PREDICTIVE POTENCY OF STUDENTS' ENGAGEMENT IN MOBILE ELECTRONIC TECHNOLOGY LEARNING (MET-LEARNING) ON THEIR ACADEMIC PERFORMANCE: GENDER IMPLICATION

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Abstract

The researcher investigated the predictive potency of students' engagement in mobile electronic technology learning on their academic performance and its implication on gender. The study employed the correlation survey research design, and the population comprised 9195 third year students in two public universities in Enugu state, Nigeria. A sample of 384 respondents, made up of 198 males and 186 females used for the study was drawn from the population using multi-stage sampling procedure. Two instruments named: "Students' Engagement in Mobile Electronic Technology Learning Questionnaire (SEMETLQ) and Students' Academic Performance Proforma (SAPP)", were developed by the researcher and used for data collection. The instruments were face-validated by three specialists from the Educational Measurement and Evaluation Unit, Department of Science Education, University of Nigeria, Nsukka. The SEMETLQ was subjected to reliability analysis using Cronbach Alpha method. Data collected were analyzed using multiple regression analysis to answer the two research questions and test the null hypothesis at 0.05 level of significance. The result showed a coefficient of determination (R^2) of 0.77, indicating that 77% of variation in students' academic performance is attributable to their engagement in mobile electronic technology. The result of the study also shows that gender does not significantly moderate the prediction of students' academic performance by their engagement in mobile electronic technology learning. Based on the findings and conclusions, it was recommended that: students should endeavor to engage actively in mobile electronic technology learning, discover learning task and communicate with other students about class instructions through their electronic mobile devices, both inside and outside the classroom in order to improve their academic performance. Education administrators and government should encourage and support programmes that will duly

consider teaching and assessment of students' engagement in mobile electronic technology learning in order to promote academic performance in schools and in life, generally.

Keywords: *Mobile Electronic Technology Learning; Students' Academic Performance; Gender.*

Introduction

Information and Communication Technology (ICT) is one of the fastest growing sectors around the world. The advancement in ICT has brought about several developments and has also produced rapid changes in the society by shaping the new global economy. In line with the view above, Ligi and Raja (2017) opined that ICT has become one of the most important factors for societal development in the 21st century. Within the past decade, new ICT tools have provided sufficient incentives for enhancing communication and entrepreneurial activity (Nami, 2010). ICT has produced significant transformations in industries, education, agriculture, medicine, business, engineering and other fields. It also has the potentials to transform the nature of education where and how learning takes place and the role of students in the learning process.

Effective ICT integration into the teaching and learning process has the potential to engage learners. For instance, using multimedia to present complex problems in a problem-based learning can motivate and challenge students and hence develop their problem-solving skills. It can support various types of interaction, learner-content, learner-learner, learner-teacher and learner-interface (Sun & Hsu, 2013). These types of learning or interaction make the learning process interactive, and the learners, more active and engaged. Making use of these technologies, stimulate the interest in learning of the content taught, becoming a promoter factor of significant learning that leads to formation of competent students with open horizons and predisposed to invest in innovation (Baran, 2014; Costello, 2010). Ross, Morrison and Lowther (2010) encourage the integration of technology in the classroom. Kenny (2011) stated that since young students are already widely exposed to technology, a classroom without its use would completely be uninteresting.

With varieties of electronic technologies available, students can access a multitude of information online and use them to explore their potential. The use of these technologies in the classroom provides a closer relationship between teachers and students, promoting their interaction which will lead to

a more active learning. The constant use of tools in learning, awakens in the student, greater interest in seeking for new and improved ways in learning, thereby ensuring a larger and more consolidated acquisition of knowledge (Costello, 2010). This implies that students' engagement increases when technology is used in the learning process, leading to greater participation, better and faster acquisition of concepts and skills, and consequently enhances students' academic performance.

