trend, it was perpetuated for a number of decades, and it is still being perpetuated today.

The disparities in the proportion of male and female students influence academic work just as it is observed among university staff. A study conducted on net generation in Australia found that the confidence in using digital technologies varies among students in terms of their gender (Jones, 2012). The gender differences on uptake of technology may be the result of several factors. Göransson and Rolfstam (2013) suggest that women are relegated to the background in the areas of technology since most developments in the field are spearheaded by men and for men. In effect, males dominate when it comes to technology use in most universities around the globe.

The inference that female students are limited in the use of emerging technologies in education is not always the case. The involvement of females in higher education varies from country to country. Female students even outnumber male students in some countries. Researchers have shown that equal avenues are offered to female students in Poland and Sweden where younger females are better educated than their male counterparts (Acker, 2006; Etzkowitz et al., 2000; Ramsey & McCorduck, 2005). On the contrary, these researchers note that women are not adequately represented in scientific investigations. The notion that females contribute more to education than males cannot be substantiated. Simply put, women have the opportunity ability to match challenge their male counterparts academically and are not all the time underrepresented in most countries.

The issue of students' beliefs and experiences about information technology also play a dynamic role when it comes to technology use in education. For instance, focusing on adult students, Moslander (2000) posits that students' beliefs and experiences about information technology and the library system differ greatly according to the students' age. The study suggests that adult students might learn better in the absence of emerging technologies. Alamri and Alsaleh (2018) on the contrary argue that emerging technologies help to create "flipped classroom" experiences which served as a form of blended learning for students; that is, a situation where students take up courses online and do class assignments.

The adoption of the emerging technologies can be seen in computer laboratories or the use of gadgets to access information online. Online learning by students is another aspect of using emerging technologies. A recent study conducted by Twum and Ayite (2020) on the use of mobile technology to enhance learning among University of Cape Coast Health Science Education students found that the 98.9% of the respondents make use of the Internet. These students further revealed that they use the Internet for varied duration of hours. It was indicated that 18.9% males and 16.8% females use Internet for up to one hour in a day, 13.7% males and 21.1% females used it for up to two hours in a day, 10.5% males and 7.4% females for up to three hours in a day, 2.1% males and 3.2% females for up to four hours in a day, 0.0% males and 5.3% females for more than four hours in a day. Twum and Ayite (2020) therefore conclude that students will always make use of Internet wherever they find themselves. What can also be concluded from this study is that the use of new technologies may vary based on gender.

There is also the need to believe that student characteristics is key in adopting a particular learning style. Thus, as some students may learn best from classrooms, others may enjoy learning from books or from laptops or phones or tablets (Ahetu, 2017). According to Jonassen (2002), teachers that believe in collaborative learning establishes relationship with students as their partners and make use of ICT as an intellectual and cognitive tool. Experiences of students or teachers in the use of emerging technologies may inform how often they are used (Alharthi, 2020).

Emerging technologies may be available for use for students to learn but may at the same time cause hindrances to what and how students learn. Bianchi and Phillips (2005, p. 40) have drawn

attention to the fact that “[H]istorically, there appears to have been gender differences in relation to the uptake of new technology”. The gender differences may have also necessitated the various number of gender dimensions in the uptake of technology related fields (Amodu et al., 2020; Palmén et al., 2020). Within the context of the observations made about gender and technology adoption, the present study attempts to contribute to the body of knowledge in the area of gender, education and technology education. Earlier studies (Amodu et al., 2020; Balasubramanian et al., 2010; Göransson & Rolfstam, 2013; Palmén et al., 2020) have rather focused on gender differences or dimensions based on individual technological uses of tools but not technology in a holistic approach.

### **1.1. Research objectives**

The objectives of our study are the next:

- (1) to assess the influence of the use of emerging technologies on academic achievement of male and female students of University of Cape Coast; and
- (2) to assess the factors that influence the use of emerging technology for academic work by students of University of Cape Coast.

### **1.2. Research hypotheses**

To achieve these objectives, two main hypotheses are tested using our data set:

**H<sub>01</sub>**: there is no statistically significant difference between male and female students regarding the use of emerging technologies in their academic performance.

