

EFFECT OF BLENDED E-LEARNING ON PRE-SERVICE TEACHERS' ACHIEVEMENT IN MATHEMATICS: A CASE FOR SUSTAINABLE TEACHER EDUCATION

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Abstract: *The study investigated the impact of blended e-learning on pre-service teachers' achievement in Mathematics. The sample consists of 280 level I pre-service teachers in school of sciences of Alvan Ikoku Federal College of Education Owerri. The quasiexperimental research design adopting the pre-test, post-test non-equivalent type was used in carrying out the study. A researcher made objective test questions titled "Mathematics Achievement Test (MAT)" was used for data collection. It had reliability coefficient of 0.83 determined using Kuder-Richardson (KR20) formula. The control group was taught mathematics using the traditional method while the experimental group was taught using blended e-learning method (traditional and e-learning). The data generated were analysed using mean and standard deviation to answer the research questions while ANCOVA was used to test hypotheses at 0.05 level of significance. The result of the study revealed that blended e-learning is an effective method of teaching mathematics among pre-service teachers. Based on the result it was recommended that blended e-learning method should be applied in teaching Mathematics education of pre-service teachers.*

Keywords: *blended e-learning, pre-service teachers, achievement, mathematics*

INTRODUCTION

Education is considered to be a very important factor for sustainable development of any Nation. The economic, scientific and technological development of any nation depends so much on the nation's level of education. For this reason, science and technology education are the primary target in which case tertiary education will come to the front (Kassahun; 2014). Mathematics is the fundamental tool required for the achievement of this desired goal of education. Unfortunately, this important subject has continuously become a nightmare and mysteriously difficult for students at all levels of education. Many studies have found the method of teaching this subject as the major cause of difficulty in students' achievement. Mathematics teachers at all levels are noted to solely depend on the unproductive and un-enterprising traditional approach which does not support active learning. Berns and Erikson (2001) warned that the traditional approach to education where students

receive direct instruction and then practice specific skills is behaviouristic in nature. Agommuoh, and Ifeanacho (2013) indicated that poor academic achievement in physics and mathematics could be attributed to many factors among which are the teachers' teaching strategies. This means that Physics and Mathematics concepts cannot be well understood if students are not taught with effective teaching strategies. The teaching of Mathematics to obtain the desired objective has always been a contentious issue in education. The situation is blamed on the wrong approach to teaching used by mathematics teachers (Etukudo, 2012), Wetzel (2009). Teaching of Mathematics is not only concerned with the computational knowhow of the subject but is also concerned with the selection of the mathematics content and communication leading to its understanding and application. So in teaching Mathematics there is the need to use teaching methods, strategies and pedagogical resources that are much more fruitful in gaining adequate responses from the students (Rachina n.d.). The quest for sustainable development demands for a drastic change in the learning process of mathematics through the blended e-learning. E-learning is the use of information and communication technology e.g. internet, computer, mobile phone, learning management system (LMS), television, radios and others to enhance teaching and learning activities E-learning is a unifying term used to describe the fields of online learning web-based training and technology delivered instruction (Tareq & Kdyankar 2014, Oye, Salleh & Lahad, 2010). According to Markus (2009) in Olojo, Adewumi and Ajisola, (2012) e-learning is defined as a learning process created by interaction with digitally delivered content, network based services and tutoring support. E-learning is any technologically mediated learning using computers 574 whether from a distance or in face to face classroom setting (computer assisted learning), it is a shift from traditional education or training to ICT based personalized, flexible, individual, self-organized, collaborative learning based on a community of learners, teachers facilitators experts (Olojo, Adewumi & Ajisola, 2012). Blended learning mixes various event based activities, including face to face classroom, live elearning and self-paced learning. This often, is a mix of traditional instructor led training synchronous online conferencing or training, asynchronous self-spaced study (Singh, 2003). According to Kholoud (2016) blended learning can be defined as the process of blending the traditional roles of teachers with the roles of the e-teacher in classes. Thus it is a learning which integrates traditional and electronic learning. Whitelock and Jelfe (2003) proposed three definitions for blended learning which include: the complete integration of traditional learning and internet assisted learning; the integration of instructional means and the use of educational technology in learning; and the integration of several instructional methods regardless of technology. Bersin (2003) indicated that blended learning is a strategy which employs technology and the selection of appropriate teaching methods in solving the

