

IMPACT OF ONLINE TUTORIAL (GEOGEBR) ON PUPILS' PERFORMANCE IN LEARNING FRACTION AT UPPER PRIMARY SCHOOLS IN MINNA, NIGER STATE.

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ABSTRACT: This study investigates the impact of online tutorial (GeoGebra software) on Upper Primary School Pupils' performance in learning fractions in Minna, Niger State. Quasi-experimental research design of pre-test and post-test within-group was employed. The population of this study comprises all the pupils in the selected primary school in Minna, Niger State. An intact class of basic 4 pupils participated in the study. The instrument was validated by an expert in Mathematics education from the Department of Science Education, Abubakar Tafawa University, Bauchi, Bauchi State. Data was collected in multiple phases. The first phase is the Before Phase, where the FAT was administered to determine their achievement level before treatment. The second phase was the intervention phase, where the pupils received instructions using GeoGebra software in a computer lab on three different occasions. While the third phase was the after phase in which the FAT was administered to the pupils to measure their achievement after the intervention. The study revealed that the use of GeoGebra software in teaching fractions improves pupils' learning outcomes compared to their learning outcomes before using the software. It was concluded that GeoGebra integration into classroom instruction is a strong way of addressing pupils' learning difficulties in fractions and thereby enhances their performance in mathematics. The study recommended that School authorities and educational bodies should encourage the adoption of online teaching tutorials like GeoGebra for teaching and learning mathematics.

KEYWORDS: Online Tutorial, GeoGebra, Primary School, Fraction Achievement.

I. INTRODUCTION

The use of the internet has emerged as a potential tool in education, due to the access, sharing, storage, and use of information in the 21st century. With a variety of communication services, the internet has become an increasingly important structure in the educational sector (Tezer et al., 2019). This has led to several developments in teaching and learning methodologies, such as the use of online learning environments in the classroom. Online learning environments are models for education, where teaching and learning are controlled autonomously. For instance, virtual classroom, multimedia programs, video conferencing, as well as teleconferencing are some of the tools that make it possible for online learning activities (Tezer, 2020). Fractions have been considered by Mathematics teachers and researchers as one of the core concepts in mathematics. However, primary pupils face numerous challenges in mastering it (Fazio et al., 2016; Wijaya, 2017). As students use the concept of fractions every day throughout their school activities, it is believed that fraction needs to be taught in a more engaging way (Jarrah et al., 2022). Fractions are crucial not only at a tender age but also for later success in mathematics learning. From the perspective of numerical development, which is a process of broadening the set of numbers and requires children to accurately represent the magnitude of numbers, the

learning of fractions expands children's understanding of numbers from whole numbers to rational numbers (Bright et al., 2024). Fraction knowledge is the basis for learning decimals, percentages, and ratios, and the operations on fractions are fundamental for the formal symbolic computation of rational numbers (Yakubu et al., 2023). Indeed, competence with fractions can predict gains in mathematics achievement (Weinhandi et al., 2023). The relationship between fraction computation mastery and academic success even goes beyond math learning and is linked to learning in other disciplines, such as chemistry, physics, economics, and many other areas (Lortie-Forgues et al., 2015). This relationship between fraction mastery and other areas has led researchers to examine the effects of individual differences in fraction skills, the relationship between conceptual knowledge and procedural knowledge of fractions, and the reasons why fractions are so difficult for children from both practical (Hansen et al., 2017) and cognitive neuroscience perspectives (Huber et al., 2014).

