USE OF COOPERATIVE E- LEARNING STRATEGY IN ENHANCING PUPILS' CREATIVITY AND MOTIVATION IN LEARNING OF MATHEMATICS

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Abstract
This study investigated cooperative e- learning strategy to enhance pupils' creativity and motivation in mathematics. This study was carried out in Alvan Ikoku Federal University of Education in Owerri Municipal Council Area of Imo State. One research question and one hypothesis formulated and tested at 0.05 level of significance. This Quasi –experimental study wasadopted usinga pre-test-post-test, non –equivalent control group design. The population of the study comprised 675Pupils. A sample size of 164 Pupils was used for the study based on intact classes. The experimental group had 81 pupils while the control group had 84 pupils. The instrument for data collection was an adopted Abedi-Schumacher Creativity Test. The reliability co-efficient(r) of 0.73 was obtained using Kuder-Richardson 20. Data collected were analyzed using Mean, standard deviation for the research question and the hypothesis were tested using ANCOVA statistical tool. The results showed that Pupils teachers' creativity was improved through E- cooperative learning strategy. This indicated that Cooperative E- learning Strategy to Enhance pupils Creativity and Motivation in learning Mathematics irrespective gender. Based on the findings; it was recommended that the state Ministry of Education should organized workshop and seminars for pre-service teachers to keep them abreast of innovative strategy of enhancing pupils' creativity and motivation.

Keywords: Assessment, Cooperative E-learning, Creativity, Motivation and Mathematics

Introduction

Creativity is a process where there is interplay among several interactive cognitive and affective elements. Creativity is an important component of global competition in the 21st century. Increasing the child's creativity is a great challenge for every teacher in the primary school. Teachers should be able to stimulate child's creativity. Through is a learning process, each child can be prepared to be superior in global competition. Education should be able to help pupils to find and solve problems. The learning environment should be able to help the children to develop

their creativity so that pupils are able to optimize their ability. The child's must be prepared to survive in real life. Therefore, children need communication, action and creativity skills Zakaria (2007). According to Jackson, Witt, Ganes, Fitgarld, Eye & Zhao(2012) creativity is a mental process involving the development of new ideas and concepts, or new relationships between existing ideas or concepts. Based on scientific point of view, the product of creative thinking is usually considered to have originality and conformity.

Creativity is defined as the ability to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems (Franken, 2007). It is the ability to be aware of problems, think of possible solutions to the problems and test the practicability of the solutions. Creativity is seen as any act, idea, or product that changes an existing domain or that transforms an existing domain into a new one. Therefore, creative individuals have the ability to view things in new ways or from different perspectives. Creativity is not a talent but away of operating and it can be taught. It is also not restricted to the arts since it can be applied to any human endeavor. At the same time, intelligent quotient (IQ) is not related to creativity but one requires a minimum level of IQ to be creative (Cai, Harrison, Kanady&Mednick, 2009). Creativity plays an important part in innovation and invention and is important in professions such as business, economics, architecture, mathematics, music, science, engineering and teaching (Caietal.,2009). Pink (2005), notes that creative thinking is increasingly necessary to accomplish goals in our complex, interconnected world. Educational researchers and psychologists tout the social, emotional, cognitive, and professional benefits of possessing creative abilities (Sternberg, 2006). Franken (2007) argues that creativity is linked to fundamental qualities of thinking such as flexibility, tolerance of ambiguity or unpredictability and enjoyment of things thereto unknown. Halford and Wilson (2002) argue that school must be the place for introducing new ideas, explicit representation of imagination, using mental processes to create novelty. Schools should thus be seen as incubators of creativity and innovation. Therefore, enhancing creativity among learners should be a function of a school system. Indeed, this is crucial for innovation, industrialization and socio-economic development. This strongly suggests that creativity can be enhanced through classroom instruction. It is, therefore, hoped that if learners are taught in a manner that encourages divergent thinking, this would enhance their creativity and hence make them come up with new ideas on how to tackle issues which may boost their motivation (Pink,2005).

