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Imperatives of Pedagogical Update for Mathematics Education: The Digital Technology Sensibility in a Resilient Professionals World

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ABSTRACT: *This research examined the imperatives of pedagogical updates for Mathematics education professionals: The digital technology sensibility in a resilient word. What informed this research is the need for considering better ways of impacting mathematical knowledge and skills in students as the usages of Mathematics are geometrically increasing in this world of Technological advancement. Quasi- experimental research of pretest, posttest control group design was adopted. Multi-stage sampling technique was adopted in the selection of samples for the study. 101 Senior Secondary School II (SSSII) students were purposively selected as sample for the study base on access to smart phones/computer. Three null hypotheses were generated. Mathematics Performance Test (MPT) was the instrument used to collect data. The reliability of the instrument was calculated using Pearson Moment Correlation Analysis. Υ=0.88 was obtained which showed that the instrument was good enough for the study. Pre and post tests were conducted and Data collected were analysed using t-test and Analysis of Covariance (ANCOVA). The results obtained showed that the use of WhatsApp (treatment) has positive effects on students' performance in Mathematics. Hence, it was recommended that WhatsApp as a means of communication in Social Media could be employed in the teaching and learning of Mathematics for better performance.*

KEYWORDS: Social Media, WhatsApp, net-surfing, uploading, downloading.

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INTRODUCTION

The world is dynamic, the only unchangeable is change. This is possible because of the resilience acts of the inhabitants of the globe. The social has provided the vent through which human dynamism, divergent views and desires are displayed. Consequent upon this is the paradigm shift that embraces digitalization, moving from analogue to digital. Selwyn & Stirling, (2016) describe social media as a cornerstone of everyday life. The use of social media is divergent and it has become part of daily life. Phone is a device mostly used by people to access social media applications (Mirembe, Lubega & Kibukamusoke, 2019). Students engage in the use of phones more than reading printed materials. Adesina & adetunji (2021) describe smartphone as "Addictive Devise". This adjectival phrase explains the intent to which the engagement of smartphone had eaten deep into the mind of the users especially students. This is traceable to the unguided use of phones mainly by the teenagers which have occasioned some irrelevances on the use of social media by learners. Wisdom demands that learners are guided towards the usage of social media to explore its maximal benefits to up-shoot learners' performance in their various field of studies. This will enable the fostering of blended learning and collaborative approach as both learners and teachers would be able to share ideas beyond the boundary of conventional classrooms. Wikipedia, 2017 defines social media as the means of interactions among people in which they create, share, and/or exchange information and ideas in virtual communities and networks. This definition exhibits social media as a way of communicating that involves internet. Social media has upgraded education to a high pedestal since its inception. Selwyn N. & Stirling E. 2015 describe social media as cornerstone of everyday life. This definition reveals the high exponentiation of the value of social media at every facet of human existence. Carr & Hayes (2015) explain social media in relation to its different categories such as; Public Relations, Information Technology & Management Scholarship and Popular Press. These have to do with how people use social media to communicate messages, its usage in technology and how social media is used in the creation of awareness about industries, companies and businesses.

The use of social media extends its tentacles to the process of learning and classroom activities (Kolan, & Dzandza, 2018). This explains the benefits in teaching and learning of the contemporary time as teachers and students have tools that can be explored to make learning more profit oriented. Imperatively, Mathematics is part of our day-to-day activities. Hence, social media and Mathematics are in the same matrix. Mathematics is a means of communication, through which scientific discovery are offloaded into the word of works (Akinwamide 2022). Mathematical symbols, terms and terminologies connotes meanings and information that when interpreted, have invaluable benefits to every generation. Social media and Mathematics are bolt and nut that become functional when affixed. Media moguls, content writers and digital marketers make use of Mathematics to determine and view the reactions of the masses toward their product or contents. This is carried out by checking the number of their followers, likes, costumers, product sold and

regions where their materials are purchased most. Data collected are converted to figures, charts or graphs. These give directions for improvements and better profit orientations. Researchers make use of social media to collect information using any appropriate tool and result into mathematical computations to get the desired results. Online Mathematics instructor have the opportunity of discovering the area of difficulties of students by accessing the reactions of learners after each topic treated, this will help to discover topics that will be considered specially or repeated for better understanding. Examples of social media applications include WhatsApp, Twitter, Instagram, Facebook, Pinterest, Linkedln and YouTube. For this study, the use of WhatsApp as an application in the teaching and learning of Mathematics was considered as the treatment.