Academic performance of students especially at the university level is not only a pointer to the efficacy or otherwise of schools but a major determinant of the future of youths in particular, and the nation in general. Academic performance has become a phenomenon of interest to all and this, accounts for the reason why scholars have been working tirelessly to unravel factors that militate against good academic performance (Aremu & Sokan, 2008). According to Ward, Stocker and Murray (2007), academic performance refers to the product of education; the extent to which the student, teacher or institution have achieved their educational goals. In the view of Santrock (2007), academic performance refers to how well a student is accomplishing his or her academic tasks in the cause of learning. Adedeji (2008) stated that students' academic performance is important because it appears to be the major criterion by which the effectiveness and success of any educational institution could be judged. Academic performance can therefore be seen as the observable and measurable behaviour of an individual within a particular situation. Cumulative Grade Point Average (CGPA), Grade Point Average (GPA) and test results represent students' academic performance.

Students are the most vital asset for any educational institution. The social and economic growth of the country is directly linked with students' academic performance. Aina and Olanipekun (2014) also maintained that the academic performance of students both at secondary school and post-secondary school is worrisome. This trend of low academic performance is also rampant among students of tertiary institutions. This has been a subject of major concern to educational planners, administrators, stakeholders in education and the students themselves.

However, poor academic performance has in the recent time been traced to lack of the use of technological devices in education. Nikana (2008) claims that students' academic performance may increase through the use of technological devices because students could be participating in group discussion and dialogue more often and receive quick and effective feedback,

which may reinforce learning and increase memory retention. Students in higher educational learning that engage in e-learning may tend to perform better than those who do not. In consonance to the above assertion, Holley (2012) posited that students who participate in e-learning could achieve better grades than students who studied with the traditional approach. But based on available literature, the researcher observed that there seems to be limited empirical evidence to support all these claims. This paradigm has led to the discussion of the learning process supported by mobile electronic technologies.

Mobile Electronic Technology Learning (MET-Learning) is seen as any activity that allows individuals to be more productive while consuming, interacting with, or creating information mediated through a portable digital device that the individual carries on a regular basis, has reliable connectivity and fits in a pocket or purse (Looi, Seow, Zhang, So, Chen & Wong, 2010). However, new mobile technology learning perspectives acknowledge it as a novel paradigm and put emphasis on learner-centeredness and individualism (Mockus, Dawson, Malizia, Shaffer, An & Swaggerty, 2011). According to El-Hussein and Cronje (2010), such devices must ensure mobility of technology, mobility of learners and mobility of learning process. It can therefore be deduced that this type of learning ensures that students have control over their own learning and are also responsible for the learning process. Nikana (2008) maintained that mobile learning leads to increased understanding of the material and curriculum content and through different collaborative methods and delivery approaches. It also provides students with an increased understanding and depth of knowledge regarding the materials and curriculum contents. Some researchers claim that mobile devices cause students to lose concentration by being distracted with activities such as chatting, surfing immoral content on the web, playing video games, and so on (Kerawalla, 2007; Livingstone, 2007). However, other researchers assert that educational games, video, sound, small animations and flash cards among other mobile technologies have the capacity to support and foster motivation, collaboration, interaction and engagement of learners, and enhance better learning outcomes (Fisher & Baird, 2007). The flexibility and individualized settings offered by MET-Learning encourage engagement among learners.

For students to become engaged in MET-Learning, some self-direction in learning is required, whereby students participate in learning-related activities with their mobile devices that extend beyond the boundaries of formal classroom. To foster self-directed learning, a shift is required from teacher and

content-centred learning towards student-centred learning environments where consequently, learners become responsible for their learning (Ingleton, Kiley, Cannon & Rogers, 2008). It is important to note that such learning can only be sustained through the use of mobile devices.

Various researchers have attempted to define mobile devices. Trifonova and Ronchetti (2006) see it as computational devices that are small, self-directed and unnoticeable for everyday use. Mobile devices however, are those instruments that facilitate mobile learning. Examples of such instruments include smart phones, tablets, ipad, etc. Perhaps a better description of what defines devices as being mobile is that they can be wearable (De Frietas & Levene, 2008). By being wearable, it becomes part of a person's daily wardrobe, filling a need as important as a piece of clothing, fitting into a pocket or purse, and very likely being kept with the person at all times (Livingstone, 2009). The treatment of mobile devices in this study excludes laptop computers since they do not fit into the category of being wearable; although they are portable, they are not currently mobile in the sense of being wearable. Among many MET-Learning devices, smartphones and tablets have a potential of improving the teaching and learning processes, as they contain useful applications and networking features. Leaning through such devices can occur anywhere and anytime (Brown, 2008). However, Pyramid research (2010) claimed that the adoption rate of mobile learning was very low. This low adoption of mobile learning can be influenced by several factors including gender.

