**Effects of Scaffolded-Microlearning Model of Instruction on Pupils’ Interest and academic Achievement in Numeracy in Central Senatorial Zone of Plateau State, Nigeria**

**ABSTRACT**

**Aims:** To examined the effects of scaffolded microlearning model of instruction on pupils’ interest and achievement in numeracy. This was guided by two research questions and hypotheses.

**Study design:** Quasi-experimental with non-equivalent pre-test and post-test control group approach was employed.

**Place and Duration of Study:** Central Senatorial Zone, Plateau State, Nigeria between 2025 and April 2025.

**Methodology:** The population comprises of 220 primary five pupils from five schools and a sample size of 65 pupils from three intact classes selected using purposive and simple random sampling. Numeracy Interest Scale (NIS) and Numeracy Achievement Test NAT) were used to collect data. The instruments were validated through face and content validity with validity index of 0.72 and 0.75 for NIS and NAT respectively. Similarly, Split-half and Cronbach alpha reliability methods were used to obtain reliability of 0.74 and 0.78 for NIS and NAT respectively. The data were analysed using mean, standard deviation, t-test and analysis of covariance (ANCOVA).

**Results:** Scaffolded microlearning model of instruction improved pupils’ interest in numeracy significantly with (t, 0.05,43, 9.662, p= 0.00 < 0.05) for experimental but not significant with (t,0.05, 19. 1.593, 0.146 > 0.05) for the control group between the pre-test and post-test interest rating. Similarly, there was a significant difference in the numeracy achievement since (F1, 0.05, 65, 7.984, p= 0.007 <0.05).

**Recommendations:** The study therefore recommended that the strategy should be adopted by the teachers in teaching and learning of numeracy and there should be provision of microlearning modules for teachers by government and educational managers.

**Key words: Numeracy, Scaffolded, Microlearning, Instruction, Interest and Achievement**

**INTRODUCTION**

The primary level of education is built to help in actualizing overall educational objectives which is, to help individuals to cultivate and grow abilities, attitudes, values and other forms of behavioural attributes that enables individuals to contribute to the well-being of his or herself and the society at large (Amadioha, & Akor, 2018). In Nigeria the primary school is denoted as the foremost stage of mandatory education, aimed at improving and promoting life-long learning skills in literacy and numeracy as stated in the philosophy of primary education in Nigeria. The system is designed to grow young minds into great minds through sufficient learning of literacy and numeracy skills to enhance their self-reliance. Aligned with this, the National Policy on Education (NPE, 2013) underscores the importance of primary education in fostering numeracy skills, critical thinking, and problem-solving abilities in children. Specifically, it emphasizes the inculcation of permanent literacy and numeracy, the development of basic scientific and reflective thinking skills, and the provision of a sound foundation for higher learning.

Numeracy skills are fundamental to everyday life, especially in an age characterized by rapid technological progress. Brady and Bowd (2021) highlight that numeracy contributes to children's development of self-confidence, self-efficacy, and resilience when faced with problem-solving tasks, thereby shaping their attitudes toward learning in general. Numeracy extends beyond basic arithmetic; it includes the capacity to analyse information, recognize patterns, estimate outcomes, and make logical decisions in a wide range of contexts. Geiger et al, (2015) describe numeracy as an essential life skill, enabling individuals to function effectively in daily life and contribute meaningfully to society. Early numeracy experiences form the bedrock for future learning, particularly in STEM fields, where mathematical reasoning and logic underpin conceptual understanding. Steen et al. (2017) argued that numeracy is as vital as literacy for navigating the complex, data-driven demands of modern life.