WhatsApp is a messaging Application for smartphone created in 2009 by two former Yahoo employees, Brian Acton and Jan Koum (Iqbal 2022). It is an application that can be engaged in instant chatting by typing, voice mail, video calls, sharing images, keeping documents and group charting. Hence, it can be employed in audio, visual and audio visual activities. WhatsApp is good at transmission and reception of messages as it allows uploading and downloading of messages. Group platforms can be created for passing information across to either a minimum numbered group or a large group. This application can be viewed and use in a smart phone or by using a computer. Several educators have lunched into the use of WhatsApp in the teaching and learning processes. Celetinkaya (2017) was able to observe that students developed positive opinions towards the use of WhatsApp in learning. The use of WhatsApp in teaching gives room for the extension of classroom work at home which is blended Learning (Meyers & Matins, 2020). The use of WhatsApp is footed in the theory of social independence that premised on the interaction; learner-to-learner, learner-to-teacher, teacher-to-learner. This is 'within & between' style of interaction. The use of WhatsApp also accommodates collaboration among learners especially in terms of finding solutions to collective assignments. Supporting this theory was the submission of Ezeugo &Ajemba, (2020) that the use of WhatsApp in teaching foster positive relationship among learners. Jere, Jona & Lukose (2019) pointed out several advantages of teaching Mathematics with WhatsApp application which includes the opportunity of freedom on the side of the learner to ask question and also discuss critical topics in the group. This erases the question-phobia that enslaves some students when they are face to face with the instructor. Barhoumi, (2015) observed that learning engaged in activities through social medium such as WhatsApp ensues collaboration. WhatsApp can be a door opener for emphasis and aids understanding of an idea, communication practice that promotes the repetition and re-echoing of a message can prolongs the positive effects of such message or instruction especially when done in a right way. Such a benefits oriented medium such as WhatsApp could be considered for the teaching and learning of a subject of importance such as Mathematics.

The benefits of studying Mathematics are innumerable, to mention a few; Mathematics helps in the development of our reasoning and reasoning faculty. It promotes critical and analytic thinking. It strengthens and toughens our mind. It helps in making us efficient in our plans and execution of

our daily chores. The knowledge of Mathematics enables students to find job and be successful in labour market (Hodanova & Nocar, 2016). Mathematics stands out in its relationship with other subjects. At the elementary levels, questions and point are numbered for clarifications. Students' assignments, classwork and examination answers are scored numerically, this make the understanding of learners' performance easy. Data analyses that are sources for decision making in some fields like medical, Agriculture, Business and Finance to mention a few, are mathematical. Mathematics is a powerful tool in Politics. In managing incomes, calculation commences till the last dine is spent. In purchase, items needed are listed with one-to-one mapping with the prices. To the cook in restaurants palatable dishes speak volume about the effective use of Mathematics. Farmers, especially those that never stepped schools for formal Education make effective usage of Mathematics in counting

The dwindling performance of students especially in Mathematics, is crystal-clear to anyone who has followed the trend of events in the primary and secondary levels of learning over the past few years. This degradation is not only observed by the researcher as a Mathematics teacher in public secondary schools for years and still very conversant with the trend of issues in Mathematics and in Mathematics education in higher institutions. This evident in many ways, including students inability to interpret questions, poor or unsatisfying marks obtained by students in both internal and external examinations. The concerned educators/researchers are working to proffer permanent solution to this recurring unpleasant performance of learners in Mathematics. Consequent upon this observation, the researcher examined the possible effects that the use of WhatsApp in the teaching of Mathematics could be.

