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Utilizing Social Media to Enhance Pre-Service Teachers' Creativity and Self-efficacy in Learning Mathematics

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Abstract

The study investigated utilizing social media to Enhance Pre-Service Teachers' Creativity and Self-Efficacy in Learning Mathematics. Based on the objectives, four research questions and four hypotheses were formulated. Experimental research design was adopted. The population comprises all the 407 pre –service teachers at Alvan Ikoku Federal College of Education in Owerri Municipal Council of Imo state. A sample of 117 pre-service teachers participated in the study, comprising of 49 male and 68 female. The instrument used for data collection was Abed-Schumacher creativity test (ACT) and self –efficacy questionnaire Scale (SQS). The ACT and SQS were adopted by the researchers and validated by two expert judges from measurement and evaluation department. The instrument has reliability of 0.79 and 0.83 Cronbach alpha and split-half (Spearman-Brown) respectively which was considered very adequate. The data generated was analyzed using mean and standard deviation for the research questions and t-test were used to test the hypotheses at 0.05 level of significance. The results showed that social media enhanced pre service teachers' creativity and self-efficacy in learning mathematics across gender. Based on the findings, it was recommended that Mathematics teachers should be granted in-service training in the area of using social media tools in teaching and learning of mathematics at the tertiary education level.

Keywords: Social Media, Creativity, Self-Efficacy, Pre-Service Teachers' and Mathematics

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Introduction

The quality of teaching and learning of Mathematics has been one of the major challenges and concerns of educators (Saritas &Akdemir, 2019). Ganal & Guiab (2014) describes Mathematics as a subject which many students find most difficult, obscure, and of little interest and according to Ogochukwu (2010) it can be due to the fact that the process of learning Mathematics is a very complex cognitive task that can be very imposing on students since it requires a lot of effort from them. Zin, Zaman & Noah in Unamba, Ngozi, & Chukwudeblu (2022)conclude that most observed failures and substandard performance in mathematics are due to insufficient teaching-learning environment. Thus, students need a lot of motivation to cope with the subject. According to teacher educators who are handling the subject at school, students' performance in the subject has persistently been poor as manifested by the mastery level obtained from the formative and summative evaluations in class as well as in the local and national examinations or competitions in the learning area. A multiple of causes for the students low achievement in mathematics has been attributed to: difficulty in understanding the specialized mathematical language (Barton, 2002; Oyaya& Njuguna, 1999; Battisa & Clements, 1996; O'connor, 2000), ineffective, teacher-centered teaching methods and learners' negative attitudes towards the subject (Miheso, 2012; Ngeno & Changeiywo, 2007), Learners lack of motivation to learn the subject (Githua & Mwangi, 2003) and lack of mathematics syllabus coverage (Shikuku, 2009). Uchechi (2013) opined that despite the introduction and implementation of different teaching methods/strategies suggested by researchers, the achievements of students in mathematics have persistently been poor, hence the need to explore different instructional approaches. In order to realize the aims and objectives of teaching mathematics, the National council of teachers of Mathematics stresses the essential use of technology in teaching and learning the subject as it influences what is taught and enhances students' learning (NCTM, 2000). Tolhurst (2018 learners) suggests that it is pertinent that Mathematics educators examine the opportunities and challenges of new technologies in order to enhance their teaching styles; and innovative instructional approaches and techniques should be developed to ensure that students become successful learners (Saritaas & Akdemir, 2009). Kim (2020) affirms that meaningful learning occurs when individuals are engaged in social activities, and one of the technological innovations nowadays which promote learners critical thinking is the use of social media.

Social media has become considerably a topic of interest in education over the years. With the rapid increase in social media participation due to broadband availability and increasing affordability of computers and software as cited by Dewing (2018), and its improved accessibility feature through mobile phones as reported by Mingle & Adams (2015), more and more educators and experts around the world have started to regard it not merely as a social environment which is used to stay connected with friends and family but also for academic purposes (Salvation & Adzharuddin 2014, & Bharti n.d.). Researchers have categorized social media in a variety of ways (e.g., Boulos & Wheeler, 2007; Bower, 2016; Koehler & Ertmer, 2016; Mao, 2014; McCay-Peet & Quan-Haase, 2016; Orehovački, Bubaš, & Kovačić, 2012; Scott, Sorokti, & Merrell, 2016). Categories include social networking sites (e.g., Facebook and LinkedIn), blogs (e.g., WordPress and Blogger), wikis (e.g., PBworks and Notion), microblogging (e.g., Twitter and Tumblr), collaborative authoring or editing (e.g., Google Docs), instant messaging (e.g., WhatsApp and Telegram), idea mapping (e.g., Miro and Mindomo), social bookmarking (Pinterest and StumbleUpon), podcasting (e.g., Apple Podcasts), social news (e.g., Reddit), and media sharing (e.g., YouTube and Vine). The researchers'interest is on social media is WhatsApp.

