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Examining the Effectiveness of Using Rhymes on Improving the Learning of Multiplication Times Tables in Year 3 Students in Dubai

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ABSTRACT

This study investigates the effectiveness of using rhymes to enhance the learning of multiplication timetables among Year 3 students at The Westminster School in Dubai. A total of 66 students were selected and divided into two groups: an experimental group and a control group, each comprising 33 students. Over three weeks, the experimental group learnt the 3, 4, and 8 times tables through specific rhymes—"Row Row Row Your Boat" for the 3 times table, "Twinkle Twinkle Little Star" for the 4 times table, and "This Old Man" for the 8 times table. The control group received traditional instruction without rhymes. The study utilised a pre-test and post-test design to measure the student's ability to recall multiplication facts before and after the intervention. The outcomes were quantitatively analysed through an independent two-sample T-test and assessed the mean differences in learning outcomes between the control and experimental groups. The results indicated that using rhymes significantly improved the student's understanding and retention of multiplication facts. Students in the experimental group exhibited higher levels of engagement, enthusiasm, and motivation compared to the control group. This increased engagement was reflected in their improved performance on multiplication tests. The findings suggest that incorporating rhymes into mathematics instruction can be a highly effective strategy for teaching multiplication tables, fostering both cognitive and affective gains in students.

Keywords: Mnemonic Devices; Multiplication Tables; Rhymes

Background

The National Agenda of the UAE aligns with Vision 2021 and focuses on improving education, particularly primary education in Dubai, to ensure students gain essential skills and knowledge for future success. Key targets include achieving top rankings in international assessments like PISA and TIMSS, which evaluate student abilities in reading, mathematics, and science. While PISA measures outcomes for 15-year-olds, foundational skills from primary education are crucial. Similarly, TIMSS assesses mathematics and science achievements for fourth and eighth graders, highlighting the importance of primary education improvements (Orr & Pearce, 2020).

Additional priorities include national reading initiatives, teacher quality and professional development, early childhood education, inclusive education, technological integration, curriculum standards, school leadership, and community engagement. Despite facing challenges such as low student engagement in mathematics, Dubai has implemented strategies to enhance learning. These include integrating dynamic teaching methods, such as games and real-world problem-solving, and providing continuous professional development for teachers to strengthen subject mastery and instructional practices (Miller *et al*., 2011). Programs like "Teach for UAE" aim to attract skilled educators. Dubai's reforms focus on curriculum enhancement, technology integration, and parental involvement to build a strong foundation in mathematics, ultimately supporting the UAE's Vision 2021 educational goals and improving learning outcomes (Boaler, Williams, & Confer, 2015).

Literature Review

Research strongly supports the use of music and rhymes as effective tools in the learning process, particularly for mastering multiplication tables (Kling & Bay-Williams, 2015). The National Association for Music Education (2014) highlights that music and rhymes enhance memory and learning in young children, offering similar benefits for multiplication mastery (Hetland, 2000). Susan Hallam’s study (2010) underscores the cognitive benefits of music, such as improved memory retention and intellectual development, which can be applied to mathematical learning (Chen & Siegler, 2000).

Mnemonics, including rhymes, are also effective aids in mathematics instruction, as reviewed by Knott & Thaut (2018). S. Bellezza's work (1981) further supports the use of rhymes as mnemonic devices to boost memory and learning. Damashek, & Chaffin (2012) provides evidence of significant improvements in elementary students’ multiplication performance when musical mnemonics are employed (Knott & Thaut, 2018). Similarly, Amy M. Wiggins (2007) demonstrates the broader effectiveness of integrating music into kindergarten math curriculums, enhancing both engagement and learning outcomes. Additionally, Coble *et al.* emphasize the positive influence of rhythmic patterns and music on students’ mathematical motivation and understanding (Vaughn, 2000). Their findings illustrate how rhythm and music foster a more interactive and effective learning environment (Hetland, 2000).

Collectively, these studies affirm that incorporating rhymes and music into math education enhances understanding, retention, and enthusiasm (Boaler, Williams, & Confer, 2015). By leveraging these cognitive benefits, educators can create an engaging and impactful learning experience for students of various ages (Owens & Sweller, 2008). Rhymes play a vital role in enhancing learning and memory retention, particularly in teaching multiplication times tables (Miller *et al*., 2011). Cunningham & Stanovich (1997) demonstrated that rhymes provide a structured and memorable framework, aiding recall. Similarly, Bower *et al*., (2021) highlighted that rhymes activate verbal and auditory memory, supporting

the encoding and retrieval of multiplication facts. These rhythmic patterns organize information effectively, making it easier for students to recall facts.