Motivation is a process whereby goal directed behaviour is instigated and sustained. In a classroom setup it is viewed as the willingness of learners to achieve the set goals. Moreover, motivation could be defined as an internal drive that directs behaviour towards positive goal oriented. Motivation plays an important role in the classroom organization because it increases the cognitive, affective, psychomotor domains of the learner and the goals can be achieved in an efficient way. The behaviour of the learners can be change through motivation , the level of motivation differs with in an individual (Robbins, Judge, and Sanghi in Unamba,

Ajuzie&Ewuonu, 2023) . Motivation also takes part in an important role for teachers because it helps to achieve the target in an efficient way. Motivation is very important because it improves the skills and knowledge of teachers because it directly influences the pupils' achievement (Mustafa, and Othman in Unamba, Ajuzie&Ewuonu, 2023). If in schools, the teachers do not have sufficient motivation then they are less competent which directly influence the learners and the education system. According to Obi, 2014 in Unamba, Ajuzie&Ewuonu, (2023) defined motivation as a complex socially learned pattern of behaviour involving situations, needs, desires, mechanisms and results. It embraces all factors that can enhance development to accomplish effective teaching and learning. According to Peretomode, 2011 in Unamba, Ajuzie&Ewuonu, (2023) motivation is the process of influencing or stimulating a person to take action that will accomplish desired goals. However, motivation is a way of empowering teachers in the occupation and involves the perceptions, variables, methods, strategies and activities used for the purpose of providing a climate that is conducive to the satisfaction of the pupils learning, so that they may become satisfied, dedicated and effective in performing their task. In education, learners should be motivated in order to boost their productivity, effectiveness, efficiency and dedication in performing their task, which will enhance quality, quality education and quality instructional delivery in the educational system. This will also enhance the achievement of educational objectives (Obi, 2014 in Unamba, Ajuzie&Ewuonu, 2023) .

Motivation, like other attitudinal behaviors, encompasses many aspects and one such aspect is motivational orientations. According to Steward, Bachman, and Johnson (2010), motivational act as a driving force that encourages a learner to engage in a task. Motivationconsists of several constructs and among these are intrinsic motivation, extrinsic motivation, personal relevance, self-efficacy and self-determination

Intrinsic motivation is an inner force that motivates learners to engage in academic activities, because they are interested in learning and they enjoy the learning process as well (Schiefele, 2012). Harter in Unamba, Ajuzie&Ewuonu, (2023) explained that intrinsic motivation is the true drive-in human nature, which drives individuals to search for and to face new challenges. Their abilities are put to the test and they are eager to learn even when there are no external rewards to be won. Learners with learning goals of seeking understanding for mastery of science content and skills are said to be intrinsically motivated (Cavallo, Rozman, Blinkenstaff, & Walker, 2003). Csiksezentmihalyi and Nakamura in Unamba, Ajuzie&Ewuonu, (2023) stated that intrinsically motivated individuals possess the following characteristics: They engage in both mental and physical activities holistically, they remain highly focused throughout these activities with clearly defined goals, they are self-critical, they self-reflect on their own actions realistically, and they are usually relaxed and not afraid to fail during learning.

A research study done by Stipek in Chow & Bob (2013) concluded that intrinsically motivated pupils learn independently and always choose to do

challenging tasks. They persevere to complete the tasks they have undertaken. They integrate their knowledge acquired in school with their experiences gained from outside school. They often ask questions to broaden their knowledge and learn regardless of any external push factors or help from teachers, and they take pride in their work and express positive emotions during the learning process. Highly intrinsically motivated students are able to learn new concepts successfully and show better understanding of the subject matter (Stipek in Chow & Bob, 2013). Unlike intrinsic motivation, extrinsic motivation drives students to engage in academic tasks for external reasons. Extrinsic motivators include parental expectations, expectations of other trusted role models, earning potential to enroll in a course later and good grades. According to Benabou and Tirole (2003), extrinsic motivation promotes effort and performance with rewards serving as positive reinforces for the desired behaviour. Extrinsic motivation typically produces immediate results and requires less effort in comparison to intrinsic motivation (Ryan & Deci, 2000). The down side of it is that extrinsic motivators can often distract learners from true independent learning. Another problem with extrinsic motivators is that they typically do not work over the long term. Once, the rewards are removed, learners lose their motivation (DeLong & Winter, 2002). As extrinsically motivated, students tend to focus on earning higher grades and obtaining rewards, Biehler and Snowman (1990) believed that extrinsic motivational factors can diminish learners' intrinsic motivation. Such observation has also been reported by Bain (2004) who concluded that extrinsic rewards have negative impacts on intrinsic motivation. In the case of relevance, it has been commonly equated with students' interest in a task that they do (Matthews, 2004; Osborne & Collins, 2001).