In a report by Lawan (2023), he lamented that fraction is found to be among other mathematical concepts that primary school pupils find difficult and continue to perform poorly. Lazic et al. (2021), Obande and Dogo (2018) all in their respective findings indicated that primary school pupils find fractions difficult to understand and exhibited poor skills to perform basic operations on fractions. Several reasons have been attached to the difficulties faced by pupils in comprehending fractions. For instance, Yakubu et al. (2023) argued that pupils' difficulty in learning fraction is due to their failure to develop the conceptual understanding needed to acquire the procedural knowledge of solving fractions. On the other hand, Siegler (2017) blamed the pupils' difficulty in learning fractions on two factors, inherent factors and culturally contingent factors. Inherent factors are those factors like notations used to express fractions, complex relations between fraction arithmetic and whole number arithmetic and complex conceptual relations among different arithmetic operations on fractions. While, culturally contingent factors include language of describing fractions, teacher understanding of fractions and nature of fractions presentations in textbooks. Other researchers like Osakwe et al. (2019) were of the view that the type of teaching method used by teachers remains one of the key reasons. Lazic et al (2017) further mentioned instructional methods as one of the foundational areas that needs to be considered for pupils to learn fractions in a meaningful way. Despite the role of teaching method adopted to comprehend fractions, there is enough evidence showing that mathematics teachers at primary school level uses traditional teaching method with little or no consideration to innovative approaches (Yakubu et al., 2023; Osakwe et al., 2019). This shows that there is a need for mathematics teachers to try other innovative approaches to enhance learning of fractions. Therefore, this study investigated the impact of online mathematics tutorial in learning fraction in upper primary school.

Studies have found it beneficial to teach fractions using an online mathematics tutorial. For instance, Gresalfi et al. (2018) reported that students who studied through the online mathematics tutorial were described as having enjoyed their time solving problems and asked for more exercise. Likewise, Zhang et al. (2020) stated that integrating online mathematics tutorials in solving fractions for primary students increased their conceptual knowledge of fractions and showed increased achievement when solving questions with fractions (Tashtoush et al., 2022). In a study about the effect of online and interactive games in teaching, Hamzah et al. (2019) reported that teaching using interactive games had positively increased students' interest in mathematics and showed that students could explore the mathematical concepts at their own pace and play the games during their leisure time at home or school. This could result in students learning mathematical concepts in a fun and engaging learning environment. Therefore, this study investigated the impact of online tutorials on students' performance in solving fractions among primary pupils in Minna, Niger State.

II. LITERATURE REVIEW

Mathematics concepts are sequential in nature, one topic must be understood before another. When students miss key components of one topic, then that could affect the student to fully understand the concept (Murphy 2016). It might not only affect the concept being taught at that particular period but also the next concepts. Studies have suggested that using technology in the classrooms can increase student' mathematics outcomes (Hegedus et al., 2015). The authors further argued that technology enhances teacher-student interaction and support student collaboration. The implementation of technology in school mathematics classroom is beneficial to student learning and also improve their performances (Stephen et al., 2015). Therefore, integrating technology in education particularly at primary level may allow the student to become more aware of the technology, but also may give the pupils more confidence in mathematics. In this century that we have computer with various applications, web-based, or related software can be used to support teaching and learning mathematics. The most important thing is that teachers must have sufficient knowledge to operate the software. One of the most popular software used by the teachers in schools is the Geogebra. This software provides various menu that can be used as one of the recommended media for learning mathematics. Geogebra software offers a valuable opportunities for pupils to create interactive online learning environments that enable them to explore the mathematical concepts taught. it can be use for demonstration and visualisation media, construction aids, and discovery aid. Previous research have proved that students' skills and responses were improved after learning mathematic using Geogebra (Gómez-García et al., 2020).

Several studies reviewed in this study, have shown different findings supporting the integration of technology in learning mathematics. Particularly those studies reviewed on Geogebra shows the use of Geogebra has influence on pupils mathematics performance. For instance, Bright et al. (2024) determined the impact of using technology in mathematics teaching and learning on the mathematics performance of students as mediated by students' interest in mathematics. The study adopted a survey research design, Simple random sampling techniques were used to sample 216 students from the three selected SHS in Kumasi, Ghana. A structured questionnaire was used as an instrument for data collection since the study is purely quantitative. Amos (ver. 23) was used to analyze the structural paths of the study. The results from the analysis reveal that the impact of technology on mathematics performance was positive and significant, and the impact of mathematics interest on mathematics performance was positive and significant. Also, the impact of technology on mathematics interest was positive and significant. Finally, the connection between employing technology in mathematics teaching and learning and students' performance in mathematics is somewhat mediated by students' interest in mathematics, and this relationship is statistically significant.