problems related to class management and the learning directed activities which require accuracy and mastery. Blended learning has the ability of catering for students with different learning abilities. It encourages activity based learning; it allows students to construct their own learning ideas and enhance the understanding of the concept taught. Blended elearning classes allow the teacher to become a coach and not a director of the learning process. AL-Zoubi and Bani-Doumi (2012) averred that, blended learning encourages self-learning and group learning; it enables students to access information and answer questions regardless of time and place and the previous learning of the student. Kassahun (2014) stated that e-learning exercise benefited the learners to practice independent work, collaborative learning, making students to be technological friendly, making them use their extra time, etc.. enhancing constructive learning through this blended learning. Balarabe (2006) stated that students in blended classroom experienced a more positive self-concept in Mathematics, more enjoyment of Mathematics and more motivation to do Mathematics than their counterparts in only traditional group. Tareg et al (2014) noted that technology enabled instructional method is aimed at improving quality of education and student academic performance. It has been found that students in higher educational institutions that engaged in e-learning, generally performed better than those in face to face courses. Stuhlmann and Taylor (1996) recommended introduction of blended learning into the curriculum, and employing it in classes. Their recommendations included also establishing a safe learning environment, and improving the stamina of the students, providing opportunities for students for applying the skills which is achieved through the use of simple forms, introducing of technology to students, as well as the application which assist innovation, productivity of students and decrease the levels of anxiety towards the use of computers among the students.

2. Statement of the Problem Teaching of Mathematics at all levels of education has always been through the traditional method as experienced and reported by researchers. This has contributed to under achievement of the objectives of teaching Mathematics and decreased the motivation of students in the subject area. There is need to explore other methods of teaching Mathematics as to achieve the sustainable development especially at the tertiary education since the pre-service teachers will be the ones to teach at the secondary level. Therefore, this study was carried out to determine the impacts of blended elearning on student's achievement in Mathematics at the tertiary education.

2.1 Purpose of the Study

The main purpose of the study was to determine the impact of blended e-learning method on students' achievement in Mathematics. Specifically, the study will determine whether:

- Pre-service teachers taught Mathematics using blended e-learning will have better achievement than those taught using traditional method.
- There will be interaction between gender and blended e-learning method in terms of achievement.

2.2 Research Questions The following research questions guided the study: 1. What is the difference between the mean achievement scores of pre-service teachers taught Mathematics using blended e-learning and traditional methods? 2. What is the difference between the mean achievement scores of male and female pre-service teachers taught Mathematics using blended e-learning method? 2.3 Hypotheses The following hypotheses were formulated for the study. 576 Ho1: There is no significant difference between the mean achievement scores of pre-service teachers taught Mathematics using blended e-learning method and their counterparts taught using traditional method. Ho2: There is no significant interaction between gender and blended e-learning method of learning Mathematics. 3. Methodology The quasi experimental research design adopting the pre-test post-test non-equivalent control group design was used to investigate the effect of blended e-learning on preservice teachers' achievement in Mathematics. Design Pre-test Post-test Experiment X1 ~ X2 Control X3 - X4 where, X1 and X2 = Pre-test, ~ Treatment, - no treatment, X2 and X4=Post-test. The population of the study consists of all year one pre-service teachers in School of Sciences of Alvan Ikoku Federal College of Education Owerri, Imo State. The sample of the study consists of two hundred and eighty (280) pre-service teachers in two intact class groups of A and B of Elementary Mathematics 1 (MTH111) course. The two classes were randomly assigned to control and experiment groups. The control group (Group A) consists of one hundred and fifty (150) participants while the experimental group (Group B) consists of one hundred and thirty (130) participants. The control group had fifty two (52) females and ninety eight (98) males while the experimental group had forty eight (48) females and eight two (82) males. The instrument for data collection was a researcher made 30-item test questions titled mathematics Achievement Mest (MAT), drawn from the concepts taught to the groups. The construction of the test items was guided by a table of specification. The face and content validity of the instrument were determined by two lecturers in Mathematics Department and a Measurement and Evaluation specialist. Their inputs guided the restructuring of the instrument from 35 to 30 items. The reliability of the instrument was determined by 30 pre-service teachers in group C with the same characteristics but not members of the study group, their responses were analysed using Kuder-Richardson (KR20) formula which gave a reliability coefficient of 0.83 which was acceptable for the study. To carry out the study, both groups were pre-tested to ensure their background readiness for the study. After that, the control group was taught some concepts in 577 Elementary Mathematics I (MTH111) course which includes set theory, complex numbers and algebraic equation traditionally by the regular lecturer assigned to the group while the experimental group was taught the same concepts by the researcher with the help of a research assistant who is a computer technologists. The research assistant was trained