Gender has formed a recurring decimal in studies that involve students' academic performance. Gender is a concept that draws out the distinction between the males' roles and responsibilities, and that of the females. Gender refers to the socially constructed expectations for male and female behaviour which prescribes a division of labour and responsibilities between males and females, granting of different rights and obligations to them (Pollard & Morgan, 2006). In consonance with the above assertion, Cassel (2007) maintained that gender refers to the social fact of being male or female, or having the recognizable traits of one's sex. Buttressing further, the author stated that the characteristics and behaviours that are generally associated with being a male are referred to as masculine and those associated with being a female are referred to as feminine. Gender is typically used with reference to social and cultural differences to assign masculinity and femininity with different roles. In other words, gender could simply be referred to as being male or female.

Gender differences in MET-Learning and academic performance have been studied over the years. Some of the studies reported that females made more cell phone calls and sent more SMS messages than the males did (Miltra, Willyard, Platt & Parsons, 2015). Buttressing further, the researchers maintained that technologies were not utilized in similar ways and rates, by males and females, and as a result, some differences still existed. Selwyn (2006) reported that females tended to study online more than males, as online learning may be appropriate for women's lifestyles and they were also more likely to look for further views of education. Selwyn added that as the current situation changes, educational technology can be seen as a predominantly feminine activity. Some studies indicated that females were more likely to develop mobile device involvement than their male counterparts (Billieux, Van Der Linden & Rochat, 2008; Beranuy, Oberst, Carbonell & Chamarro, 2009; Walsh, White, Cox & Young, 2011; Grellhesl & Punyanunt-Carter, 2012; Hong, Chiu & Lin, 2012).

On the other hand, in some higher institutions, males show higher positive attitudes towards using technology for learning than females (Li & Kirkup, 2007). In addition, research among Chinese and British students found that males in both countries used email and chat, played games and were more confident about their technology skills than their female counterparts (Li & Kirkup, 2007). Amogne (2015) found that there was statistically significant difference between male and female students' performance favouring the former. So, there still exists a great deal of controversy among various studies on gender differences in terms of usage of mobile electronic technology. Hence, the above arguments about gender disparities in mobile learning and academic performance calls for an investigation to determine how students' engagement in MET-Learning with the moderating influence of gender, predict the academic performance of undergraduate students in public universities in Enugu state. To address the problem of the study, the following research questions were posed:

1. What is the regression model that can be used to predict students' academic performance by their engagement in MET- learning?
2. What is the amount of variation in students' academic performance that is attributable to their engagement in MET- learning as moderated by gender?

The null hypothesis below was formulated and tested at 0.05 (α) level of significance:

H_{o1}: Gender does not significantly moderate the prediction of students' academic performance from their engagement in mobile learning.

Method

The study employed a correlation survey research design. This kind of research design seeks to establish the relationship, association or co-variation that exists between two or more variables. From a population of 9195 third year students in two public universities in Enugu state, a sample size of 384 respondents (198 males and 186 females) was determined sing the Taro Yamane (1967) formula. The sample was drawn using a multi-stage sampling procedure. The researchers developed instruments titled "Students' Engagement in Mobile Electronic Technology Learning Questionnaire (SEMETLQ)" and "Students' Academic Performance Proforma (SAPP)" were utilized to elicit information from the respondents. The SEMETLQ has two sections; Section A which contains demographic data of the respondents, and Section B consists of five clusters which contains item statement, with a total of 42 items modeled on a four-point Likert type scale of Very Often (VO = 4), Often (O = 3), Seldom (S = 2) and Never (N = 1). The SAAP contains five columns: serial number, students' registration number, gender, department and students' CGPA. The instruments were duly validated by three experts from the Department of Science Education (Educational Measurement and Evaluation), University of Nigeria. The internal consistency of the SEMETLQ instrument was established using Cronbach Alpha reliability method, and reliability coefficients of .76, .70, .78, .80 and .85 were obtained for clusters A, B, C, D and E. However, an overall reliability index of .93 was obtained.