WhatsApp is one of the modern communication technologies tools. The cross-platform chat application was founded in 2009 by two ex-Yahoo employees Brian Acton and Jan Koum. It is an Internet based- communication tool that allows users who also have WhatsApp installed to send text messages for free to each other. WhatsApp replicates the text experience through push notifications (Cotton, 2013). WhatsApp also supports many different message types, from simple text to pictures to audio files. Riyanto (2013) argued that WhatsApp allows its users to use their Internet connection to send messages to each other. WhatsApp is like a chat program for mobile phones. Smart phones are becoming increasingly popular and WhatsApp is available for almost all Smartphones. WhatsApp involves not only sending text message but also message broadcasting, files, videos, audio media messages as well as their location using integrated mapping features (Riyanto, 2013). Riyanto (20130 argued that users take advantage of WhatsApp to text their friends in other countries without paying the exorbitant international texting costs that come with traditional communications. Rolfe (2013) argued that a big reason for the popularity of such apps is that they allow their users to message one another without paying high fees for text messages. The best benefits of WhatsApp application are that it's free of cost and fast in communication which is considered the best application among many users.

With the use of WhatsApp, educators have numerous opportunities to facilitate communication and collaboration, and with the widespread access to WhatsApp and popularity, the tool has great potential to support educational programs for all ages.According to Tarantino and McDonough (2013), WhatsApp for educational purposes can be beneficial for student learning in multiple ways. Aside from it can make classrooms more engaging, relevant and culturally diverse (Davis, 2014), it can also provide many opportunities for students to acquire the necessary 21st-century skills to prepare them for their future (Hyde, 2014). It also allows students and teachers to connect and interact, and share ideas and discuss school related issues in a new, exciting, collaborative, and fluid ways (Lederer, 2012; Fisher, 2011; Gregor, 2014; & by Alexander & Salas, 2008 in Flad, 2010); and improve students' over-all GPA (Junco, 2012). In addition, Wankel (2011) in McCarthy & McCarthy (2013) stated that when WhatsApp is used to enhance learning outcomes, the context of the learning extends beyond the classroom into any learning environment that the student participates in. This idea is backed up by Lederer (2012) who reasoned out that the integration of WhatsApp in the classroom can enrich the learning experience by fostering collaboration and discussion, and can be an effective way to increase student engagement and build better communication skills. Furthermore, according to Casey (2012), by integrating WhatsApp into the classroom and by designing creative learning activities, teachers become merely facilitators, and students become teachers for their peers, designers, creators, and publishers, and they have an audience beyond their teachers, which is necessary for the 21st century education. This helps educators build a culture that may help contribute to the reform of school systems (social media in Learning & Education, 2013). Moreover, according to Dixon (2011), and Luckin et al. (2009) and Mazman&Usluel (2010) in Prescott, Wilson & Becket (2013), WhatsApp, a type of social media, should be used in the class. Dixon (2011) stated that when using WhatsApp in class, students are simply more connected, calendars and events are easy to share, and students will learn 21st century skills. It also encourages collaboration, interaction, and information and resource sharing (Luckin et al., 2009 &Mazman&Usluel 2010 in Prescott, Wilson & Becket, 2013; & Dixon, 2011; Mbati, 2013). In addition, Ronan (2015) asserted that instead of being seen as a possible distraction, the use of WhatsApp in the classroom should be considered a vehicle for driving engagement and learning. Cook (n.d.) in Bolkan (2015) responded that for teachers to achieve this, it is important for them to acknowledge the influence of WhatsApp and understand how to use it

to the benefit of their students. Churcher, Downs, and Tewksbury (2014) also emphasized that educators' primary goal should be to make the technology such as WhatsApp function properly and effectively, and not to think of issues such as student learning outcomes or best teaching practices. WhatsApp, when used as educational tools, also have the potential to foster creativity (e.g., Ferguson, 2011; Jang, 2009), by creating "the potential to open up classroom experiences, making them more learner centered and expanding the potential content base of the class" (Dennen, 2018). Similar to other digital technologies, WhatsApp can be used by students and teachers to stimulate imaginative expression, autonomy, collaboration, and originality (Loveless, 2007).

