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Effects of Digital Native Environment (TDNE) on Students Performance in Mathematics

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Abstract
The purpose of this study is to examine the effects of digital natives environment on students Performance in Mathematics. The study adopted pre-test, post-test, control group quasi experimental research design. The population for this study comprises of all Secondary School Mathematics students in Ekiti State secondary schools. An intact class of 299 students were selected through multistage sampling procedure. The instrument used for the collection of data was Mathematical Achievement Test (MAT). Face and Content validity of the instrument was ascertained and the reliability coefficients of 0.68 was obtained when test re-test method was used. Data collected were analyzed inferentially using Analysis of Variance, Scheffe posthoc and t-test analysis to test the hypotheses postulated at 0.05 level of significance. The findings showed that the use of digital native environment influence students performance in Mathematics. Based on the findings, it was recommended that mathematics teachers should embrace the use of innovative instructional strategy in the teaching and learning process in order to facilitate the high level of students' performance in Mathematics.

Keywords: Digital native, Performance, Information and Communication Technology, learning environment

INTRODUCTION

Mathematics as a language helps to describe ideas and relationships drawn from the environment. Mathematics is a vital tool of social reality and it is considered necessary for national development. Mathematics can be a difficult subject in early childhood education, both for students to learn and for educators to teach. Students who have a tough time grasping the early concepts of the subject can fall behind their peers in later years, creating an academic achievement vacuum among students (Hassidov, 2017). Historically, Mathematics uses only formulas, rules and algorithms, that is part of everyone's life and as such needs to be understood as essential. The development of new digital technology through programming, mathematical logical thinking, artificial intelligence and other applications serves as a motivator for the students to cultivate interest in mathematics.

Presently, the use of social media in recent times is on the increase, both the teachers and students are expected to appropriate technology usage optimally. According to Milutinovic (2022) digital natives are accustomed to getting information in a very short period of time; enjoy parallel processing and multitasking; prefer visual to text rather than the other way round; operate best when they are connected; prefer access that is random (like hypertext); thrive on frequent rewards and instant gratification; would rather play games than do "serious" work. Yet, it appears somehow difficult for some mathematics teachers to blend fast with the new digital natives environment that can enhance academic excellence. Such teachers belong to the class of digital immigrants, this is because they had to adapt to the new language of technology

Digital native is a term coined by Marc Prensky in 2001 to describe the generation of students who grew up in the era of ubiquitous technology, including computers and the internet (Boyle, 2021). Digital natives are comfortable with technology and computers at an early age and consider technology to be an integral and necessary part of their lives. Many students in developed countries are considered to be digital natives, as they mainly communicate and learn via computers, social networking services, and texting. In the meantime, with the developments in technology and Internet infrastructure, online learning environments have become popular as an alternative learning environment in schools. Students spends a lot of time on the Internet specifically in social media environments and they commonly get connected to the Internet with their mobile phones which necessitates a new skill and mathematics knowledge in online learning environments.

Social media, as a technological resource, are present in the daily lives of students, enabling dialogue, information exchange in a shorter time, with different and low cost media. However, in the school environment there are still many resistances from teachers and managers to integrate social media into formal education. Some educational gatekeepers within the system ensure that bringing cell phone is

made prohibited, which is counter-productive in this 21st century, thereby making it difficult for students to practicalise ideas or instruction during the classroom setting especially by the teachers that are digital immigrants. Bates (2016) remarked that despite social media is a non-formal mode of teaching, still fostering better performance when online communities of practice, posting tweets during classes are in place. According to Aharony and Gazit (2019), students who grew up with technology are more likely to have greater information literacy self-efficacy.

LITERATURE REVIEW

Emergence of digital technology in the 21st century has automatically positioned the new generation of students as a beneficiary of digital natives. Nowadays, learners are experiential in nature, and current schooling practices are adapting to relate to this generation's interest in some areas (Bittman, Rutherford, Brown, & Unsworth, 2011), particularly as a result of the outbreak of COVID-19. The period of pandemic has became an eye-opener to all and sundry whereby the private primary and post primary schools began the use of electronic learning. This inturn popularized learning through technology. The outbreak of COVID-19 had forced millions of parents and guidance to procure social media learning tools for their children and wards for teaching learning activities. One way to individualize instruction is through the use of technology.