**H<sub>02</sub>**: there is no statistically significance difference between the academic work of students and the factors that influence the use of emerging technologies.

### **1.3. Assumptions**

The following assumptions were tested to ensure the statistical tools used produced the correct values.

- (1) All the observations from both groups are random and are independent of each other.
- (2) Samples do NOT meet the normal distribution criteria but are interval or ratio.

## **2. Methodology**

### **2.1. Design**

In undertaking this study, the quantitative research survey design was used. This design encourages using step-by-step procedures in conducting research, explanation of natural occurrences of events via data collection, and the making of inferences from results. This approach is consistent with Creswell (2014). The quantitative research survey design is therefore deemed appropriate for carrying out a study in gender dimensions of emerging technologies for learning.

### **2.2. Participants**

The participants of the study comprised all regular full-time students at the University of Cape Coast. This category of participants was considered for the study as it helped to obtain information on how emerging technologies are being applied across the various faculties of the university. Majid (2018) posits that a study’s population of interest is the target group intended to be studied.

However, it is advisable to select a representative number from the respondents when dealing with large numbers such as the one in this study where about 19,300 students form the target of the study. Based on the criteria formulated by Krejcie and Morgan (1970), p. 400 respondents in the third year of a four-year undergraduate programme were targeted out of the estimated

population of 19,300. These students were selected based on a technology-related elective course they offered from their respective departments. Therefore, an entire class of students was selected. From the Department of Mathematics and ICT Education, 102 students were selected, 82 from Biochemistry Department, 64 from English Department, 65 from Arts Education Department, and 64 from the Department of Business and Social Sciences Education.

### **2.3. Instruments**

A self-developed questionnaire was the instrument used for data collection. The choice of questionnaire is because questionnaire help to collect data within a reasonably short period of time. Also, studies have shown that questionnaires, if well-structured and handled, can produce high validity and reliability (Sarantakos, 2005). The questionnaire is made up of both closed and open-ended items. The closed-ended items were made up of a 4-point Likert scale. The Likert scale had strongly disagree at 1, and strongly agree at 4. Also, the open-ended items requested respondents' opinion on the influence of emerging technologies on their academic performance. Other open-ended items focused on respondents' assessment of their performance.

### **2.4. Data collection procedures**

Approvals for data collection were granted from the affiliated departments of the respondents following the grant of ethical clearance. The ethical clearance was obtained from the Institutional Review Board of the University of Cape Coast. Before the administration of the questionnaire instrument, a pilot study was conducted to ensure validity and reliability. The reliability coefficient, thus Cronbach  $\alpha = 0.79$  was obtained when a sample of 50 students from the University of Education, Winneba was used. These students shared similar characteristics with the actual participants of the study. According to Cho and Kim (2014), a Cronbach alpha value greater or equal to 0.7 or 0.8 is acceptable for an instrument to be considered reliable. Based on the reliability coefficient alpha of  $\alpha = 0.79$ , the researchers accepted the instrument to be reliable. A response rate of 89.3% for the completed questionnaires by respondents was achieved.

### **2.5. Data processing and analysis**

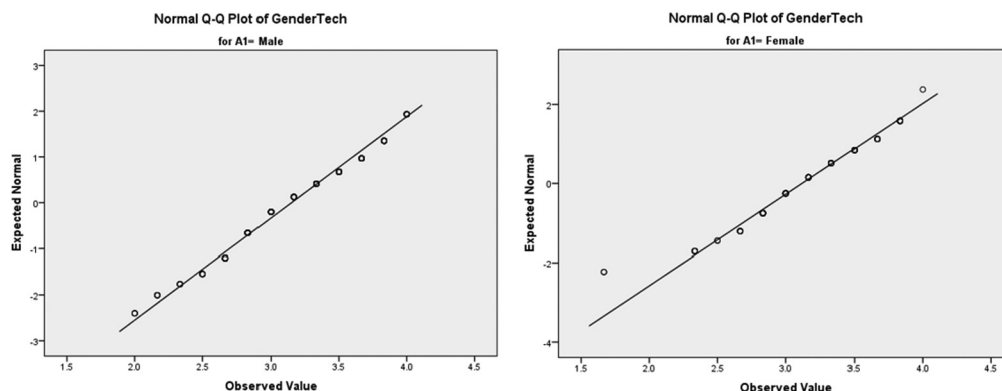
The completed data collection instruments by respondents were organised and seriated for easy identification. All the responses were categorised and coded into the Statistical Product and Service Solutions (SPSS) software. The frequency count tool was used for the opinions while the Mann-Whitney U test and the Pearson correlation tools were used in analysing research hypotheses 1 and 2, respectively.