REVIEWED LITERATURE

Naidoo & Kopung (2016) observe that the use of WhatsApp messaging the premise of Constructivism theory that believes in the effect of the learning environment on the performance of the learner. This follows the ability of the instructor to control the messaging and the interactions through the created platform. The findings of this review support this research as it serves as eye-opener to the researcher to manage to handle learning community significantly. This is very important to avoid the diversion of the specific objectives of opening the platform by posting junks by the learners.

Al-Takhyneh (2018) investigated the attitude of learners towards the use of mobile Applications in the teaching of Mathematics. The result showed that learners were positively disposed to the use of the predictor variable. This was in conjuncture with the summation of Abdul Ghafoor, (2012) who observed that technology can facilitate learning environment and enables students to access learning in any place at any time. This strongly support this research as each member of the sample connected from different places which serve as convenient environment for them individually.

Mota & Ferreira (2020) found out that learners of Mathematics can explore the use of WhatsApp in sending difficult questions to their teachers for better understanding. It was observed that the use of WhatsApp in teaching could equip the teacher as he gains more new ideas and information about the learners individually. Resultantly, this was in agreement with the goal of this study, the teacher was able to identify the learning pace on the individual student.

Kihwele J.E & Mgata F. (2022) submitted that Informal WhatsApp Groups (IWG) serve as teachers' developer in pedagogical skills and also improve their knowledge about the content to be taught by the for the improvement on the learning outcomes elicit by the learners. This was in consonance with Akinwamide (2021) opined that when a teaching strategy is good, both the teacher and the learner will benefit maximally. This is in agreement with this study that aimed at improving students' performance in Mathematics which could be achieved through effective teaching by the instructors.

Banhoumi (2015) concluded in his findings that the use of WhatsApp in the teaching of Mathematics was effective in blended learning supporting the activities performed in this study as learners were first taught by the teacher through video where he was able to behold the learners before given them the opportunity to ask questions through voice messaging.

Research Hypotheses

The following null hypotheses were generated for the study.

1. There is no significant difference in the performance mean score of students in Mathematics in experimental and control groups before the treatment.
2. There is no significant difference between the performance' mean scores of students exposed to Mathematics through Social Media Learning Platforms and those exposed to Conventional Method.
3. There is no significant difference between the pre-test and post-test mean scores of students exposed to Mathematics through Social Media Learning Platforms and those exposed to Conventional Method.

METHODOLOGY

This study adopted the quasi-experimental of pre, post and control design to establish the effectiveness of the use of social media on the performance of learners in Mathematics. The design is represented diagrammatically thus:

Experimental Group: O_1 X O_2
Control Group: O_3 X_c O_4

O_1, and O_3 represent the pre-tests for the groups,
O_2 and O_4 represent the post-tests for the groups,

X - Social Media (WhatsApp)
X_c - Conventional strategy.

The population for the study comprised all Senior Secondary School II students in public secondary schools in Ikere Ekiti Local Government Area of Ekiti State. The sample for the study is made up of 101 students selected from the population. Multistage random sampling technique was used to select the samples. Simple random sampling technique was adopted in selecting three secondary schools out of ten public secondary schools in Ikere Local Government Area of Ekiti State. Stratification technique was adopted to select all the SSS II students that own or have access to smartphones, the number was 49 which form the experimental group. The remaining students form the control group, numbering to 52. A self-developed instrument named Mathematics Performance Test (MPT) was used to collect data for the study. MPT contained twenty Mathematics questions drawn from the SSII syllabus based on the treated topics. Each question had options A to D from which the learner chose the appropriate option that answered the question. Test-retest was employed to determine the reliability of the instrument, data collected were analysed by engaging Pearson Moment Correlation Analysis, Υ=0.88 obtained was good enough for the instrument to be used. The researcher in collaboration with the selected students for the experiment fixed a convenient time for the lessons after the pre-test. The researcher created a WhatsApp platform and added all the students in the experimental group with the research assistance. The Mathematics teachers in the three selected schools did their teaching normally for all the students but the students in the experimental group had the opportunity of being engaged by the researcher on the taught topics on WhatsApp. In each lesson, the teacher introduced the topic using WhatsApp video, learners listened attentively and they were able to see the instructor. During the teacher's explanations, the group would be locked to avoid distractions and irrelevances being posted by the students, but would be unlocked for students to ask questions and contribute or supply answers to questions. The lesson notes written by the researcher was used to teach the students, the researcher posted each step in the lesson note before video explanations. Students interacted by using voice and instant messaging to ask questions and solve tasks given by the instructor. Assignments were given after each class. Posttest was administered thereafter.