Numerate individuals are more likely to make informed financial, health, and civic decisions. According to Jerrim (2024), children with poor numeracy skills are more likely to struggle academically, drop out of school early, and face limited career prospects. Thus, ensuring that all learners acquire numeracy proficiency is essential for equity and inclusive education. Recognizing these broader implications, Dowker et al, (2016) emphasize the importance of early interventions and instructional innovations that support learners’ engagement and mastery of numeracy. This early intervention will enhance pupils’ interest in numeracy and improve their achievement because interest is one the factors that predict academic achievement (Schiefele et. Al., 2014)

**STATEMENT OF THE PROBLEM**

The continued reliance on traditional teaching method and teacher-centred instructional approaches have failed to stimulate pupils' curiosity and active engagement leading to widespread difficulties in understanding numeracy concepts. Many primary school pupils in Nigeria including those in Central Senatorial Zone of Plateau State have continues to struggle with numeracy as a result of teaching strategies which is affecting their interest and achievement (Dalong & Falade, 2024; Awofala, 2020). Despite the importance of numeracy skills, there seems to be unresolved sufficient learning problems in numeracy skills which has the bane of technological advancement.

Studies such as Caridah, et.al. (2024), among others have highlighted the need for innovative instructional strategies to enhance pupils' interest and achievements in numeracy. Also, since early learning of numeracy skills has a significant effect on the mathematics achievement of the pupils in primary school (Mei-Shiu, 2018). Hence, the active learning strategies embedded in scaffolded microlearning model of instruction encourages curiosity, persistence, and problem-solving skills (Awofala, 2020). It is therefore imperative to address this unresolved and long-term learning problem with an innovative strategy such as scaffolded microlearning model of instruction to enhance pupil’s numeracy interest and achievement in primary school within the Central Senatorial Zone of Plateau State, Nigeria.

**RESEARCH QUESTIONS**

1. What is the pre-test and post-test mean interest of primary school pupils taught numeracy using scaffolded microlearning model of instructions and those taught with traditional methods in Central Senatorial Zone of Plateau State?
2. What is the pre-test and post-test mean achievement of primary school pupils taught numeracy using scaffolded microlearning model of instruction and those taught with traditional methods in Central Senatorial Zone of Plateau State?

**STATEMENT OF HYPOTHESES**

* + - 1. There is no significant difference in the pre-test and post-test mean interest of primary school pupils taught numeracy using scaffolded microlearning model of instructions and those taught with traditional methods in Central Senatorial Zone of Plateau State.
      2. There is no significant in the pre-test and post-test mean achievement of primary school pupils taught numeracy using scaffolded microlearning model of instruction and those taught with traditional methods in Central Senatorial Zone of Plateau State.

**THEORETICAL FRAMEWORK**

Scaffolded model of instruction was rooted in Vygotsky’s (1978) theory of the Zone of Proximal Development (ZPD), which involve provision of structured supports to learners and gradually reducing assistance as they gain competence. Scaffolded instruction also supports differentiated instruction, which caters for diverse learning needs in classrooms with varying academic abilities by providing individualized learning pathways that allow pupils to progress at their own pace (Tomlinson, 2014). This approach has been established to enhance pupils' interest in learning while simultaneously improving their achievement. However, teacher’s subject mastery vastness and patience attribute play a critical role in facilitating learning when using scaffolded instruction by identifying pupils' specific needs and providing instructional support accordingly. Similarly, the microlearning model delivers content in small, easily digestible units, aligns with contemporary cognitive load theory and has been linked to increased interest and better academic achievement (Omodara & Amoo, 2021).

**LITERATURE REVIEW**

Scaffolding model of instruction refers to as temporary and adaptive instructional support provided by teachers to help learners perform tasks they could not accomplish independently. The supports are gradually withdrawn as learners gain mastery, promoting independence and confidence in tackling numerical tasks (Van de Pol et al, 2015). Scaffolded model of instruction significantly improves comprehension and retention of mathematical concepts and performance among primary school children (Wang, 2020).

Microlearning supports children's cognitive development by reducing cognitive overload and enabling them to concentrate on one concept at a time (Leong et al, 2020). Microlearning in numeracy involves bite-sized lessons on topics such as number recognition, basic operations, or measurement, followed by quick formative assessments and feedback. It is particularly effective for younger learners who have limited attention spans and may find traditional mathematics instruction overwhelming. It also promotes repetition and reinforcement, which are essential for building fluency in numerical operations (Zhou & Wang, 2021).