Lei (2010) found that the quantity of technology in education is not significantly effective unless the quality and adaptability of the technology is proficient. Bridging the gap from home to school, this study emphasized the application of technology in schools that is relative to the amount of technology that children are exposed to in the home. With the advancement of digital technology, some educational institutions such as schools and universities have rethought their values and teaching practices. Prior to the outbreak of the COVID19 pandemic, Webbased information services (WIB) such as ZOOM app, WebCT, Desire@Learn, Coursework, Atutor and Interact, Google Hangout, Google Meet, Google Classroom, Blackboard, Moodle, and WebEx are not optimally popular as impetus to teaching some Nigerianstudents in the teaching and learning of mathematics. ZOOM app allows students and lecturers to share the whiteboard, share the screen, add participants, mute participants in case of noise distortion, and upload lecture notes during the teaching and learning process (Zulu et.al. 2021)

It is necessary to rethink the resources used in the classroom, as well as to create alternatives that meet the needs of the subjects involved and immersed in a technological culture and thus contribute to significant changes in teaching in the current scenario, where information are fully parked in space, and the more anyone search the better he becomes. The world has become a global village, it is imperative for any serious parent to allow their children to interact with internet with a view to broaden their intellect with or without teacher. The arrival of mobile technologies in the classroom brings tensions, new possibilities and great challenges. (Moran, 2014) "The very words "mobile technologies" show the contradiction of using it in a fixed space like the classroom. Mobile technologies are increasingly available in the hands of students and teachers, making it possible to use these resources for educational purposes unless the teachers still showing adamant attitude for digital alternatives.

Teachers must have a deep understanding of cultural demands that are unique to the teaching and learning of mathematics in a changing society. When students learn using a mathematics software program, they might need their teacher's assistance in order to properly interpret the feedback they receive from the program. This becomes more important when students prefer to interact better with the computers gadgets such as laptops and phone. Although the importance of discoursing between teacher and students Mathematically in the process of teaching and learning has gained considerable attention in recent years as a result of technological sophistication (Moschovich, 2007)

According to Jennifer et. al. (2016) digital natives can also motivate students and allow them to be engaged on a completely different level than they have ever before. digital natives does in fact increase students achievement and increase motivation in students to learn. The use of technology allows teachers to truly differentiate and tailor instruction to meet the needs of their students. (Spears, 2012). Education technology shows great potential for facilitating mathematics instruction and improving students' mathematics learning outcomes (Cheung & Slavin, 2013).

A randomized controlled trial, considered the gold standard of education research, indicated that a mathematics intervention significantly improved scores on most strands of a mathematics examination of kindergarten students who used the Researching Order of Teaching (ROOTS) instruction program compared to students who did not use the program (Clarke et al.,2017). ROOTS is a small-group tutoring program for kindergarten students experiencing mathematics difficulty. With ROOTS, students participate in lessons focused on developing number sense to help improve understanding of kindergarten mathematics numbers and vocabulary. It has became imperative for the mathematics teachers at all levels to experience a paradigm shift from digital immigrants to digital natives.

According to Orlando & Attard (2016), digital natives are now of age and comprise the new generation of early career teachers. This is an important change in teacher demographics given that new technologies have been introduced into classrooms with expectations that teachers embed them effectively into the teaching of mathematics. Digital natives are the accumulation of techniques, skills, method, and processes used in the production of services and accomplishment of objectives through technology intervention. Digital natives are also the set of knowledge, skills, experience and techniques through which humans experience transformation and key into current technology environment in order to create tools, machines, products and services that **meet present needs and desires. Digital natives** could be described as products and processes used to simplify our daily lives in technology applications **(Prensky, 2021)**. In this study, digital native is a blended teaching and learning phenomena where parents and schools collaborated and procure electronic device for school and home use for students in Mathematics lessons. This involve any technology device that accommodate the internet to download learning packages on certain Mathematics concept or You- tube teaching package as well Technology can extend human abilities by making people the most crucial part of any technological system. Technology is relevant in almost everything we do in our daily lives, at work, in communication, transportation, learning, manufacturing, securing data, scaling businesses and so others. Technology is human knowledge which involves tools, materials, and systems. The application of technology typically results in products. If technology is well applied, it benefits humans in no small measure.

High-quality educational technology can potentially assist students in STEM learning, especially in early childhood. One type of technology that can be particularly effective is computer-assisted instruction (CAI), which presents students with different forms of interactive educational media.

The digital revolution is transitioning our schools from paper-rich to technology-and-media-rich learning environments. In the midst of these changes, a big issue arises: Technology in schools can either accelerate the momentum in mathematics education or undermine that momentum. Digital learning environment for mathematics in secondary school enhances interactive teaching and feedback. On one hand, technology can help students visualize and comprehend mathematics, while their teachers gain deep insights into student cognition and share their professional growth with a web-connected community. On the other hand, technology can water down mathematics into competitive, drill and practice games for students, while relegating teachers to the role of computer proctors who are disengaged from their role in helping students to learn and grow (Puentedura, 2015).

