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RESEARCH ARTICLE

Enhancing Primary School Student's Mathematical Motivation and Interest using Math-Island

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Abstract

Over the years, mathematics has assumed a vital part of the educational landscape of every society. Nevertheless, the subject has attracted considerable attention from researchers relating to the observed low performance and suitable approaches to improve outcomes. In this study, a quasi-experimental design was adopted to establish the effect of the Math-Island on primary school students' mathematical motivation and interest. A total of eighty-two students with an age range of 7 – 12 years and a mean age of ($M=9.12$), ($SD= 1.22$) participated in the study. The samples were grouped into two and were exposed to a pre-test and post-test investigation. Mean and standard deviation scores were used. The independent t-test analysis established a statistically significant difference between the groups, $MD = 11.53$, $t(80) = 6.313$, $p < 0.05$. Thus, the result supported the study's hypothesis. It was concluded that Math-Island is effective in enhancing student's mathematics motivation and interest. The study recommends adopting the system in math class and that teachers be regularly trained on using the device for teaching.

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Introduction:-

Mathematics is an essential subject in the educational system of every society that has received greater attention at any level. The subject is a crucial component of education in national development and economic sustainability (Etuk & Bello, 2016; Josiah & Olubunmi, 2014). Additionally, mathematics has been designated as a discipline indispensable to developing human capital in science, technology, engineering, and other vital parts of the economy (Musa & Dauda, 2014). It anchors as one of the implications for attaining the shared vision of the Federal Government of Nigeria (Charles-Ogan, 2015). Mathematics is of central importance to contemporary society because it provides the essential underpinning of the knowledge of socio-economic development. Hence, the subject is proved to be inevitable in the education setting.

Mathematics is categorized as a core subject globally because it is required to complete every level in education. Hence, it is designated a compulsory subject for all students in Nigeria's education (Adebule & Ayoola, 2015; Ugodulunwa & Okolo, 2015). Mathematics effectively builds mental discipline and encourages logical reasoning and cognitive rigor required for educational advancement and career development. Researchers have reflected the challenges associated with mathematics to include pedagogy and the notion that the subject is complex (Adedeji, 2018; Dele-Ajayi et al., 2019). Perhaps, this conceptualization is reflected in the growing loss of interest and poor performance associated with the subject, especially in the lower educational levels.

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The underlying essence of mathematics is based on abstraction, thus, creating phobia among many students. Indeed, the growing underperformance in mathematics among school students in Nigeria has generated considerable concern in the nation's education system. Perhaps, numerous researchers have emphasized the prospect of poor performance in the subject in the Nigerian context (Aburime, 2007; Agnes & Mathew, 2019; Dada & Akpan, 2019; Owan, 2018; Owan et al., 2020; Abdurrahman et al., 2015; Ogochukwu, 2010; Olanrewaju & Suleiman, 2019; Salami & Okeke, 2017). Researchers in recent times have tried to understand the underlying causes of mathematical challenges in the country. For example, Abdurrahman et al. (2015) contend that teaching style and curriculum factors inhibit math performance. Other variables including class size (Afolabi et al., 2020; Idowu, 2016), poor mathematics foundation and unconducive environment (Adolphus, 2011), student's handwriting (Oche, 2014), also, other characteristics of the students (Adesoji & Yara, 2008) have been identified as correlates of poor mathematics performance in Nigeria.

In addition, teaching and learning mathematics has overly depended on the traditional and theoretical approaches. The trend seems unproductive given the continued declined mathematical interest and motivation among the students. There is a growing consensus that instructional methods are the basis for enhancing mathematical interest and inspiration and improving performance. For this reason, authors have explored diverse strategies relevant to enhancing mathematical knowledge, skills, and interest in the country. In this regard, many scholars such as Fehintola (2020) explored approaches that target improving the student's self-efficacy. The idea reflects self-efficacy as a psychological construct that could influence mathematical attention and motivation. Other strategies including problem-based learning (Fatade et al., 2013), flipped classes (Makinde, 2020), multimedia presentations (Ogochukwu, 2010), peer tutoring strategy (Abdurrahman et al., 2015), improvisation (Okori & Jerry, 2017), student-problem skills (Nenty, 2001), and diagnostic and feedback assessment approach (Ofem et al., 2017) has been deployed in enhancing mathematical learning, and the outcome has always proved favorable. However, research in recent years has focused on the integration of technological innovation in mathematical classrooms.