Using rhymes in instruction boosts student motivation and engagement. Nurhudayah (2018) found that the melodic nature of rhymes fosters a positive learning environment, promoting active participation while reducing anxiety about memorization. Research by Montag, Jones, & Smith (2015) revealed that students taught multiplication through rhymes retained the information longer than those using traditional methods. The rhythmic patterns facilitated memory retrieval, enabling better recall over time. However, individual differences must be considered, as Chen, Siegler, & Daehler (2000) noted that some students might benefit more from alternative strategies. Hernandez-Ruiz (2023) explored the role of musical mnemonics in mathematics education, emphasizing the cognitive benefits of rhythm and melody for encoding and recalling mathematical concepts (Knott & Thaut, 2018). His findings affirmed that integrating rhymes enhances memory retention and student engagement, offering valuable insights for improving mathematics instruction (Macmillan, 2002).

Methods

A quasi-experimental study was conducted using a convenient sampling method involving 66 Year 3 students from two classes in a Dubai school. The researcher, a Year 3 form tutor, leveraged their role to access and coordinate with students and staff effectively. The study aimed to assess whether rhymes improved multiplication table learning. Students were divided into an experimental group (33 students from Class 3A), taught using rhymes, and a control group (33 students from Class 3B), taught using traditional methods. A non-equivalent group design with pre-tests and post-tests was employed to measure knowledge improvement. Surveys and observations were used to evaluate student engagement and interest. This controlled setup ensured consistent teaching conditions, facilitating accurate data collection and comparison of learning outcomes. Results were analyzed to determine the effectiveness of rhymes in enhancing and sustaining multiplication table learning.

A quasi-experimental design with pre-tests and post-tests was utilized to assess the effectiveness of rhymes in teaching multiplication tables. The study involved two groups: the experimental group, which learned the 3-, 4-, and 8-times tables using rhymes and skip counting synchronized with the rhyme's melody, and the control group, which relied on traditional memorization methods.

Modified, curriculum-aligned tests with multiple-choice, true/false, and open-ended questions were made using Quizizz. It also provided thorough performance insights and made it possible to follow students' growth. In order to measure the learning consequences for both groups, oral evaluations were also performed.