Similarly, Ekwue et al (2023) investigated the effectiveness of GeoGebra application on geometrical mathematics among secondary school students in Delta state. A descriptive survey and quasi-experimental design was used, specifically, the pretest-posttest non-equivalent control group. The population consists of all the SS 2 students and mathematics teachers in all the public and private schools in Delta State. Fifteen mathematics teachers participated in the online workshop and that form the sample size of the teachers and 600 students were sampled, but 516 scripts were returned. Three (3) research questions guide the study. Two instruments were developed for the study; Mathematics Ability Test (MAT) and a Questionnaire on Mathematics Teacher's Attitudes toward GeoGebra Software (QMTAGS) were used for data collection. MAT was administered as a pre-test and post-test to the experimental and control groups which have 15 objective questions, while QMTAGS was administered to teachers after the workshop exercise on the GeoGebra software which contained 14 multiple-choice items. The data obtained were subjected to mean and standard deviation. The result showed that

GeoGebra make teaching and learning of mathematics fun and enjoyable. The study further revealed some factors that are responsible for mathematics teachers' non-access to digital teaching of mathematics such as; lack of computer-literate skills, non-availability of computer lab software, lack of power supply, and lack of professional development. Also, Male students were found to performed better than their female counterparts, while private schools also outperformed than public school students.

Quynh et al. (2021) examined the combined influence of intrinsic motivation and extrinsic one on the engagement about behavioural, emotional, and cognitive of university students to bring academic achievements. To do this, an experimental questionnaire was designed to collect data from Vietnamese students in Danang and employed Structural Equation Modelling (SEM) to estimate the relationships among proposed variables. The results from 393 samples indicated that intrinsic motivation is the crucial element stimulating their efforts and engagement to obtain learning success. In contrast, extrinsic motivation is found to not bring a positive influence on the cognitive engagement of students. Also, Tamam and Dasari (2021) investigated the uses of Geogebra software in teaching mathematics. this article provides a brief description of Geogebra software as a medium for teaching mathematics. This study was a library research. the researcher uses the documentation method to collect data and then analyse the data gathered using content analysis. After analyzed twelve related articles which revealed the advantages of using Geogebra in learning mathematics, it is found there are several significant results obtained. These findings, including Geogebra, ease students to comprehend geometry. Students also tend to be happier in learning fraction by using Geogebra, which was operated by using a computer. Murphy(2016) investigate the effects of implementing technology into a high school mathematics classroom. Mathematics has a hierarchical structure in learning and it is essential that students get a firm understanding of mathematics early in education. This literature review is to stimulate reflection on the effect of using technology in the high school mathematics classroom since it can help engage students in the learning process, allow students to have a higher accuracy with computational tasks, help create a less-anxious mathematics environment for students, help motivate students, and help students get a deeper understanding of the mathematical content.

Furthermore, earlier studies on the effects of online learning on student achievement shows. For instance, Goodman et al. (2016) examined the student performance in spatial mathematics, and it was discovered that physical representations of spatial tasks were more successful. Other studies on the usefulness of mobile education have also revealed different findings. Güler et al. (2023) found that, compared to face-to-face apps, online learning boosted the academic success of university students. Al Khateeb (2019) investigated the effect of online tutorials on mathematical achievement in the 4th grade. The results indicated that the use of online tutorials served as an effective educational support to the students in mathematics. Lazem and Jad (2017) conducted research in one of the rural areas in Egypt (Burg El-Arab City) populated by Bedouins to explore the impact of online tutorials on students' performance in solving mathematical questions containing fractions. They found that students have beneficial to teach fractions using an online tutorial. However, Hung et al. (2020) found no significant improvement in the students' performance, which might be due to several factors. Despite the benefits of online tutorial on students' mathematics achievement, little are known about its effect on primary pupils in Minna, Niger state. It is against this background, this study investigated the impact of online tutorials, particularly Geogebra, on pupils' performance in upper primary school in Minna, Niger state.