## **3. Results and discussion**

### **3.1. Gender influence on the use of emerging technologies on academic performance**

The responses provided in this section are in line with those reported by other researchers. The use of emerging technological tools provides avenues for students to explore other sources of information. Generally, results are agree with Alamri and Alsaleh (2018) who established from a review that technology provides grounds for improvement of academic opportunities for students. Also, Alamri and Alsaleh found that emerging technologies provide opportunities for students to learn new content online and at the same time, do assignments. To some extent, it can be said that emerging technologies help with the acquisition of more educational resources. It was discovered that emerging technologies helped almost two-thirds of the students to achieve positive learning outcomes. A minute portion of them (23 out of 357) indicated that it affected them negatively. Thus, emerging technology can be termed as a double edge sword. It can be beneficial or detrimental to any individual depending on how it is being used. However, to determine the influence of gender on the use of emerging technologies on academic work, the Mann-Whitney U test was used. This was done to avoid the pitfalls that could have occurred if parametric analysis was used since the normality assumption, even though appears to be normal, has some deviations from the normal graph.

**Figure 1. Normality and homoscedasticity assumptions' tests.**



**Table 1. Mann-Whitney U test for gender influence on the use of emerging technologies on academic performance**

Groups	N	Median	Mann-Whitney U	Z	p	r
Male	243	3.10	13,849.000	-0.002	0.998	-0.0001
Female	114	3.05				
Total	357					

\*p < 0.05, Source: Field survey

### 3.2. Testing for hypothesis 1

The Mann-Whitney U test was used since the normality assumption was not met. The normality graph is presented in [Figure 1](#).

Results of the Mann-Whitney U test is presented in [Table 1](#).

It can be observed from [Table 1](#) that there is no statistically significant difference in the performance of respondents based on the gender when it comes to the use of emerging technologies since the Mann-Whitney U test showed that the performance of males (Md = 3.10, n = 243) is at par with the performance of females (Md = 3.05, n = 114), U = 13,849.0, z = -0.0002, with a weak effect size r = -0.0001.

The results obtained for the Mann-Whitney U test are contrary to the disparities that researchers have shown to exist between males and female students. A typical example is the study by Göransson and Rolfstam (2013) which suggest that women are relegated to the background in the areas of technology and technical development perhaps, because most technological developments are done by men and for men. The contribution of female students in education in this study matched that of males as there is no significant difference in their performances. This fact is reflected in the median values of their performances. This implies that, in terms of academia, when technology is integrated into teaching and learning experiences, it favours both males and females. The academic achievement of males is the same as that of females when they are taken through the same learning experiences without being gender bias. This position is confirmed by the results from this study. Considering results from [Table 1](#) and the above discussion, the study fails to reject the null hypothesis that there is no statistically significant difference between male and female students regarding the use of emerging technologies in academic work.

**Table 2. Influence of emerging technologies on academic performance**

S/N	Response	No. of respondents
1	<i>I get clearer understanding from online tutorials on concepts that I do not understand during lectures</i>	201
2	<i>Animations make it easier to understand abstract concepts</i>	177
3	<i>Easy access to electronic books helps to obtain alternate sources of information</i>	176
4	<i>Emerging technologies helped to improve research by reducing the amount of time needed to go through huge files. These technologies helped me to improve upon my performance</i>	232
5	<i>Emerging technologies negatively influence my performance since I use them to watch movies more than I use them to learn</i>	23

N = 357; Source: Field survey

### 3.3. Factors influencing the use of emerging technologies for academic work

The factors that influence teachers in their use of emerging technologies in academic work are many and varied. Table 2 gives an overview of respondents' opinions on factors that influence their use of emerging technologies for academic performance.