Levitt (2001) interpreted relevance as importance, usefulness, or meaningfulness to the needs of the learners. Keller, 2008 inChow & Bob (2013) defined relevance as a more personal interpretation, i.e., a student's perception of whether the content or instruction satisfied his/her personal needs, personal goals, and/or career goals. When students themselves decide on the topics of interest in school science, relevance takes on a personal meaning when students' hearts and minds are captured (Osborne & Collins, 2001; Reiss, 2000). Thus, school science will only engage pupils in meaningful learning, if the curriculum has personal value and enriches students' cultural self-identities. According to Holbrook, Rannikmae, Yager, and De Vreese (2003), students perceive science education as relevant to them through three areas: Firstly, usefulness of science in the society which means they are more interested to learn if the content is related to societal issues; Secondly, pupils' interest towards mathematics learning which means that students are motivated to learn and do the tasks and activities in mathematics; and Lastly, importance of mathematics in the course they are taking which means the mathematics content learnt is meaningful and useful to them.Indeed; this is why cooperative learning teaching approach is now receiving prominence in mathematics education.

Cooperative E-learning (CEL) approach combines the benefits of cooperative learning and ICT and is likely to foster creativity, motivation and

enhance achievement in mathematics. Given that the world is embracing information technology. Cooperative E- Learning is a successful teaching strategy usually online, involving integration of the small teams, each with learners of different levels of ability on programmed instructional materials. It's an interactive instruction technique where a computer is used to present the instructional material and monitor the learning that takes place. The uses a variety of learning activities to improve their understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping team – mates learn, thus creating an atmosphere of achievement. CEL has been suggested as the solution for an astonishing array of educational problems: it is often cited as a means of emphasizing thinking skills and increasing higher-order learning; as an alternative to ability grouping, remediation or special education; as a means for improving race relations and acceptance of mainstreamed students; and as a way to prepare learners for an increasingly collaborative workforce (Slavin, 1991). CEL enables teachers to use face-to-face instructions and interactive environment at the same time. He went further outline importance of CEL in teaching and learning

- Enables students to use web-based resources in whole-class teaching. They could bring the outside world inside classroom that is the Internet.
- Enables linking objects which is an excellent way to make classes non-linear and to bring the Internet straight into the classes.
- Enables teachers to save and print what is on the board, including notes made during the lesson, reducing duplication of efforts and facilitates revision for future use. (Walker, 2003).
- Enables students to provide authentic materials and information through text, pictures, sounds, video segments, and animation.
- Enhances learners' engagement more than conventional whole-class teaching does.
- Encourages more varied, creative and seamless use of teaching materials.
- Allows teachers to share and re-use materials, reducing workloads (Glover & Miller, 2001).
- Inspires teachers to change their pedagogy and encouraging professional development (Smith, 1999).
- Inspires teachers to re-think their approach to teaching and learning. The flexibility and the scope for creative lesson planning are huge.
- Supports classroom management with the ability to walk around the classroom, and be near learners; this could make a difference in learner's behaviors.
- Enables teachers and students to add amazing interactive charts to every presentation.

Gender means the socially/culturally constructed characteristics and roles which are associated to males and females in any society (Okeke 2007). Gender is the outcome of cultural learning and socialization which continues throughout life because undue attention is paid to socialization during childhood. It is socially

constructed and not biologically determined. Gender ascribes some unique characters to males and others to females.

Such characterization is never genetically but social. According to Okeke (2007), males are assigned such attributes as boldness, aggressiveness, logical in reasoning, intelligence, self-confidence, dominion/assertiveness, tactfulness, economic in use of words etc whereas females are assigned the opposite attributes such as fearfulness, submissiveness, tactlessness and talkativeness etc. Some studiesNzewi (2010), Okeke (2007) are of the view that there is gender disparity with females being disadvantaged in the teaching and learning of science, technology and mathematics. Nworgu (2005) maintains that the recent move towards mathematics education reform is based on the fact that the traditional education environment neither attracts nor retains sufficient number of females in science subjects.Onwudiokiti, 2012 in Unamba,Ajuzie&Ewuonu (2023) state that gender is an important factor in students' achievement.Ayoguand Nworgu, 2009 in Unamba,Ajuzie&Ewuonu (2023)find out that males out performed females in mathematics. Adigwe (2019) and Njoku (2005) note that boys perform better than girls in chemistry. Nworgu (2005) finds out that gender sensitization instructional approach is more effective in the achievement and interest of students in Integrated Science than the conventional instructional approach. Igbo (2004) however finds out that the influence of gender on Mathematics achievement of learning-disabled children was not significant when they are exposed to peer-teaching. Nwachukwu (2008) reports that exposing female students to small group cooperative interaction learning style makes them attain high cognitive achievement in Chemistry. This is in line with Nzewi(2010) who is of the opinion that females prefer cooperative academic environment for optimal performance to competitive learning environment. While comparing boys and girl's performances in science, Njoku (2005) states that boys always dominate learning activities in coeducational schools, when the instructional strategy adopted is competitive. Adigwe in Unamba,Ajuzie&Ewuonu (2023)concludes that male and female students have unequal opportunities for learning mathematics in Nigeria classrooms.