There are several problems faced in some rural areas, including Manokwari, West Papua, Indonesia. The limited infrastructure of Information Communications Technology (ICT) for teachers and students is a problem in the online learning system particularly in the rural area. The distribution of ICT facilities is another factor that hinders the implementation of online learning systems in West Papua. This is because the obstacle in rural areas has a unique character compared to urban communities. (Benidiktus et.al. 2021). Based on some factors indicated in this study, it became imperative that the researchers investigated the effects of teacher digital native environment on students performance in secondary schools

Statement of the Problem

The researchers observed that the dynamic nature of knowledge seem not to be experienced in teaching of Mathematics in some public secondary schools in Ekiti State, particularly in the area of technology application. Also it appears that the majority of Mathematics teachers in the schools are analogue based while the world has shifted to digital. Therefore, it is necessary to verify the effects of digitalization in classroom activities. The researchers observed with dismay the attitude of some teachers that are giving corporal punishment to students for sighting a phone at their disposal, instead of guiding them on the best way to use it. To put the teaching of Mathematics in its proper perspective, especially with this current reality of technology envolving, there is need to consider knowledge switching from analogue to digital. Moreover, Mathematics students seem to exposed to just one method of teaching, the researchers deemed it necessary to investigate the effect of digital natives on students performance in Mathematics.

Purpose of the Study

The purpose of this study is to determine the effect of digital natives on students performance in Mathematics. It also determine the environment that is more efficient in carrying out digital technology activities in Mathematics teaching.

METHODOLOGY

The study adopted quasi- experimental research design of pre test, post test and control group design. The population for this study comprised all Upper Basic 3 Students in Ekiti State. The sample for the study was 299 Upper Basic 3 students selected using multistage sampling procedure. At first stage, a local government each was randomly selected from each of the three senatorial districts in the state. At stage two,

stratified sampling technique was used to select at least two schools in each of the local government whereby one was situated in urban while the other in rural area. Purposive technique was used to select a school from each location that is well fortified with digital technology (such as interactive board, internet facilities, functioning laptops) while another set a school each was selected without digital technology. The last stage was the use of intact class to select 90, 97 and 112 students in conventional, HTDNE and LTDNE groups respectively.

Teachers from a fortified digital technology are tagged "High Teacher Digital Natives Environment (HTDNE) while those teachers with non fortified digital technology classroom are tagged "Low Teacher Digital Natives Environment (LTDNE). Mathematics teaching package on Algebra, Arithmetic and Geometry was given to the HTDNE for their teaching and interaction with their students with recommended links for their students to study the same package while they are not in schools. The teachers in LTDNE were given the YouTube link to study and apply same in teaching their students, although they shared the links with their students probably they might get a device to download and study the link. The control group was taught conventionally the concept of Arithmetic, algebra and geometry.

The instrument used for the collection of data was Mathematical Achievement Test (MAT), developed by the researchers. It has two sections, section A consist students biodata while the section B contains 30 multiple choice items from Arithmetic, algebra and geometry. Face and Content validity of the instrument was ascertained by experts in mathematics education. Test re-test method was used and the reliability coefficients of 0.68 was obtained.

The pretest was firstly administered on all the groups, where the homogeneity was discovered in the groups performance. After that, HTDNE and LTDNE groups were given treatment for six weeks. Later, the post test was administered on all the groups in order to verify the effects of the treatment given. Data collected were analyzed inferentially using, Analysis of Variance (ANOVA), Scheffe posthoc and t-test analysis were used to test the hypotheses postulated at 0.05 level of significance. Four null hypotheses were postulated and tested at 0.05 level of significance in the study:

RESULT AND DISCUSSION

Hypotheses 1:

There is no significant difference in the performance of students taught Mathematics by high and low teacher digital natives environment before treatment

Table 1;- *ANOVA summary on students performance in high and low teacher digital natives environment after treatment*

Source of variations	**SS**	**Df**	**MS**	**F_{cal}**	**Sig**
Between groups	177.420	2	88.710	1.156	0.074
Within groups	9049.657	296	28.105		
Total	9227.077	298			

p>0.05 (Not significant)

Table 1 revealed that $F_{2, 296} = 1.156$, $P > 0.05$.The hypothesis is not rejected. This implies that there is no significant difference in the academic performance of students taught Mathematics by HTDNE and LTDNE before treatment. This shows that the three groups were homogeneous at the commencement of the experiment and any change thereafter could be as a result of treatment.