Generally, results from Table 2 show variation when it comes to emerging technology use for academic performance. Generally, students see emerging technologies as very important in their quest to understanding lectures through the abundance of tools and in the area of research. The results confirm findings of earlier research conducted by Bester and Brand (2013) and Shelly, Shelly et al. (2004). Respondents whose academic performances were negatively affected by emerging technologies were in the minority. The finding that students' addiction to new technologies may gradually develop into an automatic habitual pattern difficult to control is constituent with findings of Bianchi and Phillips (2005). Therefore, emerging technologies also serve as a threat to achieving academic excellence when not checked.

Putting the results from the Mann-Whitney U test (Table 1) and the number of responses obtained from the respondents in Table 2 together, it is apparent that technology integration in learning helps both males and females to comprehend concepts that were not easy to understand during learning experiences. Technology has given students the ability to surf the internet in search of contents that will enable them to understand difficult concepts. Using multimedia resources on the internet coupled with other technological tools is important and can cause positive change in the performance of students when used appropriately. In essence, there is no disparity between and males' and females' academic performance when using technology in education. In addition, emerging technologies in education influence academic performance more positively than negatively.

**Table 3. Pearson correlation on students' use of emerging technologies and their academic performance (N = 357)**

Items	r	Sig. (1-tailed)
Enabling resources are always available	0.112	0.017
Emerging technologies help me to contribute my quota to learning via chat rooms, social media groups and in presentations	0.102	0.027
Enabling facilities such as internet access are expensive	0.084	0.057
I am motivated to use emerging technologies when learning	0.072	0.087
The use of emerging technologies in learning consumes more time than the traditional way of learning	0.062	0.121
Emerging technologies help to understand difficult concepts	0.049	0.180
Emerging technologies, especially mobile phones, distract me during lectures	0.028	0.299
Technological resources are expensive to come by and maintain	0.024	0.325
Social media and the internet addiction contribute to a decrease in performance	-0.024	0.326
I find it difficult operating my devices effectively	-0.024	0.324
I find it difficult to locate the information I am looking for	-0.044	0.205

Source: Field survey

### 3.4. Testing for hypothesis 2

To obtain the significant factors that influence the use of emerging technologies for academic work, regression analysis was run from the IBM SPSS statistical software. However, the Pearson Correlation obtained for the variables against academic performance is tabulated in [Table 3](#).

Per the correlation values presented in [Table 3](#), it appears that the only contributing factors that influence the academic performance of students are the availability of enabling resources—the use of chat rooms, social media groups, and presentations that helped students to contribute their quota to learning. These two factors obtained correlation coefficients of 0.112 and 0.102 with significant values of  $p = 0.017$  and  $p = 0.027$  (1-tailed) respectively against the current cumulative grade point average (CGPA) of the respondents. It could be inferred that the presence of enabling resources is one of the major factors affecting the use of emerging technologies for educational purposes. Also, using emerging technologies to contribute to the development of learning goals in chat rooms, social media groups and in presentations is another important factor that contributes to the use of emerging technologies. Emerging technologies are powerful tools in attending to the learning needs of students and contribute to the development of new strategies that teachers can use to bridge the gap that exists between teachers and students. It is evident that, when resources are available, students use them to seek new knowledge and/or obtain more understanding of concepts taught in school. This is shown in the results obtained in [Table 3](#). Moreover, the position of Ferriman (2019) attests to the fact that emerging technologies such as digital learning platforms meet the

**Table 4. Regression analysis of factors contributing to the use of emerging technologies in academic performance**

Model	B	Mean	SD	Beta (β)	t	Sig.
(Constant)	2.731				21.709	0.000
Enabling resources are always available	0.092	2.83	0.643	0.112	2.117	0.035
Emerging technologies help me to contribute my quota to learning via chat rooms, social media groups and in presentations	0.073	3.14	0.651	0.089	1.468	0.143

Source: Field survey  
 (Constant = 2.731, B- Unstandardized Coefficient = 0.092, Beta (β) = Standardized Coefficient = 0.112, Mean = 2.83, Standard Deviation = 0.643, t-value = 2.117, sig. value = 0.035)

learning needs of students. In conclusion, when emerging resources are used for the right purposes, they provide better results. Using these tools in education also helps to obtain improved outcomes. [Table 4](#) provides more analysis on the factors that contribute to the use of emerging technologies in education.