Results & Discussion

Theoretical Framework

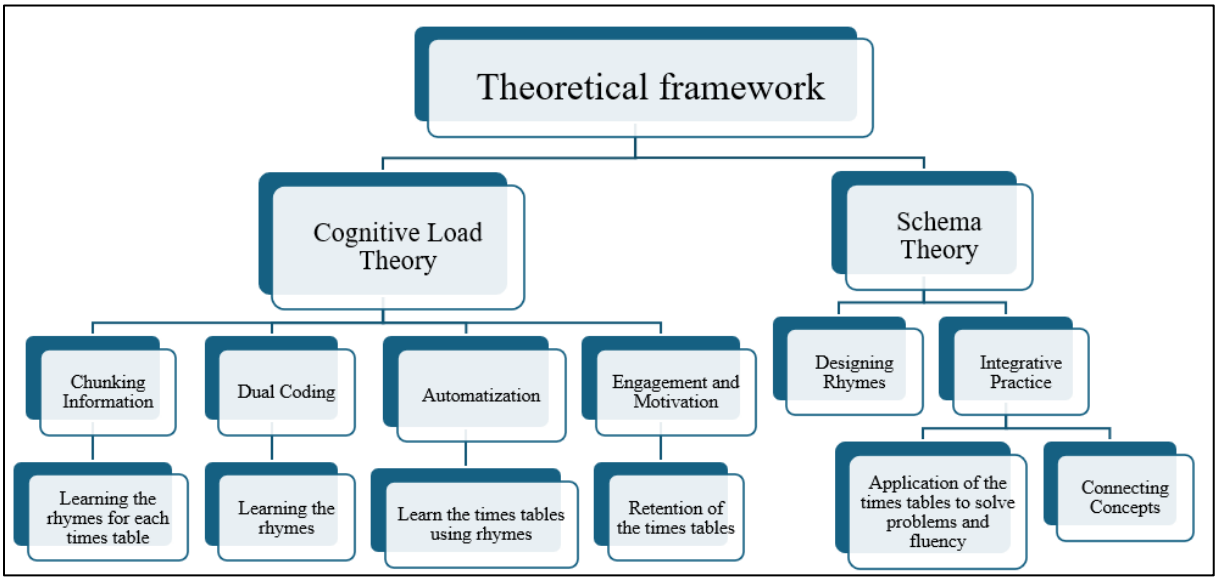


Figure 1: Theoretical Framework

Cognitive Load Theory (CLT):

- Proposed by Sweller (1988), CLT explains that learning becomes difficult when cognitive demands exceed mental capacity.
- Rhymes organize information into smaller, memorable chunks, reducing cognitive load (Owens & Sweller, 2008).
- Structured rhythmic patterns in rhymes allow easier organization and recall of multiplication facts, freeing cognitive resources for other tasks (Macmillan, 2002).

Schema Theory:

- Originating from Jean Piaget, this theory suggests learning improves when new information connects with pre-existing knowledge structures (schemas).
- Rhymes act as mnemonic devices, leveraging music and nursery rhymes to enhance encoding and retrieval of multiplication facts (Nurhudayah, 2018).
- Integrating rhymes fosters motivation, engagement, and memory retention, aligning with both theories' cognitive and motivational benefits.

The purpose of this study was to determine the impact of using rhymes in teaching and learning multiplication facts on learners' deep understanding and long-term retention. The objective of this paper was to use these rhymes to make learning more interesting resulting in lasting memory for students. These mnemonics were intended to familiarize learners with some multiplication facts by means of catchy rhythmic phrases. (Figure 1)

Conceptual Framework

- Provides a holistic view of integrating rhymes into teaching multiplication tables.
- Highlights connections between key elements: input, integration strategies, learning process, outcomes, feedback, and contextual factors.

Framework Elements: (Figure 2)

Independent Variable (Input): Strategy of using rhymes in multiplication instruction.

- Focus on three times tables: 3, 4, and 8.

Dependent Variable (Outcome): Students' retention of multiplication tables and learning results.

Process:

- Design instructional strategies to enhance participation, interest, and long-term retention.
- Implement reflective and contextual preparation for teaching and evaluation.

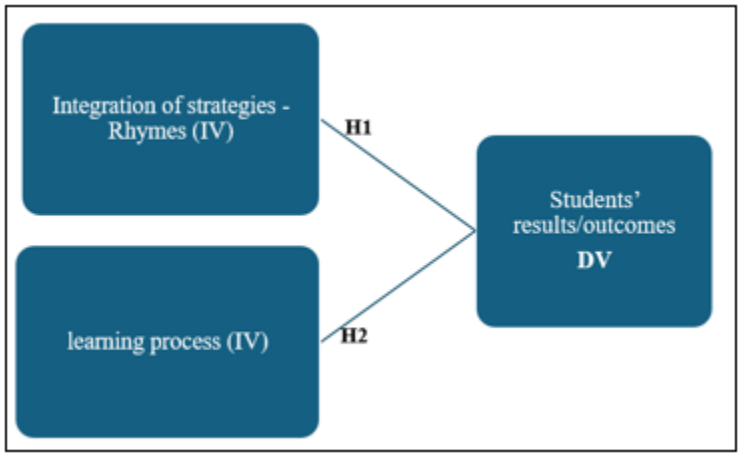


Figure 2: Conceptual Framework

Hypotheses: Implementing rhymes to teach multiplication time tables will improve Year 3 students' memorisation and retention of the tables. The use of rhymes will help sustain students' interest and engagement in learning multiplication.

H1: Students using rhymes will demonstrate better recall and understanding of multiplication times tables compared to those using traditional memorization techniques.

H2: The use of rhymes will increase student engagement and motivation in learning multiplication time tables.

Implementation of Rhymes:

The rhymes were introduced on the 5th of January 2024 for the experimental group and incorporated into the multiplication lessons as a teaching strategy for over 3 weeks. The rhymes were designed to help students remember and recall multiplication facts more easily by associating them with catchy and rhythmic phrases. Rhymes were recited daily during the stater activity during the lesson. Below are times tables that are associated with the rhyme.