Hypotheses 2: There is no significant difference in the performance of students in high and low teacher digital native environment after treatment

Table 2:- ANOVA summary on students performance in high and low teacher digital native environment after treatment

Source of variations	**SS**	**Df**	**MS**	**F_{cal}**	**Sig**
Between groups	319.632	2	159.816	5.929*	0.003
Within groups	7979.980	296	26.959		
Total	8299.612	298			

p<0.05 (significant)

Table 2 revealed that $F_{2, 296} = 5.929$, $P < 0.05$.The hypothesis is rejected. This implies that there is significant difference in the academic performance of students taught Mathematics by HTDNE and LTDNE after treatment. In order to locate the source of significant difference among the groups, Scheffe Posthoc analysis was carried out. The result is presented in Table 3

Table 3:- *Scheffe Posthoc analysis on students performance in HTDNE, LTDNE and conventional groups*

Source of variation	Conventional	LTDNE	HTDNE	N	Mean
Conventional		*	*	90	14.40
LTDNE				112	16.04
HTDNE		*		97	16.16

Table 3 showed that there is significant difference in the academic performance of students taught

Mathematics by LTDNE and conventional method, HTDNE and conventional method at 0.05 level of significance. Similarly, there is significant difference in the academic performance of students taught Mathematics by LTDNE and HTDNE in favour of HTDNE. By implication, students exposed to HTDNE had the highest mean score of 16.16, followed by students engaged by LTDNE with mean score of 16.04 and the conventional method had the least mean score of 14.40.

Hypotheses 3: There is no significant location difference in the performance of students engaged by high teacher digital natives environment

Table 4:- *t-test on the performance of students engaged by HTDNE considering their location*

Location	N	Mean	SD	Df	t_{cal}	Sig
Urban	49	17.31	4.288	95	4.050*	0.000
Rural	48	13.79	4.257			

p<0.05 (Significant)

Table 4 revealed that $t_{110} = 4.050$, $p<0.05$. Thus, the null hypothesis is rejected. By implication, there is significant location difference in the performance of students engaged by high teacher digital natives environment in favour of the students in the urban area. This could be as a result of the environment where they are living.

Hypotheses 4: There is no significant location difference in the performance of students engaged by low teacher digital native environment

Table 5:- *t-test on the performance of students engaged by low teacher digital natives environment*

Location	N	Mean	SD	Df	t_{cal}	Sig
Urban	63	16.59	4.845	110	1.029*	0.000
Rural	49	15.35	7.844			

p<0.05 (Significant)

Table 5 revealed that $t_{110} = 1.029$, $p<0.05$. Thus, the null hypothesis is rejected. By implication, there is significant location difference in the performance of students engaged by low teacher digital natives environment in favour of the students in the urban area. This could also be as a result of the environment where the students are residing.

DISCUSSION AND CONCLUSION

The findings revealed that there is significant difference in the academic performance of students taught Mathematics by high teacher digital natives environment HTDNE and LTDNE after treatment. This is in line with the work of Orlando & Attard (2016) that digital natives are now of age and comprise the new generation of early career teachers that are making waves in the teaching of the subject. The findings also contradicted the study carried out by Lei (2010) that the quantity of technology in education is not significantly effective unless the quality and adaptability of the technology is proficient.

The findings revealed that there is significant difference in the academic performance of students taught Mathematics by high teacher digital natives environment and low teacher digital natives environment in favour of high teacher digital natives environment. This is in consonants with the work of Kumar & Kumar, (2003) that teacher positive attitude toward technology and access to long-term professional development could be key components for the effective integration of technology into the classroom. The findings is in agreement with the work of Bouzid et.al (2017) that 38% of those teachers declare that most students are lacking basic computational and autonomy skills. However, most teachers had positive attitudes towards technology after they used it high technology while teaching.

The findings revealed that there is significant location difference in the performance of students engaged by high teacher digital natives environment in favour of the students in the urban area. This supported the earlier work of Isa (2018) who found significance difference between urban and rural in favour urban students. The finding is also corroborated the work of Essien (2017) that there is no significant influence of location on students' academic achievement.

It can be concluded from the finding of this study that digital natives environment is an essential impetus that improve student academic performance in Mathematics than Conventional method of teaching. The findings of Shonfeld et al. (2021) corroborated and found positive relationships between information literacy self-efficacy and digital native traits, as well as computer abilities. The study contradicted the work of Yong (2017) that students are characterized as digital natives and do not portray a significant gender gap in technology usage. Therefore, the use of digital natives environment helps the students to derive maximum benefit from the lesson, hence, it is more effective in the teaching of Mathematics concept.

RECOMMENDATIONS

Based on the findings above, it is recommended that the use of digital natives environment should be encouraged in teaching Mathematics in secondary school. Teacher should be trained on the need to apply digital technology in teaching Mathematics. Likewise, government through the relevant ministry should organize seminars and workshops on digital technology for effective teaching of Mathematics.

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