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. 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 asbusiness, economics, architecture, mathematics, music, science, engineering and teaching (Caietal, 2009). Pink (2005), notes that creative thinking is increasingly necessary to accomplish goals in ourcomplex, 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 self-efficacy.

One of the affective factors that determine the students' achievement in the learning process is self-efficacy. Bandura is the first person to reveal about self-efficacy. Bandura believes that self-efficacy is an important factor in the learning process. Self-efficacy is judgment of a person to his capabilities to plan and implement the action to reach certain goals (Mukhid, 2009). In an academic context, self-efficacy reflects how confident students are in performing specific tasks (Perez & Ye, 2013). Self-efficacy plays a role in academic motivation and learning motivation (especially students' ability to manage their learning activities), and resistance to teach (Zimmerman, 2000). Self-efficacy has three dimensions

that are magnitude, the level of task difficulty a person believes she can attain; strength, the conviction regarding magnitude as strong or weak; and generality, the degree to which the expectation is generalized across situations (Lunenburg, 2011). The magnitude dimension refers to the difficulty level of the task that a person believes he or she can accomplish. That is, the students' self-confidence toward their abilities in accomplishing various tasks at different levels of difficulty. The strength dimension refers to the resilience and persistence of students in accomplishing various tasks. Meanwhile, the generality dimension refers to students' beliefs about their abilities in accomplishing certain tasks as well as on a broader range of activities and situations. Self-efficacy in mathematics is described as an individual's mathematics self-efficacy is his or her confidence about completing a variety of tasks, from understanding concepts to solving problems, in mathematics (May, 2009). High mathematics self-efficacy will encourage the achievement of good learning outcomes, and when students have good learning outcomes, they will be more motivated in the learning process. Higher self-efficacy expectations can lead to better results and therefore increase the motivation for learning mathematics (Zimmermann, et al, 2011). Based on the description above, it can be concluded that mathematics self-efficacy is a belief or self-assessment of the student's ability in overcoming certain mathematical problems and tasks related to mathematics in the three dimensions that are magnitude, strength and generality. The dimension of magnitude refers to the students' self-confidence in their ability in overcoming the mathematical problems and tasks at different levels of difficulty. The dimension of strength refers to the resilience and persistence of students in overcoming various mathematical problems and tasks. The dimension of generality refers to students' beliefs about their ability in accomplishing certain mathematical activities as well as on a broader range of activities and situations.Students should have high self-efficacy, so it can support the success of mathematics learning process and it can improve the student achievement. This is caused mathematics self-efficacy has a strong influence on mathematical achievement (Fast, et, al, 2015). Students with higher math self-efficacy persist longer on difficult math problems and are more accurate in math computations than those lower in math self-efficacy (Fast, et, al, 2015). Students with high self-efficacy are able to solve a problem than students with low self-efficacy. However, these expectations have not been supported by the facts.

In a study conducted by Abrahim and Helou (2014) entitled "Influence of Social Networking Sites on Students Academic Performance", they found out that the majority of respondents agreed that social networking sites have a positive impact on their academic performance. In addition, in an effort to improve the teaching of mathematics, Ng & Latif (2011) and Prasad & Prasad (2013) conducted a study on social media and mathematics teaching, and their study concluded social media enhances learning and teaching experiences of the learners and caused a significant change in their behavior in the classroom. Baran (2010) in Tham & Ahmed (2011) contradicted that some studies showed that students found it quite appropriate for a teacher to use Facebook, and for teachers and students to socialize by this means. Students also believed that such tools could allow them to share knowledge in formal education contexts. Causey, Rivera, Saldana (n.d.) reported that students who used social media in academic way had a higher GPA than those who did not. Moreover, according to Lederer (2012), "as an educational tool, social media enriches the learning experience by allowing students and teachers to connect and interact in new, exciting ways. He asserted that web sites such as Facebook, Twitter, and LinkedIn provide a platform where users can dialog, exchange ideas, and find answers to questions. These sites are designed to foster collaboration and discussion. Moreover, Lederer (2012) also cited the benefits of social media when integrated in the classroom. These are: social media can enrich the learning experience by fostering collaboration and discussion, create meaningful dialogue, exchange

ideas, and boost student interaction; social media is an effective way to increase student engagement and build better communication skills; social media like Facebook and Twitter can enhance communication among students and teachers. Educators can answer students' questions via a Facebook page or Twitter feed, post homework assignments and lesson plans, send messages and updates, schedule or announce upcoming events, and share interesting Web sites and multimedia content.