The researcher, with the help of three other research assistants administered the SEMETLQ instrument to students. The instruments administered were successfully retrieved on the spot. The SAPP was used to collect the existing four consecutive semesters' CGPA of the sampled third year students in the public universities. Data collected were analyzed using multiple regression analysis. Precisely, the regression model generated was used to answer research question one while research question two was answered by comparing the coefficients of determination (R^2) for male and female students. T-test statistic was used to test the significance of difference between two sample correlation coefficients at 0.05 level of significance.

Results

Table 1: Regression model used in predicting students' academic performance by their engagement in MET- learning

Model	Coefficients			t	Sig.
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta		
(Constant)	-.93	.136		-6.855	.000
Student-Student Activities (SSA)	.15	.010	.87	14.640	.000
Student-Teacher Activities (STA)	-.03	.009	-.18	-3.511	.010
Student-Content Activities (SCA)	.05	.009	.26	5.334	.000
Assessment Related Activities (ARA)	-.03	.009	-.14	-2.899	.030
Outcome Related Activities (ORA)	.02	.006	.11	3.406	.010

a. Dependent Variable: Students' Academic Performance (SAP)
b. Predictors: (constant), Student-Student Activities (SSA), Student-Teacher Activities (STA), Student-Content Activities (SCA), Assessment Related Activities (ARA), Outcome Related Activities (ORA)

From the result in Table 1, the regression model that can be used in predicting students' academic performance from their engagement in MET- learning in raw score form is:

$$SAP = 0.15SSA + 0.05SCA + (-0.03STA) + (-0.03ARA) + 0.02ORA + (-0.93)$$

While the regression model in standard score form is:

$$Z_{SAP} = 0.87Z_{SSA} + 0.26Z_{SCA} + (-0.18Z_{STA}) + (-0.14Z_{ARA}) + 0.11Z_{ORA} + (-0.93)$$

From the regression model, the five predictor variables proved potent at predicting students' academic performance to an appreciable extent with student-student activities (β = .87) having the highest predictive capacity followed by student-content activities (β = .26), then student-teacher activities (β = .18), followed by assessment related activities (β = -.14) and lastly, outcome related activities (β = .11). The regression model shows that one unit change in student-student activities contributed 0.87 units change in students' academic performance. Also, one unit change in student-teacher activities accounted for -0.18 change in students' academic performance. And lastly, one unit change in outcome related activities contributed 0.11 change in

students' academic performance without the influence of the predictor variables i.e., student-student activities, student-teacher activities, assessment related activities and outcome related activities.

Table 2: Amount of variation in students' academic performance that is attributable to their engagement in MET- learning as moderated by gender

Model	Variable (Gender)	N	R	R^2	Adjusted R^2
1.	Male	198	.88	.77	.77
2.	Female	186	.89	.80	.79

N = Number of respondents (students), R = Correlation coefficient, R^2 = Coefficient of determination

In order to answer the above research question, the scores from male and female respondents (students) on the engagement in MET- learning were correlated with their academic performance. The result in Table 2 shows that correlation coefficients (R) of .88 and .89 with associated coefficients of determination (R^2) of .77 and .80 were obtained for male and female students, respectively between their academic performance (criterion variable) and engagement in mobile learning (predictor) variables. These coefficients of determination (R^2) indicated that 77% variation in students' academic performance was due to engagement in MET- learning for male while 80% was due to engagement in mobile learning for females. The difference in the variation of male and female students' academic performance as predicted by their engagement in mobile learning jointly was 3% in favour of females. Hence, gender moderated 3% of the variation in students' academic performance in favour of the females.

Table 3: t-test analysis of the significant difference between the correlation coefficients (R) of male and female students in the prediction of student's academic performance from their engagement in MET-learning.

Variable (Gender)	R	N	Df	S. E	t-cal	t-crit	P>.05
Male	0.878	198	378	0.100	-0.160	1.960	Ns
Female	0.894	186					

Key: R = Correlation coefficient, N = Number of respondents (students), df = degree of freedom, SE = Standard Error, t-cal = t-test value calculated, t-crit = t-test critical or table value, Dec = Decision, NS = Not Significant.