The scaffolded microlearning model of instruction is a strategy aimed at providing learners with temporary support structures that are gradually removed as competence is developed. It is designed to meet learners’ current level of understanding and guide them towards independent mastery. The strategy is found to be effective in enhancing learners’ cognitive engagement and helping them navigate complex learning tasks through chunking and modelling of learning contents (Belland et. Al, 2017). It was also observed to be useful in primary education contexts where learners are still building foundational academic skills. The strategy provides guided learning paths through small, focused lessons, ensuring both comprehension and engagement. The combination has been found to enhance performance in technology-supported learning environments by reducing cognitive overload while maintaining learning flow (De Gagne et al, 2019).

Scaffolded microlearning helps to clarify mathematical concepts by breaking down tasks into manageable components. Smit et al, (2017) highlighted its effectiveness in guiding pupils through step-by-step problem-solving and in supporting critical thinking. Through guided tasks and fading support, pupils are able to gradually take ownership of their learning and apply numeracy skills in broader contexts (Wang, 2020). Many pupils in primary schools struggle with acquiring core numeracy competencies due to challenges in instructional delivery, engagement, and retention but the active learning in scaffolded microlearning encourages curiosity, persistence and problem-solving skills (Awofala, 2020).

In the Nigerian context, particularly in Plateau State Central Senatorial Zone where numeracy outcomes remain low as a result of poor interest and teaching strategy because the traditional methods have proven ineffective (Dalong & Falade, 2024). The application of scaffolded microlearning model of instruction offers a timely and necessary innovation by leveraging on structured support and micro-units of instruction, to fosters interest, improves achievement, and enhances retention among pupils.

**METHODOLOGY**

The study employed quasi-experimental design through the use of intact class of the students to explore the effect of scaffolded micro-learning model of instruction without disrupting normal school activities and programme. The non-equivalent pre-test, post-test control group designs was adopted for the study. The pre-test was administered at the beginning of the study while the post-test was administered after the treatment which lasted for 4 weeks. The population consists of 220 primary five pupils, located in five main public primary schools within the headquarters of the five Local Government Areas in the Central Senatorial Zone of Plateau State while the sample size consists of 65 primary five pupils from three intact classes of the selected schools.

The primary schools were selected purposively due to their centrality in each LGA while the three intact classes were selected using simple random sampling technique. The instruments for data collection were ten (10) items Numeracy Interest Scale (NIS) and forty (40) items Numeracy Achievement Test (NAT). The instruments were validated using face and content validity with validity index of 0.72 and 0.75 for NIS and NAT respectively. Cronbach alpha and Split-half reliability methods were used to obtain reliability index of 0.74 and 0.78 for NIS and NAT respectively. Mean and standard deviation were used to answer the research questions while paired sample t-test and analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

**RESULTS:**

**Research question one:** What is the pre-test and post-test mean interest scores of primary school pupils taught numeracy using scaffolded microlearning model of instructions and those taught using traditional method in Central Senatorial Zone of Plateau State?