Meanwhile, Marin (2015) on his study of "Enhancing Learning with The Social Media: Student Teachers' Perceptions on Twitter in A Debate Activity" results showed that positive perceptions towards the use of social media in education and students' willingness for future use, learning opportunities from Twitter and the use of mobile technology were also envisioned. In addition, according to Tom Murray (n.d.) in Stevens (2013), social media is high interest for most students; collaboration, communication, and global connections are possible. This is because, according to Mingle and Adams (2015) an interesting aspect of social media is that, it is not limited to desktop or laptop computers but could be accessed through mobile applications and smart phones making it very accessible and easy to use. Therefore, this study intends to investigate the utilization of social media to enhance pre-service teachers' creativity and self-efficacy in learning mathematics.

Purpose of the study

The main purpose of the study was to examine whether utilizing WhatsApp will enhance pre-service teachers' Creativity and self-efficacy in learning Mathematics. Specifically, the studyseeks to,

i. Examine the mean score level of pre-service teachers oncreativity before and after utilizing WhatsApp in learning mathematics?
ii. Examine the mean score level of pre-service teachers on self-efficacybefore and after utilizing WhatsApp in learning mathematics?
iii. Examine the mean score level of male and female pre-service teachers on creativity after utilizing WhatApp in learning mathematics?
iv. Examine the mean score level of male and female pre-service teachers on creativity after utilizing WhatApp in learning mathematics?

Research Questions

The following questions guided the study

1. What is the mean score level of pre-service teachers on creativity before and after utilizing WhatsApp in learning mathematics?
2. What is the mean score level of pre-service teachers on self-efficacy before and after utilizing WhatsApp in learning mathematics?
3. What is the mean score level of male and female pre-service teachers on creativity before and after utilizing WhatsApp in learning mathematics?
4. What is the mean score level of male and female pre-service teachers on self-efficacy before and after utilizing WhatsApp in learning mathematics.

Hypotheses

HO_1: There is no significant difference in the mean score level of pre-service teachers on creativity before and after utilizing WhatsApp in learning mathematics.

HO_2: There is no significant difference in the mean score level of pre-service teachers on self-efficacy before and after utilizing WhatsApp in learning mathematics

HO_3: There is no significant difference in the mean score level of male and female pre-service teachers on creativity after utilizing WhatsApp in learning mathematics.
HO_4: There is no significant difference in the mean score level of male and female pre-service teachers on self-efficacy after utilizing WhatsApp in learning mathematics

Method

The research design used for this study was quasi-experimental. This design randomly presented two intact classes (two experimental groups). Experimental Group 1 got involved in WhatsApp with creativity and Experimental Group 2 got involved in WhatsApp with self-efficacy. The population of the study comprised of all 407 pre-service teachers in school of early childhood care and primary education in Alvan Ikoku federal college of education in Owerri Municipal Area of Imo State Nigeria. The sample for this study was 117pre-service teachers. Two classes were randomly drawn for this study using simple random sampling technique. The researcher ensured that the sample pre-service teachers have the same psychological factors in common regarding their chronological age, mental development, cultural background and mathematics experience. The groups were selected based on the facts that the subjects had been taught, the basic and prerequisite mathematics concepts necessary for understanding of basic mathematics and geometry which were discussed in this work.Two research instruments and one instruction package were used for data collection. They are: The Abedi-Schumacher Creativity Test (ACT) designed by O'Neil, Abedi, and Speilberger in 1992 (as cited in Cropley, 2000) was also applied in this study. The ACT consists of 60 multiple choice items to measure the four traits of Fluency (22 items), Flexibility (11 items), Originality (16 items), and Elaboration (11 items). Each item has three options ranging from least to most creative responses with a range of scores between 0-2. Therefore, the ultimate score is estimated in the possible range of 0 to 120 and participants are supposed to answer the items in 60 minutes. To measure the self- (MSLQ) developed in 1991 by Pintrich, Smith, Garcia, and Mc Keachie was used. The scale, which is a 7-point Likert scale, consists of the three dimensions of Motivational Beliefs, Cognitive and Met cognitive Self-Regulation, and Resource Management Strategies. Under these three dimensions there are 15 sub-dimensions. In this study self-efficacy sub-dimension was used. The scale was adapted to Turkish by Altun and Erden (2006) who also examined its validity and reliability. There are 8 items in the scale and factor scores were calculated between 0.55 and 0.80. The reliability of the self-efficacy sub-dimension was found 0.89.Experts in the field of mathematics Education validated the ACT in terms of ensuring items clarity and removal of ambiguous words that could confuse the pupils. The reliability co-efficient obtained for ACT using Kuder-Richardson was 0.85. Instructional Package of Nine Teaching manuals were used for treatment in the study. Four of the teaching manuals were taught for 40 minutes each while the rest were taught for 80 minutes (i.e. Double Period) lesson period. The Experimental Groups were taught using Problem-Solving Model with varying modes of instruction while the Control Group was taught using the Conventional Lecture Method. The procedure for data collection was in three main phases and it lasted for seven weeks. The phases were: Pre-test for the first one week, treatment for five weeks and Post-test for the last one week of the seven weeks. Prior to the collection of data, the participating teachers and pupils were trained. The training programme lasted for two weeks. The training of the teachers and pupils focused on the use of problem-solving method and the different treatment conditions. The teachers and the pupils in the control group were not given any special training. Pre-test instruments were administered in the following order: the mathematics achievement test on pupils.