An essential approach to learning mathematics that has attracted attention recently is gamification. The concept of gamification has motivated, engaged, and focused learners towards their learning processes (Sobihatun et al., 2018). The use of computer games in mathematics is extensive in the literature (Al Khateeb, 2019; Cunha et al., 2019; De Vecchi Galbiati et al., 2017; Holguin-Alvarez et al., 2019; Hu & Shang, 2018; Kalloo et al., 2019; Queiros Ed, 2018; Reddy et al., 2021; Ross, 2017; Watson-Huggins & Trotman, 2019). Perhaps, the trend has been found effective in the Nigerian context. Researchers have deployed various game models to improve the position of mathematics in the country. For instance, SpeedyRocket (Dele-Ajayi et al., 2019), Prodigy Math (Haruna & Umar, 2021), also (Oyesiku et al., 2018) had leveraged on the Unity game engine platform to develop math game software. Interestingly, the math game apps were confirmed effective in math classrooms. Thus, the present study examined Math-Island as a newer gamification version.

The Math-Island game is a Web application initially developed and used by (Yeh et al., 2019). The app is designed to support cross-device interactions among students, teachers, and the mathematics content structure. The pedagogical knowledge and learning materials are embedded in the module of digital learning content, organized by a mathematical knowledge map. The essence of the app is to enhance learners' mathematics interest and achievement. Also, the app is aimed to complete the mathematics curriculum of primary schools. The interface reflects the island, with a virtual city representing the knowledge map. The island includes areas, roads, and buildings that provide a series of learning tasks for learning the specific concept. The app is equipped with various learning tasks covering primary one to primary six, with more numerous questions in the functions. Yeh et al. (2019) found an increased performance, especially in the calculation and word problems following exposure to the Math-Island game. Based on this outcome, the present study is aimed to explore the role of the Math-Island in enhancing primary school mathematical motivation and interest in Kogi state Nigeria. Thus, the study hypothesized that the game would enhance student's motivation and interest in mathematics.

Method:-

The population comprises school children enrolled in the primary education system in Ankpa and Lokoja in the Kogi State of Nigeria as the research participants. Eighty-two students enrolled in the primary six classes, comprising males and females between 10 – 12 years and mean age of ($M=9.13$) and ($SD= 1.23$) were assigned to groups. The research implemented a quasi-experimental design with pre-test and post-tests and two groups (experimental and control). The student's mathematical motivation and interest were established in the pre-test study. The student in the treatment group was exposed to the Math-Island, while the control conditions were given a different mathematical task. After that, their mathematical motivation and interest were assessed.

Measure:-

Motivation and interest in mathematics were measured using a self-developed instrument adapted from relevant literature. The Linkert type scale contains parts A and B, with the first part assessing primary motivations and the second part focusing on subtle mathematics interest. The scale was scored over one hundred (100). A higher score indicates high motivation and interest. An internal consistency reliability coefficient of .79 was recorded for the instrument in the present study.

Result:-

In the pre-test study, the student's motivation and interest were determined. Table 1 below indicates a mean score of $M = 21.11$ for the experimental group in the pre-test study and $M = 21.29$ for the control group, respectively. In addition, standard deviation scores of 3.14 and 2.91 were obtained. This shows that no significant difference was recorded for both group's mean scores in the pre-test study. Thus, the student's mathematical motivation and interest level were almost equal.

Table 1:- The table shows the mean and standard deviation scores of the students' mathematics motivation and interest for both groups.