**Table 1: Mean Response of the Pre-test and Post-test Interest of Primary School Pupils**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Pre-interest Control | | Pre-interest Experimental | | Post-Interest Control | | Post-interest Experimental | |
| s/n | **Items Statement** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** |
| 1 | How interested are you in learning numeracy skills in your school | 2.20 | .696 | 2.07 | .720 | **2.05** | .759 | **3.42** | .941 |
| 2 | How interested are you in solving examples in numeracy in the classroom | 2.40 | .821 | 2.04 | .767 | **2.50** | .827 | **3.36** | 1.13 |
| 3 | How interested are you in solving numeracy examples in your home | 1.95 | .826 | 1.96 | .737 | **2.15** | .813 | **3.47** | .991 |
| 4 | How excited are you seeing your teacher teaching numeracy lesson in the classroom | 2.00 | .725 | 2.16 | .796 | **2.00** | .725 | **3.47** | .894 |
| 5 | How interested are you in participating in numeracy lesson activities | 2.20 | .696 | 2.20 | .726 | **2.35** | .813 | **3.73** | .924 |
| 6 | How excited and interest do you look forward to numeracy lesson | 1.90 | .788 | 2.16 | .673 | **2.10** | .788 | **3.89** | 1.00 |
| 7 | How interested is the numeracy skills and knowledge in your daily activities | 2.50 | .889 | 2.04 | .737 | **2.55** | .887 | **3.78** | .974 |
| 8 | How interested are you in counting and adding things to represent quantity | 1.85 | .813 | 2.51 | .843 | **1.85** | .813 | **3.47** | .919 |
| 9 | To what extent do you enjoy and interested in solving numeracy problems | 1.85 | .933 | 2.07 | .809 | **1.85** | .933 | **3.64** | 1.03 |
| 10 | How active and interested are you to learn more about numeracy skills | 2.00 | .649 | 2.11 | .935 | **2.00** | .649 | **3.44** | 1.14 |
|  | **Overall Mean** | **2.09** | **.230** | **2.13** | **.774** | **2.14** | **.249** | **3.57** | **.994** |

The table presents the pre-interest mean and post-interest mean scores in numeracy skills of primary schools’ pupils taught using scaffolded microlearning model of instructions and those taught with traditional method in Central Senatorial Zone of Plateau State. The result obtained revealed an increase in pupils’ interest in numeracy after being taught using scaffolded microlearning model of instruction. The experimental group had overall mean interest scores of 2.13 and 3.57 at pre-test interest and post-test interest while the control group had overall mean interest score of 2.09 and 2.14 at pre-test and post-test interest mean score. Generally, there was great improvement in the pupils’ interest in numeracy among the experimental group in areas such as learning numeracy skills, solving more examples within the classroom and at home and wanting to participate in numeracy activities exercise than those in the control group taught using traditional methods.

**Research question** **two:** What is the pre-test and post-test mean achievement difference of primary school pupils taught numeracy using scaffolded microlearning model of instruction in Central Senatorial Zone of Plateau State?

**Table 2: Pre-test and Post-test Mean achievement Score difference of Primary School Pupils**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Groups | N | Min | Max | Mean | Std. Dev | Mean diff |
| Pre-test control group | 20 | 3 | 16 | 8.90 | 3.626 | 5.45 |
| Post-test control group | 20 | 10 | 20 | 14.35 | 2.560 |  |
| Pre-Test Experimental group | 44 | 2 | 16 | 9.84 | 2.901 | 12.71 |
| Post-Test Experimental group | 44 | 15 | 28 | 22.55 | 2.945 |  |

The table presents the pre-test and post-test mean achievement scores of primary school pupils taught numeracy using scaffolded microlearning model of instruction and the control group taught using traditional method in Central Senatorial Zone of Plateau State. The result revealed that the pre-test and post-test mean achievement scores of the experimental was 9.84 and 22.55 with 2.901 and 2.945 standard deviation respectively, while the pre-test and post-test mean achievement score of the control group was 8.90 and 14.35 with 3.626 and 2.560 standard deviation respectively. The result indicates a high achievement difference in favour of the experimental group than the control group in the study establishing the positive effect of scaffolded microlearning model of instruction in enhancing numeracy skill achievement among primary school pupils in the Central Senatorial Zone of Plateau State.

**TESTING OF HYPOTHESES**

**Hypothesis one:** There is no significant difference between the pre-test and post-test mean interest scores of primary school pupils taught numeracy using scaffolded microlearning model of instructions and those taught with traditional method in Central Senatorial Zone of Plateau State.