In the Experimental Group treatment group involved the following steps. - Teachers presented the topic in form of discussion with the demonstration of the how to solve given problems using the PSM for pupils based on Groups. Teachers recognized the performance of the pupils in each of the Group. - Teachers gave assignment while the control group treatment for each lesson involved the following steps: - The teacher presented the topic in form of lecture. - Pupils listened to the teacher and wrote down the chalkboard summary. - Pupils asked the teacher questions on areas of the topic that is not clear to them. - The teacher also asked the pupils questions and the pupils responded accordingly. - Pupils were given problems to be solved while the Teacher marked to assess their performance. Post-test After seven weeks of treatment, the MAT- whose items had been re-arranged was administered as the post-test on the experimental and the control groups. The SPST was re-administered again. Analysis of Covariance (ANCOVA) was used to analyze the data. Scheffe's Pairwise comparison was also used to establish the variation due to treatment and to locate the source of significance.

Results

Research Question 1: What is the mean score level of pre-service teachers on creativity before and after utilizing WhatsApp in learning mathematics?

Table 1: Mean and Standard deviation on level of pre-service teachers'creativity before and after utilizing WhatsApp in learning mathematics

Variables	N	Mean	SD	Mean Gain
Before (Pre-test)	**57**	**42.34**	**1.05**	
After (post-test)	**57**	**53.56**	**2.21**	**11.22**

Results in table 1 shows that the mean score level of pre-service teachers before 42.34 with a standard deviation of 1.05 while after utilizing WhatsApp in learning mathematics, the mean score level was 53.56 with a standard deviation of 2.21 This implies that creativity of pre-service teachers was improved with a high mean gain of 11.22 after utilizing WhatsApp in learning mathematics.

Research Question 2: What is the mean score level of pre-service teachers on self-efficacy before and after utilizing WhatsApp in learning mathematics?

Table 2: Mean and Standard deviation on level of pre –service teachers'self-efficacy

Variables	N	Mean	SD	Mean Gain
Before (Pre-test)	**60**	**32.12**	**3.01**	
After (post-test)	**60**	**51.46**	**2.08**	**19.34**

Results in table 1 shows that the mean score level of pre-service teachers before 32.12 with a standard deviation of 3.01 while after utilizing WhatsApp the mean score level was 51.46 with a standard deviation of 2.08. This implies that self-efficacy of pre-service teachers was improved with a high mean gain of 19.34 after utilizing WhatsApp in learning mathematics.

Research Question 3: What is the mean score level of male and female pre-service teachers' on creativity before and after utilizing WhatsApp in learning mathematics?

Table 3: Mean and standard deviation on gender creativity

GENDER	N	MEAN	SD	MEAN Gain
MALE	22	28.71	3.43	0.4
FEMALE	35	29.11	3.18	

Table 3 show that the mean score level of male pre-service teachers at post-test is 28.71 with standard deviation of 3.43 and the female pre-service teachers is 29.11 and a standard deviation of 3.18. Their mean gain is 0.4. The slight difference is in favour of female pre-service teachers.

Research Question 4: What is the mean score level of male and female pre-service teachers' on self-efficacy before and after utilizing WhatsApp in learning mathematics.