Researchers like Gunawan, Sahidu and Nisrina (2018) Improving students' creativity using cooperative learning with virtual media on static fluida concept. The results showed that the improvement of students' creativity in the experimental group was higher than the control group. The difference in the improvement of students' creativity in both group is significant. Students become more creative especially related to indicators of fluency and elaboration. Hamid and Homayra (2017). Using Cooperative Learning to Boost Creativity and Motivation in Language Learning. The results in relation to cooperative learning proved to have a significantly positive effect on EFL learners' creativity and motivation. This study provided yet further evidence in favor of applying cooperative learning in the ELT environment.Souter's (2001) posited that integrating cooperative learning strategy into mathematics can increase student's achievement and motivation, foster positive student motivation, and enhance student outcomes. Kim, Grabowski, and Song (2003) after in-depth interviews and classroom observations of five middle school teachers from three

middle schools in rural Pennsylvania, concluded that using cooperative learning strategy leads to active learning and motivates students to engage in the learning process. Nakata& Okumura, 2001; Marashi&Tahan-Shizari, 2015; Moskov-sky, Assulaimani, Racheva, & Harkins, 2016; Wat-kins, McInerney, Lee, Akande, &Regmi, 2002) in their different studies prove that the use of cooperative learning strategy in classroom teaching bears a significantly positive impact on students' outcomes. Therefore, there is need to apply cooperative e-learning in mathematics.
The main purpose of the study was to asses of the Impact of Using Cooperative E-learning Strategy to Enhance Pupils' Creativity, Motivation and academic achievement in Mathematics. Specifically, the study determined, whether:

i. Pupils taught Mathematics utilizing cooperative E- learning will enhance their creativity from those taught conventionally.
ii. Male and female pupils' teachers taught mathematics utilizing cooperative E-learning will enhance their creativity.
iii. Pupils motivational level towards learning of mathematics utilizing Cooperative E- learning.

Research Questions

The following research questions were drawn for the study.

1. What is the difference in mean creativity scores of pupils taught mathematics utilizing cooperative E- learning strategy and those taught using conventional approach?
2. What is the difference in mean creativity scores of male and female pupils taught mathematics utilizing cooperative E- learning strategy?
3. What is the Pupils motivational level towards utilizing cooperative E- learning strategy in learning mathematics.

Research Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance

1. There is no significant difference between the mean creativity scores of pupils taught mathematics utilizing cooperative E-learning strategy and those taught conventionally.
2. There is no significant difference between the mean creativity scores of male and female pupils taught mathematics using cooperative E- learning strategy.

Methodology

This study employed a Quasi-experimental research design. The specific design the researcher employed is a pretest post test non-equivalent control group design. In this design there were both experimental and control groups. In this design also there is no random assignment of subjects. Intact classes were used. The population of the study comprised of 266 primary six pupils of AlvanIkoku Federal College of Education demonstration school in Owerri Municipal Council of Imo

State, Nigeria. A sample of 165 pupils was used for the study, these comprised 75 males and 90 females. Two classes were drawn through simple random sampling. Out of the two classes that they used for the study; one was assigned to the treatment group while the other was assigned to the control group through a simple toss of coin. The experimental groups had 81 subjects (47 females and 34 males) while the control groups had 84 subjects (43 females and 41 males).