for one week on blended e-learning method with respect to Mathematics using a commercial Mathematics software domiciled in the department. The researcher taught the concept traditionally and intermittently referred to the assistant who controlled e-learning aspect through computer and projected same to the screen showing step by step solutions to problems as solved through the software which had the ability to resolve mathematical problems automatically. The participants had opportunities to visit other sites on the internet relevant to the concepts taught, they had opportunities of directing questions to the researcher who solved them both traditionally and electronically. Some of the participants also manipulated the computer system as to solve problems which they formulated. The participants had opportunity to collaborate with each other and the researcher with the assistant coaching them through the process of solving problems electronically within the concept taught. The study lasted for one hour for three days in a week for three weeks which gave a total of nine (9) contact hours. After that, the post-test was administered to both groups using a re-arranged version of the pre-test and scored over hundred percent (100%). The data generated was organized on a frequency table and mean and standard deviation was used to answer the research questions while the hypotheses were tested using ANCOVA at 0.05 level of significance.

5. Results

“What is the difference between the mean achievement scores of pre-service teachers taught Mathematics using blended e-learning and traditional methods?”

Table 1: Summary of achievements

Variable	Group	N	Mean	SD	Mean	SD	Mean Gain	Diff
Method	Expt	130	32.79	7.51	60.36	7.27	27.50	26.45
	Control	150	32.52	7.46	33.57	7.43	1.05	
Gender	Male	82	32.96	7.48	60.73	7.56	27.77	
	Female	48	31.62	7.53	59.73	6.79	28.11	0.34

Table 1 shows that the experimental group had mean gain of 27.50 while the control group had mean gain of 1.05; this gave a mean difference of 26.45 in favour of the experimental group.

578 “What is the difference between the mean achievement scores of male and female pre-service teachers taught Mathematics using blended e-learning?”

Table 1 shows that male participants in experiment group had mean gain of 27.77 while their female counterparts had 28.11; this gave a mean difference of 0.34 in favour of the females.

H₀₁: There is no significant difference between the mean achievement scores of students taught Mathematics using blended e-learning and their counterparts.

Table 2: Summary of ANCOVA analysis

Source	Type	in sum of squares	df	Mean square	F	sig
Corrected model		50103.287	4	12525.822	231.000	.000
Intercept		40210.448	1	40210.448	741.558	.000
Covariate		64.897	1	64.897	1.197	.275
Method		44556.847	1	44556.847	821.714	.000
Gender		39.228	1	39.228	.723	.396
Method & Gender		1.130	1	1.130	.021	.885
Error		14911.680	275	54.224		
Total		657771.000	280			
Corrected total		65014.968	279			

Table 2 shows that calculated of value (821.74) for method is greater than the table value (3.84) and $p < 0.05$. Based on the result the null hypothesis is rejected and the

alternative hypothesis accepted at 0.05 level of significance. This implies that, there is a significant difference between pre-service teachers taught Mathematics using Blended e-learning and their counterparts taught using traditional method. Ho2: There is no significant interaction between gender and blended e-learning method of learning Mathematics. Table 2 shows that, f-calculated value (1.130) for method and gender interaction is less than the table value (3.84) and $p > 0.05$. Based on the result, the null hypothesis is upheld at 0.05 level of significance.

6. Discussion of Findings

The result of the study revealed that blended e-learning method is an effective method of teaching Mathematics to pre-service teachers. The pre-service teachers in the experiment group had greater mean achievement scores than those in the control group. Further statistical analysis revealed a statistical significant difference between pre-service teachers taught Mathematics using blended e-learning than their counterparts taught using traditional method. This result could be attributed to the 579 nature of the blended e-learning environment which allowed them to learn at their own pace, permitted collaborative work and enhanced participants active learning. This result is in line with that of Kholoud (2016) and Akkonyunlu and Soylyu (2006) which showed that students in blended learning setting had better achievement than those in the traditional setting. The study revealed that male and female pre-service teachers in the experimental group had almost the same mean achievement level and further analysis did not reveal a statistical significant interaction between blended e-learning and gender. This result is also ascribed to the nature of the method applied as it did not allow any form of gender discrimination and affected male and female equally. The result is consistent with the results of AI-Basheer and AI-Hasanat (2013) which indicated no significant difference in the achievement of male and female students' in an blended e-learning classroom.

CONCLUSION

The result of the study revealed that blended e-learning is an effective method of teaching Mathematics at teacher education level and its efficacy is felt across gender. If this tempo is maintained, then mathematics teachers who will be teaching at the secondary and other levels of education will be properly groomed to do their jobs.

7.1 Recommendations

Based on the results, the following recommendations are made:

1. Blended e-learning method should be applied in teaching Mathematics by educators of pre-service teachers.
2. Resources required for blended e-learning in teacher institutions should be provided to enable the educators use them in teaching.
3. In-service training should be organized for pre-service teachers' educators by institutional management to train them on use of blended e-learning in effective lesson delivery.

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