Table 4: Mean and standard deviation on gender self-efficacy

GENDER	N	MEAN	SD	MEAN Gain
MALE	27	26.47	3.10	0.01
FEMALE	33	26.46	3.09	

Table 4 show that the mean score level of male pre-service teachers at post-test is 26.47 with standard deviation of 3.10 and the female pre-service teachers is 26.46 and a standard deviation of 3.09. Their mean gain is 0.01. The slight difference is in favour of male pre-service teachers.

Hypotheses testing

$HO_{1:}$ There is no significant difference in the mean score level of pre-service teachers on creativity before and after utilizing WhatsApp in learning mathematics.

Tale 5: t-test analysis on pre-service teachers' creativity

GROUP	N	MEAN	SD	Df	t-cal	t-tab	Decision
Pre-Test	57	42.34	1.05	2	2.05	1.96	Reject
Post –Test	57	53.56	2.21				HO

The result of the t-test presented in table 5 shows the calculated t-value of 2.05 is significant at ($P<0.05$), the null hypothesis is rejected and the researchers conclude that there is significant difference in the mean score level of pre-service teachers on creativity after utilizing WhatsApp in learning mathematics.

$HO_{2:}$ There is no significant difference in the mean score level of pre-service teachers on self-efficacy before and after utilizing WhatsApp in learning mathematics

Tale 6: t-test analysis on pre-service teachers'self-efficacy

GROUP	N	MEAN	SD	Df	t-cal	t-tab	Decision
Pre-Test	60	32.12	3.01	2	3.09	1.96	Reject
Post -Test	60	51.46	2.08				HO

The result of the t-test presented in table 6 shows the calculated t-value of 3.09 is significant at ($P<0.05$), the null hypothesis is rejected and the researchers conclude that there is significant difference in the mean score level of pre-service teachers on self-efficacy after utilizing WhatsApp in learning mathematics.

HO_3: There is no significant difference in the mean score level of male and female pre-service teachers on creativity after utilizing WhatsApp in learning mathematics.

Table 7: t-test analysis on gender creativity

GENDER	N	MEAN	SD	t-cal	t-tab	Decision
MALE	22	28.71	3.43	1.06	1.96	Accept
FEMALE	32	29.11	3.18			HO

The result of the t-test presented in table 7 shows the calculated t-value of 1.06 is not significant at (P>0.05), the null hypothesis is accepted and the researchers conclude that there is no significant difference in the mean scores on gender creativity after utilizing WhatsApp in learning mathematics.

HO_4:.There is no significant difference in the mean score level of male and female pre-service teachers on self-efficacy after utilizing WhatsApp in learning mathematics

Table 7: t-test analysis on gender self-efficacy

GENDER	N	MEAN	SD	t-cal	t-tab	Decision
MALE	33	26.47	3.10	1.06	1.96	Accept
FEMALE	27	26.46	3.09			HO

The result of the t-test presented in table 8 shows the calculated t-value of 1.06 is not significant at (P>0.05), the null hypothesis is accepted and the researchers conclude that there is no significant difference in the mean scores on gender creativity after utilizing WhatsApp in learning mathematics.

Discussion

The results of the study revealed that creativity and self-efficacy of pre-service teachers was improved with a high mean after utilizing WhatsApp. The finding in hypotheses one and two showed that there was a significant difference after utilizing WhatsApp in learning mathematics. This result is in accord with the findings of Abrahim and Helou (2014) entitled "Influence of Social Networking Sites on Students Academic Performance", they found out that the majority of respondents agreed that social networking sites have a positive impact on their academic performance. In addition, in an effort to improve the teaching of mathematics, Ng & Latif (2011) and Prasad & Prasad (2013) conducted a study on social media and mathematics teaching, and their study concluded social media enhances learning and teaching experiences of the learners and caused a significant change in their behavior in the classroom.

Also, there is no significant difference in the mean score of male and female pre-service teachers I creativity and self-efficacy. These results are in accord with the findings of Abe (2004), Bichi (2004), McGreith and Lapointe (2005), Atadoga (2005), Lynn and Jaan (2008), Lawal (2009) and Olasehinde and Olatoye (2014) indicated that there were no significant differences between male and female students in mathematics.

Conclusion

The study investigated Utilizingsocial media to Enhance Pre-Service Teachers' Creativity and Self-Efficacy in Learning Mathematics. The results of the study showed that social media enhanced pre service teachers' creativity and self-efficacy inlearning mathematics across gender.

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 social media tools in teaching and learning of mathematics at the tertiary education level.
2. The Government should through federal ministry of education and Tet fund provide ICT facilities in schools to enable mathematics teachers use them in teaching to enhance pre service teachers' self -efficacy.
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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