III. RESEARCH METHODOLOGY

The study adopted a Quasi-experimental research design of before and after within group on the impact of GeoGebra software among primary school pupils in Minna, Niger state. An intact class of basic 4 pupils participated in the study, which comprised 20 pupils. This design was considered appropriate by the researcher since the random selection or random assignment of schools and classrooms is quite impracticable. Purposive sampling was used to select the school and class. This is due to the accessibility of the participants, ICT facilities, internet and cooperation by the school management. In many cases purposive sampling is used in order to access participants or access to networks, expertise or experience (Ball 1990). Two instruments were used: the Geogebra software as treatment instrument, and Fraction Achievement Test (FAT). The FAT was adopted from the SMART mathematics textbook, Basic Four. It contains only 15 questions with multiple choice options, with one correct option and three distractors to achieve the following specific objectives:

- (a). To examine the effect of using online tutorials on students’ ability to solve fraction at upper primary school in Minna
- (b). To examine the difference between genders who uses online tutorial to study fraction at upper primary school in Minna

The FAT was validated by an expert through face and content validation, data collected was analysed using mean, standard deviation, and independent t-test was used to test the formulated null hypotheses at 0.05 Alpha level of significance.

IV. RESULTS AND DISCUSSION

Table 1 shows the mean and standard deviation of the student score before treatment was 7.74, the mean rises to 12.16 after the treatment , with mean gain of 4.42, showing that the online tutorial(Geogebra) improve the student performance in solving fractions at the upper primary school level in Minna, Niger state. This finding is supported by Murphy (2016), who argues that students stay motivated in the pedagogy of the learning process. Also, the result of this study is in agreement with Ekwue et al (2023), who found that GeoGebra make teaching and learning of mathematics fun and enjoyable. To understand the mean differences in the mean achievement score of male and female pupils before the treatment, Table 2 presented the analysis.

Table 1: Mean and Standard Deviation before and after

Variable	Mean	Standard Deviation	Mean Gain
Before	7.74	2.08	4.42
After	12.16	2.01	

From Table 2, male pupils have a mean value of 7.00 with a standard deviation of 2.000, while female pupils have a mean value of 8.08 with a standard deviation of 2.100. The mean difference was 1.08, $t=1.054$, $p\text{-value}=0.107 > 0.05$. This implies that the pupils are of the same range in terms of their performance in solving fractions. However, the differences in the mean performance score of the pupils observed might be due to some factors.

Table 2: Mean and Standard Deviation of Gender differences before Treatment

Variable	Gender	Mean	Std. Deviation	Mean Difference	t-value	Df	p-value
BEFORE	Female	8.08	2.100	1.08	1.054	18	0.107
	Male	7.00	2.000				

Table 3 shows that male pupils have the mean value of 12.17 with a standard deviation of 2.317, while female pupils have the mean value of 12.15 with a standard deviation of 1.951. The mean difference was 0.02, $t=-0.013$, $p\text{-value}=0.990 > 0.05$. This shows their performance improved and no differences was found in the mean performance score after the treatment. This finding contradicts Ekwue et al(2023), who say male students perform better than female students.

Table 3: Mean and standard Deviation of gender differences after treatment

Variable	Gender	Mean	Std. Deviation	Mean Difference	t-value	Df	p-value
AFTER	Female	12.15	1.951	0.02	-0.013	18	0.990
	Male	12.17	2.317				

CONCLUSION

This study investigated the impact of online tutorial(GeoGebra) on pupils' performance in learning fractions at the upper primary school in Minna, Niger state. It was found that the uses of Online tutorials (GeoGebra) improve the pupils performance in solving fraction in the selected primary school in Minna, Niger State. The software plays a crucial role in learning mathematics at the upper primary level, as it creates an opportunity for pupils to learn mathematics on their own. Therefore, teachers must adopt technology-enhanced teaching strategy such as GeoGebra for teaching and learning of mathematics among primary school pupils in this 21st century. Already, these pupils are digital native who needed guide and opportunity to maximise the potential of Geogebra to aid their learning of mathematics.

1. School authorities and educational bodies should encourage the adoption of online teaching tutorials like GeoGebra for teaching and learning mathematics.
2. Pupils in primary school should be provided with laptops and access to the internet, as this will help in mastering different topics on GeoGebra.
3. The school authority should provide training for the pupils to improve their proficiency in operating computers.

ACKNOWLEDGMENT

The authors wish to acknowledge the participated school, pupils and instrument validators for their contribution to this study.

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