The instruments for data collection were Nicolas Holt Creativity Test (NHCT) adopted. Each participant was examined using a Nicolas Holt Creativity Test (NHCT) to measure the level of creativity of pupils. This instrument was a twenty-nine-item scale that developed by Nicolas Holt in order to measure the level of creativity of participants in the areas of fluency, originality, flexibility, and elaboration of traits, among others. The validity and reliability of the instrument was investigated through a test re-test method, they found a reliability of 0.88 for the instrument (NHCT). Nicolas Holt Creativity test was scored on a five-pointlikert format type continuum scale which ranged from one to five. The five options of this instrument are: 1) "not so true of me", 2) "not true of me", 3) "averagely true of me", 4) "true of me", and 5) "fully true of me and the second instrument was motivational scale Questionnaire (MSQ) was adopted and developed Glynn et al (2009). The first section of the instrument was designed to obtain the demographic profiles of pupils, such as participants' age and gender. The second section consisted of 30 self-assessment items measured on a 5-point Likert type scale ranging from five for always, four for usually, three for sometimes, and two for rarely to one for never. The 30 items were not grouped into six separate variables but were randomly arranged. The items were categorized into five motivational scales, namely, intrinsic motivation, extrinsic motivation, personal relevance, self-efficacy and self-determination. The description of each scale and an example of the test item are given in. The NHCT and MSQ were subjected tocontent validity by the researchers through specialists in Mathematics Education and Measurement and Evaluation. During the content validation, the test was scrutinized in terms of relevance, general test format, suitability and clarity. The reliability NHCT and MSQ was assessed using a measure of stability and internal consistency. The NHCT internal consistency index was 0.91 while MSQ yielded internal consistency index of 0.89, 0.78, 0.74,0.81 and 0.82 respectively.

The two groups were pre-tested to ensure equity in their cognitive backgrounds. The experimental group was taught by their regular mathematics teacher trained on the mode of cooperative E- learning instruction applied in the process. Mathematics software (JavaScript) was use for teaching the experimental group on longitude and latitude was projected on the board for the students after the normal introduction of the topic. The teacher guided them through step-by-step tutorial on the features of longitude and latitudes. Also, solution to problems on distance, bearing and animation of globe showing longitude and latitudes was directed on the board. The students were allowed to ask questions, make inputs and were cleared at points of need. They were also allowed to identity features of the

topic as projected on the board. The software had the ability to reverse the solutions related to problems on distance and bearing relaying the steps for the students to follow. They were also allowed to present problems which were solved by the software and compared with their book solutions. The control groups were taught the same topic by their regular mathematics teacher through the conventional "chalk and talk" approach which was teacher centered. The process lasted for two weeks after which a post-test was administered on both groups using a rearranged version of the pre-test instrument. The generated data were analyzed using mean and standard deviation to answer research questions while the hypotheses ware tested using ANCOVA statistical tool at 0.05 level of significance.

Results

Table 1: Mean creativity scores of pupils taught mathematics utilizing cooperative E-learning strategy and those taught using conventional approach

Group	Test	N	Mean	SD	Mean Gain	Diff. in Mean Gain
Expt.	Post test	81	59.40	15.53		
	Pre test		38.54	12.22	20.86	20.29
Control	Post test	84	40.13	13.42	0.57	
	Pre test		39.56	12.45		

Table I shows that the experimental group had a mean creativity gain of 20.86 while the control group had 0.57. This gave a difference of 20.29 differences in favour of the experimental group.

Table 2: Mean creativity scores of male and female pupils taught mathematics utilizing cooperative E- learning strategy

Group	Test	N	Mean	SD	Difference in mean	Diff. in Mean Gain
Male	Post test	34	59.69	15.52		
	Pre test		38.51	12.42	21.18	0.99
Female	Post test	47	59.82	15.56		
	Pre test		38.63	12.50	20.19	

Table 2 shows that, the mean achievement gain of males in the experimental group is 20.18 while that of the female is 20.19. This gave a slight mean difference of 0.99 in favour of the males in the experimental group.

Table 3:Mean scores of pupils' motivational level towards utilizing cooperative E-learning strategy in learning mathematics

Scales	Mean	SD	Rank
Intrinsic motivation	14.20	3.29	2
Extrinsic motivation	15.36	3.49	1
Personal relevance	13.83	3.32	3
Self-determination	13.35	3.19	5
Self-efficacy	13.52	3.89	4
Average mean	14.31	3.34	

Results in table 3 shows the mean scores for each of the five motivational components ranged from 13.35 to 15.52. The mean total motivation score was 14.31 (SD = 3.34), which indicates that students were moderately motivated to learn. However, they displayed a high level of personal relevance in rank order (see Table 3). This indicates that students, first and foremost, find that it can help learners to deal with real-life issues in which they need to solve problems that increase their awareness of the usefulness of learning geometry theorems Results also show that this group of students displayed a high level of extrinsic motivation in learning. Students considered earning a good grade is important in helping them to get a good job and in helping them in their career.