RESULTS

Test of Hypotheses

Hypothesis 1: There is no significant difference in the performance mean scores of students in experimental and control groups before the treatment.

Table 1: t-test analysis difference in the performance mean scores of students in experimental and control groups before the treatment

Variations	**N**	**Mean**	**SD**	**df**	**t_{cal}**	**P**
Experimental	49	24.01	3.47	99	0.876	0.383
Control	52	24.62	3.44			

p>0.05

Table 1 shows that the t-cal value of 0.876 is not significant because the P value (0.383) > 0.05. This implies that null hypothesis is rejected. Hence, there is no significant difference in the performance mean scores of students in experimental and control groups before the treatment. This implies that students' performances in the two groups before treatment were equal and ascertained the homogeneity of the two groups.

Hypothesis 2: There is no significant difference between the performance mean scores of students exposed to Mathematics through social media learning platforms and those exposed to conventional method

Table 2: t-test analysis difference in the performance mean scores of students in experimental and control groups after the treatment

Variations	**N**	**Mean**	**SD**	**df**	**t_{cal}**	**P**
Experimental	49	76.39	7.00	99	22.159*	0.000
Control	52	50.58	4.51			

*p<0.05

Table 2 shows that the t-cal value of 22.159 is significant because the P value (0.000) < 0.05. This implies that null hypothesis is rejected. Hence, there is significant difference between the performance' mean scores of students exposed to Mathematics through social media learning platforms and those exposed to conventional method. Students exposed to social media learning platforms had better performance in Mathematics than those exposed to conventional method.

Hypothesis 3: There is no significant difference between the pre-test and post-test mean scores of students exposed to Mathematics through Social Media Learning Platforms and those exposed to Conventional Method.

Table 3: Analysis of Covariance (ANCOVA) for Pre – test and Post – test Mean Scores of Students under the Groups

Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	16858.483[a]	2	8429.242	246.809*	.000
Intercept	6781.325	1	6781.325	198.558*	.000
Pre-test	43.262	1	43.262	1.267	.263
Groups	16835.275	1	16835.275	492.938*	.000
Error	3346.984	98	34.153		
Total	422380.890	101			
Corrected Total	20205.467	100			

a. R Squared = .834 (Adjusted R Squared = .831) * P < 0.05

The result presented in table 3 shows that there is a significant difference in the pre – test and post – test mean scores of students in the groups (social media learning platforms and conventional method) as P= 0.000<0.05. There is a strong evidence to reject the null hypothesis which states that there is no significant difference between the pre-test and post-test mean scores of students exposed to Mathematics through social media learning platforms and those exposed to conventional method. This result led to the rejection of the null hypothesis. By implication, there is significant difference between the pre-test and post-test mean scores of students exposed to Mathematics through social media learning platforms and those exposed to conventional method. In order to find out the more probable effective strategy, Multiple Classification Analysis (MCA) was carried out. The result is shown in Table 4.