For the regression analysis, variables were excluded at a confidence level of 95%. From [Table 4](#), it was observed that only one variable was selected as a contributory factor to the use of emerging technologies for academic work. This is stated as follows: Use of emerging technology in academic performance = 2.731 + 0.092 enabling resources are always available.

From students' perspective, the presence of emerging technologies can contribute positively to their academic work. Thus, the presence and use of emerging technologies help to improve their understanding of concepts which translates into their academic performance. Unlike the results of [Table 3](#), the variable *Emerging technologies help me to contribute my quota to learning via chat rooms, social media groups and in presentations* is not statistically significant when regressed with the students' academic grades. In line with findings from the literature, both teachers and students use emerging technologies if they believe such technologies can help achieve greater performance (Ivanović et al., 2018; Jonassen, 2002). It can be inferred that the respondents in this study have become accustomed to the use of new technological tools to enhance their learning; students have the opportunity to research on the internet, with the help of these emerging technologies issues that they did not understand. This finding is contrary to Moslander's (2000) study which found that adult students learn better without emerging technologies. As shown in the results of this study, good, better or best learning is achieved with the availability of emerging technologies and their appropriate use in learning experiences. Students prefer the use of these technological tools as they affect learning experiences positively.

It is imperative to state that the time factor involved in the use of emerging technologies or its distractive nature, difficulty of operation and benefits did not have much influence on how respondents perform in their academic work. It is right to say that the respondents of the study prefer the use of emerging technologies in doing their academic work. Hence, the research hypothesis two (H<sub>02</sub>) is rejected since there is a statistically significant difference between the academic work of students and the factors that influence the use of emerging technologies.

### 3.5. Key findings

**Finding 1a:** The study revealed that there is no statistically significant difference between male and female use of emerging technologies on their academic performance. The performance of males as compared to females was observed to be similar based on the significant value obtained from the Mann-Whitney U test ( $p = 0.998$  which is greater than 0.05).

**Finding 1b:** Almost half of the students indicated that the use of emerging technologies helped them to understand the concepts they previously did not understand. From the respondents' point of view, emerging technologies help them to perform better than they would have without them. It was only a few (less than 7%) that responded that emerging technologies affected their performance negatively.

**Finding 2a:** More so, the study found that one of the factors that affected the performance of respondents was the availability of emerging technology resources (there is a weak positive relationship between students' performance and availability of emerging technologies,  $r = 0.112$ ,  $p = 0.017$ ). Simply put, the respondents do better when emerging technologies are readily available for their use. Thus, emerging technologies serve as boosters to respondents when learning.

**Finding 2b:** Finally, the study indicated that another factor that influence students' performance is the use of emerging technologies to contribute to learning via chat rooms, social media groups and in presentations (there is a weak positive relationship between students' performance and the use of emerging technologies to contribute to learning;  $r = 0.102$ ,  $p = 0.027$ ). However, there was no statistically significant difference in students' performance when they learned either by using the traditional methods of learning or by using emerging technologies in learning. That is the distractors or things that hinder smooth learning in the traditional and emerging methods of learning do not differ significantly.

### 3.6. Conclusions and recommendation

It can also be concluded that gender does not affect the performance of students regarding the use of emerging technologies for academic work. How well a person performs in academia mostly depends on what the person has learnt and the presence and use of materials that are perceived to present students with more opportunities, as in the case of emerging technologies. That is, this study was interested in the perception of performance by students, but this perception can be different from the real performance.

In addition, it is imperative to conclude that there are distractors in most learning methods. However, the difference in these distractors is influenced by the student, not the learning resources. Therefore, as emerging technologies present students with both relevant information and distractors (such as movies, adverts among others), students need to be guided about the elements of technology that may pose distractions to better academic performances since the results showed a weak positive relationship between technology and performance.

To sum up, it suffices to say that the use of emerging technologies in learning experiences can be beneficial. Also, emerging technologies can affect learning experiences negatively. Further, it should be noted that the contribution of emerging technologies is not dependent on gender as there is no statistically significant difference between men and women. Therefore, one should be circumspect when using emerging technologies in learning as they can contribute positively and negatively depending on how they are used.

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