**Table 3: Paired Sample t-test Result significant difference between the pre-test and post-test mean interest scores**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Mean | Std. Dev | t | Df | Sig (p-value | Decision |
| Pre-test Experimental group | 2.13 | .253 |  |  |  |  |
| Post-test Experimental group | 3.57 | .457 | **9.662** | **43** | **.000** | **Significant** |
| Pre-test Control group | 2.09 | .210 |  |  |  |  |
| Post-test Control group | 2.14 | .249 | **1.593** | **19** | **.146** | **Not significant** |

The presents the test result on the significant difference between the pre-test and post-test mean interest of primary school pupils taught numeracy using scaffolded microlearning model of instructions in Central Senatorial Zone of Plateau State. The hypothesis was rejected since the p-value of 0.000 was less than the 0.05 significant level. Therefore, it was concluded that there is a significant difference between the pre-test and post-test interest of primary school pupils when taught numeracy with scaffolded microlearning model of instruction.

**Hypothesis two:** There is no significant difference between the pre-test and post-test mean achievement of primary school pupils taught numeracy using scaffolded microlearning model of instruction and those in the control group in Central Senatorial Zone of Plateau State.

**Table 4: ANCOVA Test Result on the Significant Difference between the Pre-test and Post-Test Mean Achievement Scores of Primary School Pupils**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
| Corrected Model | 59.564a | 1 | 59.564 | 7.984 | .007 |
| Intercept | 1185.572 | 1 | 1185.572 | 158.911 | .000 |
| PREEXPT | 59.564 | 1 | 59.564 | 7.984 | .007 |
| Error | 313.345 | 63 | 7.461 |  |  |
| Total | 22738.000 | 65 |  |  |  |
| Corrected Total | 372.909 | 64 |  |  |  |

The table presents the test result on the significant difference between the pre-test and post-test mean achievement of primary school pupils taught numeracy using scaffolded microlearning model of instruction in Central Senatorial Zone of Plateau State. The hypothesis was rejected since the p-value of 0.007 was less than the 0.05 significance level. Therefore, it was concluded that there is a significant difference in the mean achievement score of primary school pupils obtained at pre-test and post-test achievement.

**DISCUSSION OF FINDINGS**

The research question one and hypothesis one revealed a great improvement in the pupils’ interest in numeracy among the experimental group more that the control group. Also, the hypothesis established a significant difference in the interest rate within experimental group signifies that scaffolded microlearning model of instruction improve learner interest in numeracy. Areas such as desiring to learning numeracy skills, solving more examples within the classroom and at home and wanting to participate in numeracy activities exercise among others increased when the pupils were exposed to scaffolded microlearning model of instructions. The finding agreed with Wang (2020) and Awofala (2020).

The research question two and hypothesis two also revealed high positive difference between the experimental and control numeracy achievement in the study. The findings revealed that innovative strategies of scaffolded microlearning model of instruction enhanced pupils’ achievement in numeracy with a significant difference. The finding agreed with Smits et al, (2017), Ahmad et al. (2018) who established that scaffolded model of instruction enhanced pupils’ achievement. However, the finding was contrary to Barzilai and Blau (2014) and Li et al, (2023) who reported that conceptual scaffolding had little or no significant effect on learning.

**CONCLUSION**

In conclusion, scaffolded microlearning model of instruction has proved to be effective in enhancing pupils’ interest and achievement in numeracy among primary schools’ pupils in Central Senatorial Zone of Plateau State. The strategy in its entirety has maintain significant difference both in numeracy interest and achievement with an improvement in pupil’s engagement in learning numeracy skills and active participation in numeracy activities.

**RECOMMENDATIONS**

The study therefore recommended that, teachers should adopt the scaffolded microlearning model of instruction in the teaching and learning of numeracy as it enhances pupils’ interest. Government or educational managers should provide enabling environment for effective use of scaffolded microlearning model of instruction by providing the necessary material needed such as time for pupils’ engagement and microlearning modules for instruction.

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**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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