Table 4: Multiple Classification Analysis (MCA) of students' performance in Mathematics by treatment

Grand Mean = 63.10					
Variable + Category	N	Unadjusted Dev'n	Eta^2	Adjusted for Independent + Covariate	Beta
Experimental (Social Media Learning Platforms)	49	13.29	.83	13.22	.09
Control	52	-12.52		-12.61	
Multiple R					.913
Multiple R^2					.834

The result in Table 4 shows the Multiple Classification Analysis (MCA) of students' performance in Mathematics by treatment. It reveals that, with a grand mean of 63.10, students exposed to social media learning platform had higher adjusted mean score of 76.39(63.10+13.29) than their

counterparts in the control group 50.58(63.10+(-12.52)). This means that social media learning platform was the more effective strategy of teaching Mathematics. There was a very high multiple relationship (R= 0.913) between the two groups and academic performance of students in Mathematics. The two treatments strategies can also account for 91.3% variability in academic performance of the students in Mathematics. It means there is a need for other researchers to find other teaching strategies (other than the two strategies under consideration) that could account for 8.7% of the variability in academic performance of students in Mathematics.

DISCUSSION

The findings of this study revealed that there was no significant difference in the pre-test mean scores of students in Mathematics exposed to social media learning platforms (WhatsApp) and the control group. This finding established the homogeneity of the two groups involved in the study prior to the experiment. In other words, it could be said that the knowledge baseline for the two groups involved in the study are equal. Hence, any noticeable change in performance is accorded the specific treatment applied.

The findings of the study showed that there was significant difference between the performance' mean scores of students exposed to Mathematics teaching and learning through social media(WhatsApp) learning platform and those exposed to conventional method. Students exposed to social media learning platform had better performance in Mathematics when compared with the scores of those exposed to conventional method. This finding is in agreement with the conclusion of Sewlwyn & Stirling (2016) that social media learning platform is a panacea to students' poor academic performance science subjects.

The study also revealed that there was significant difference between the pre-test and post-test mean scores of students exposed to Mathematics through social media learning platform and those exposed to conventional method. Students exposed to social media learning platform had higher adjusted mean score than their counterparts in the control group. This means that social media learning platform was the more effective strategy of teaching Mathematics. There was a very high multiple relationship between the two groups and academic performance of students in Mathematics. Naidoo & Kopung (2016) in their research concluded that WhatsApp instant messaging foster a social constructivist environment and improve learners' academic performance. It could be deduce from the previous researches and the findings of this study that the use of modern teaching methods particularly with the involvement of social media influence students' performance, interest and attitude towards Mathematics.

Conclusively, this study established the homogeneity of the sample before treatment.
The findings of this study showed significant difference in the performance mean scores of students exposed to Mathematics through social media learning platforms (WhatsApp) and those

exposed to conventional method. Students exposed to social media learning platforms had better performance in Mathematics than those exposed to conventional method.

Also, it was established that there was significant difference between the pre-test and post-test mean scores of students exposed to Mathematics through social media learning platforms, hence they have higher adjusted mean score than their counterparts in the control group. This means that social media learning platform is more effective in the teaching and learning of Mathematics. Consequently, this study have being able to contribute to knowledge in the following areas: The use of WhatsApp in the teaching of Mathematics is a possibility. Learners interact freely and participate actively in a class with the use of WhatsApp and this promotes better relationship among learners. Students' performance in Mathematics is improved upon when WhatsApp is adopted in the teaching and learning. Retentiveness is improved upon the use of social media in the teaching and learning of Mathematics. Based on the findings of this study, it could be concluded that, the two groups (social media learning platforms and Conventional) were homogeneous at the commencement of the experiment. The use of social media learning platforms enhanced better performance of students in Mathematics than the conventional method.

Recommendations

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

1. The use of social media learning platforms should be encouraged in passing out instruction in secondary schools so as to enhance better academic performance of students in Mathematics.
2. Mathematics teachers should be given adequate orientation through workshops and seminars to update their knowledge in the use of social media learning platform.
3. Authors of Mathematics textbooks should adopt e-textbook so that it could be useful on social media learning platforms.
4. Parents should endeavour to provide needed devices such as smartphones and laptops for their children for better participations in WhatsApp learning communities.
5. A result oriented pedagogy as WhatsApp in the teaching and learning of Mathematics should be included in the content of the curriculum.

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