Group	N	Mean	SD
Group A	42	21.11	3.14
Group B	40	21.29	2.91

The motivation and interest of the students were measured after the post-test study. Table 2 below demonstrate that mean scores of $M = 34.71$ and $M = 23.18$ were recorded for both groups in the post-test study. The data shows a high mean score for the study condition ($M = 34.71$) compared to the control condition ($M = 23.18$). The standard deviation scores also revealed an increased $M = 9.45$ for the study condition and a lower $M = 5.39$ for the control condition. Therefore, it is assumed that the mean scores show that group A's performance was enhanced due to the exposure to metacognitive tasks.

Table 2:- Table showing the mean and standard deviation scores of the two groups in the post-test study.

Groups	N	Mean	SD
Group A	42	34.71	9.45
Group B	40	23.18	5.39

To test the study's hypothesis, which states that Math-Island would significantly enhance students' motivation and interest in mathematics. An independent-samples t-test was performed to test differences between the experimental and the control conditions on mathematical motivation and interest in the post-test study. perhaps, motivation and interest were found to increase in the experimental condition (34.71 ± 9.45) compared to the control condition (23.18 ± 5.39), a statistically significant difference of $MD = 11.53$ (95% CI, 7.91 to 15.14), $t(80) = 6.313$, $p < 0.05$.

Table 3:- Table showing t-test comparison of motivation and interest of the experimental and control conditions.

Source	N	Mean	SD	df	t	Sig
Group A	42	34.71	9.45			
Group B	40	23.18	5.39	80	6.313	000

Discussion:-

The current study examined whether Math-Island as a technological tool would enhance primary school students' mathematical motivation and interest. Conceivably the independent t-test conducted on the data following the pre-test and post-test studies proved that Math-Island increased the respondent's mathematical motivation and interest at $MD = 11.53$, $t(80) = 6.313$, $p < 0.05$. Thus, the result affirmed the assumption of the study that Math-Island will enhance the mathematical motivation and interest of primary school pupils. The study's result is in line with previous studies that had established a positive correlation between computer games and student's learning motivation (Aminifar et al., 2012; Kebritchi et al., 2010; Lister, 2015; Say & Bağ, 2017), and interest (Dohn, 2020; Wan et al., 2017). This outcome indicates that Math-Island and other gamification devices meet the deficiencies of the traditional educational landscape by promoting learning through games and creating an engaging atmosphere that seems to help students improve their motivation and interest in learning.

Moreover, their attractiveness, accessibility, flexibility, and multitasking potential provide an attractive and entertaining environment for the user (Mirani Sergzi et al., 2020). Thus, applying the Math-Island in the mathematics classroom would significantly promote students' motivation and interest in mathematics-related tasks. The study provides insight into the effectiveness of gamification in the classroom and suggests its adoption in all spheres of primary education. Related studies have found that participants in the game intervention group exhibited a higher math proficiency than their counterparts in the conventional learning group (Chang et al., 2015). Perhaps research has suggested motivating young learners with computer devices might increase basic mathematics skills (Batzogiannis et al., 2018). Thus, this result further supports that game-based learning environments can deliver robust learning gains and have a significant capacity to engage students (Buffum et al., 2016). The utilization of gamification in learning might be seamless for some students. However, most students may need help with computer navigations to arrive at a conclusive ending.

Conclusion:-

The present research aimed to investigate whether Math-Island as a gamification device would enhance students' motivation and interest in mathematics. The research established a positive difference between the two study groups on motivation and interest in the post-test study. Thus, the study concludes that Math-Island is an essential technological tool that could improve primary school students' mathematical motivation and interest. Therefore, the study contributes to the mathematical literature by supporting previous researches that promote the integration of technological devices in the classroom in Nigeria. Nevertheless, the sample size used in the study may pose a significant challenge for generalizing this result. Future researchers should include more representative samples and explore other moderating variables to broaden our knowledge of gamification and student engagement. However, the study recommends the full integration of computer games, especially Math-Island, in the math classroom and consistent training of teachers on the use of the device.

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