Result in Table 3 indicated that a t-value of -0.160 was obtained, while the t-critical or table value at 0.05 level of significance and 378 degree of freedom was 1.960. The decision rule was to reject hypothesis if the calculated value of t (-0.160) was less than the t-critical or table value (1.960). The hypothesis which stated that gender does not significantly moderate the prediction of students' academic performance from their engagement in MET-learning was not rejected. In other words, there was no significant difference between the correlation coefficients (R) of male and female students in the prediction of their academic performance by their engagement in MET-learning. Therefore, the conclusion drawn was that gender does not significantly moderate the prediction of students' academic performance by their engagement in MET-learning. Any observed difference could be attributable to chance factors or sampling errors.

Discussion

The findings indicated the regression model that can be used in predicting students' academic performance by their engagement in MET-learning in raw and standard score forms. From the model, it can be observed that one unit change in student-student activities contributed 0.87 units change in students' academic performance, while one unit change in student-content activities produced 0.26 units change in students' academic performance. Also, one unit change in student-teacher activities accounted for -0.18 change in students' academic performance, whereas one unit change in assessment related activities produced -0.14 change in students' academic performance. And lastly, one unit change in outcome related activities contributed 0.11 change in students' academic performance without the influence of the predictor variables. The student-teacher and assessment activities had negative regression coefficients of -.18 and -.14 respectively. This means that as student-teacher activities and assessment-related activities increases, students' academic performance decreases.

From the findings of the study also, it was revealed that the difference in the variation of male and female students' academic performance as predicted by their engagement in MET-learning is 3% in favour of female students. That is to say that gender moderates 3% of the variation in students' academic performance in favour of the female students. The result of the corresponding hypothesis revealed that gender does not significantly moderate the prediction of students' academic performance by their engagement in MET-learning. As such, any observed difference in this study could be attributable to chance factors or sampling errors. The finding is in agreement with the findings in

predictive studies by Hilao and Wichadee (2017) who found that male and female students did not differ significantly in their usage and attitude towards mobile phones for their learning performance and Umar, Yagana, Hajja and Mohammed (2015) whose result showed that gender did not significantly affect students' academic performance. This implies that students that engage in MET-learning can achieve at the same level, whether male or female. So, gender has no significant influence the academic performance of students who engage in MET-learning.

Conclusion

The findings of the study revealed that a coefficient of determination (R^2) of 0.77 obtained indicated that 77% of the variation in students' academic performance (criterion variable) was attributable to their engagement in mobile learning (predictor) variables compositely, which implies that 23% of the variation in students' academic performance is attributable to other variables not investigated by this study.

The regression models that can be used in predicting students' academic performance by their engagement in mobile learning in raw score and standard score forms are: SAP = 0.15SSA + 0.5SCA + (-0.03ARA) + (-0-03ARA) + 0.02ORA + (-0.93) and $\not{Z}_{SAP} = 0.87\not{Z}_{SSA} + (-0.18\not{Z}_{STA}) + (-0.14\not{Z}_{ARA}) + 0.11\not{Z}_{ORA} + (-0.93)$ respectively.

The difference in the amount of variation of male and female students' academic performance as predicted by their engagement in MET-learning jointly was 3% in favour of females. Hence, gender moderated 3% of the variation in students' academic performance in favour of the female students. The corresponding null hypothesis revealed that gender does not significantly moderate the prediction of students' academic performance by their engagement in MET-learning. Any observed difference could be attributable to chance factors or sampling errors.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Students should endeavour to engage actively in MET-learning, discover learning tasks and communicate with other students more often about class instruction through their mobile devices both inside and outside of class in order to improve their performance.

2. Other variables such as home-related, school-related and cognitive-related should be taken into cognizance by the different stakeholders in order to create a favourable learning environment that will enhance students' academic performance.

3. Every teaching and learning situation mediated through mobile devices should not be made gender sensitive for adequate learning among students.

4. Education administrators and government should encourage and support programmes that will duly consider teaching and assessment of students' engagement in MET-learning, in order to promote performance in school and life generally

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