Table 4:ANCOVA result on the mean creativity scores of pupils taught mathematics utilizing cooperative E-learning strategy and those taught conventionally.

Source	Type in sum of squares	df	Mean square	F	sig	Decision
Corrected model	26640.797	6	4440.133	75.353	.000	
Intercept	1078.154	1	1078.154	18.297	.000	
Covariate	2008.091	1	2008.091	339.553	.000	
Method	**461.316**	**1**	**461.316**	**7.829**	**.006**	**S**
Sex	137.027	1	137.027	2.325	.129	NS
Method sex	9.681	1	9.681	.164	.686	
Error	9310.112	158	58.925			
Total	509025.000	165				
Corrected total	3590.909	164				

Table 4 shows that the p-value of 0.006 is less than α-value of 0.05. Based on the result, the null hypothesis is rejected. This implies that, there is a significant difference between the mean creativity scores of pre service teachers taught mathematics using cooperative E- learning strategy and those taught conventional.

Table 5: ANCOVA result on the mean creativity scores of male and female pupils taught mathematics using cooperative E- learning strategy.

Source	Type in sum of squares	df	Mean square	F	sig	Decision
Corrected model	26640.797	6	4440.133	75.353	.000	
Intercept	1078.154	1	1078.154	18.297	.000	
Covariate	2008.091	1	2008.091	339.553	.000	
Method	461.316	1	461.316	7.829	.006	S
Sex	**137.027**	**1**	**137.027**	**2.325**	**.129**	**NS**
Method sex	9.681	1	9.681	.164	.686	
Error	9310.112	158	58.925			
Total	509025.000	165				
Corrected total	3590.909	164				

Table 5 shows that p-value of .129 which is greater than α-valueof 0.05. Based on the results, the null hypothesis is upheld which implies that no significant difference exists between the mean creativity scores of male and female pre service teachers taught mathematics using cooperative E- learning strategy.

Discussion of Findings

The finding of the study revealed that, pre service teachers in the experimental group taught mathematics utilizing cooperative E-learning had a better mean score than their counterparts taught conventionally through “chalk and talk”. This implies that cooperative E-learning strategy has a better penetrating power in terms of pupils understanding towards mathematics than those taught conventional. The strategy also has the ability to liberalize the study of mathematics as it gave room for every pupil's participation. The result is in line with the findings of Abidoye (2005), Ogochukwu (2010) and Senthamarai–Kannan et al (2015) who variously found that multimedia technology enhanced students' academic achievement. The study also showed that mathematics achievement of male and female pre service teachers exposed to cooperative e-learning was similar and showed no statistical difference. This is suspected to be as a result of equal learning opportunity which the resources brought into play. The result is in tandem with that of Abidoye (2015),

Ofodu (2010) and Abidoye and Oguniyi (2012) which showed that the performance of male and female students exposed to multimedia instructional package were similar and not significantly different. Finally, the study reveals that pre service teachers showed high motivation towards utilizing cooperative e-learning strategy in learning mathematics. This results agreed with the finding of Ng &Gunstone, 2002; Dunham & Dick, 2005; Pomerantz, 2004, Souter's 2001, Nakata, & Okumura, 2001; Marashi&Tahan-Shizari, 2015; Moskov-sky, Assulaimani, Racheva, & Harkins, 2016; Oxford &Nyikos, 1989; Vandergrift, 2005; Wat-kins, McInerney, Lee, Akande, &Regmi, 2002 who differently found that multimedia technology could motivate students to learn mathematics.

Conclusion

The study investigated the effect utilizing multimedia technology as instructional approach on pre service teachers' achievement in mathematics. The results of the study showed that multimedia technology instructional approach enhanced pre service teachers' achievement and motivation in mathematics across gender and learning abilities.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Mathematics teachers should be granted in service training in the area of using cooperative e-learning strategy application in teaching and learning at the tertiary education level.
2. The Government should through federal ministry of education and Te fund provide ICT facilities in schools to enable mathematics teachers use them in teaching to enhance pre service teachers' achievement.
3. Mathematics teachers in tertiary educational institutions schools should be technologically proficient as to be able to apply the facilities in their teaching process.

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