3 Times Table: Row Row Row Your Boat
4 Times Table: Twinkle Twinkle Little Star
8 Times Table: This Old Man

Figure 3: 3 Times Table

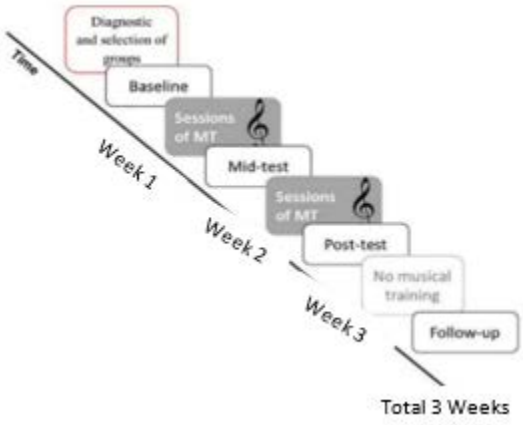


Figure 4: 1 Schematic Illustration of the Experimental Paradigm. MT, Musical Training

Pre and Post-Assessments:
The students' multiplication skills were assessed before and after the implementation of the rhymes. A pre-assessment was conducted for both groups on the 3rd of January. This helped to measure their initial level of understanding and track their progress over time. Tools used for assessment were Quizzez.com and teacher-led questions.

Control Group:
A control group was established to compare the impact of using rhymes with a group that did not use rhymes (Macmillan, 2002). The students learnt multiplication tables through standard teaching methods (e.g., repetition, drills) for over three weeks. This allowed for a comparison of the effectiveness of the rhymes in improving multiplication skills.

- **Data Analysis**:
  - Progress monitoring assessments were conducted during the intervention.
  - Baseline (pre-test) scores were compared with post-test and reinforcement test results.
  - Improvements were analysed to determine the effectiveness of using rhymes versus traditional methods in enhancing understanding and retention of multiplication tables.

Rhymes were carefully selected with catchy tunes and created original lyrics that incorporated the multiplication facts. Introduction of the songs done during the math class. Over the course of several weeks, students' progress was tracked. Pre-tests were administered to gauge the students' existing knowledge of the times tables and then provided regular practice sessions using the songs. The students embraced music as a fun and interactive way to learn, eagerly participating in class activities and singing the songs even outside of school hours. This systematic approach ensured comprehensive evaluation of rhymes as a learning tool for multiplication tables.

The results were analysed using T-Test. The following table shows each student's scores in pre, post and delayed tests (Table 1). Comparison of control group (tradition method) with the experimental group (tables using rhymes) using t-test (Table 5).

Table 1: Experimental Group Pre, Post and Delayed Test Data

Name of the Student	Pre test	Post test	Delayed post - test	Name of the Student	Pre test	Post test	Delayed post - test
E1	15	12	13	E17	3	14	15
E2	7	10	15	E18	7	10	15
E3	4	11	14	E19	10	9	14
E4	4	10	15	E20	12	14	15
E5	1	10	14	E21	6	10	15
E6	3	12	8	E22	4	14	13
E7	2	11	15	E23	1	12	15
E8	1	12	10	E24	2	14	15
E9	6	14	14	E25	9	14	15
E10	1	12	14	E26	2	13	15
E11	5	13	20	E27	1	11	15
E12	8	14	14	E28	8	12	14
E13	6	15	15	E29	5	11	14
E14	1	4	13	E30	5	14	15
E15	3	9	13	E31	4	14	15
E16	9	14	14	E32	14	13	15
				E33	4	10	15

**E - Experimental*

Table 2: Experimental Group Pre, Post and Delayed Test Data

Group	Test	Mean	SD	N
Experimental group	Pre-test	5.2	3.76	33
Experimental group	Post-test	11.9	3.87	33

Breakdown of how the grading for "above expected", "expected", and "below expected" calculated out of 15 marks using the rubric:
Above Expected: 11-15 marks, Expected: 6-10 marks, Below Expected: 0-5 marks

Pie Chart and Bar graph representations below illustrates the learning output of the students of experimental group. 3 metrics were incorporated during the quantitative assessment and are used for comparing, and personalised performance.

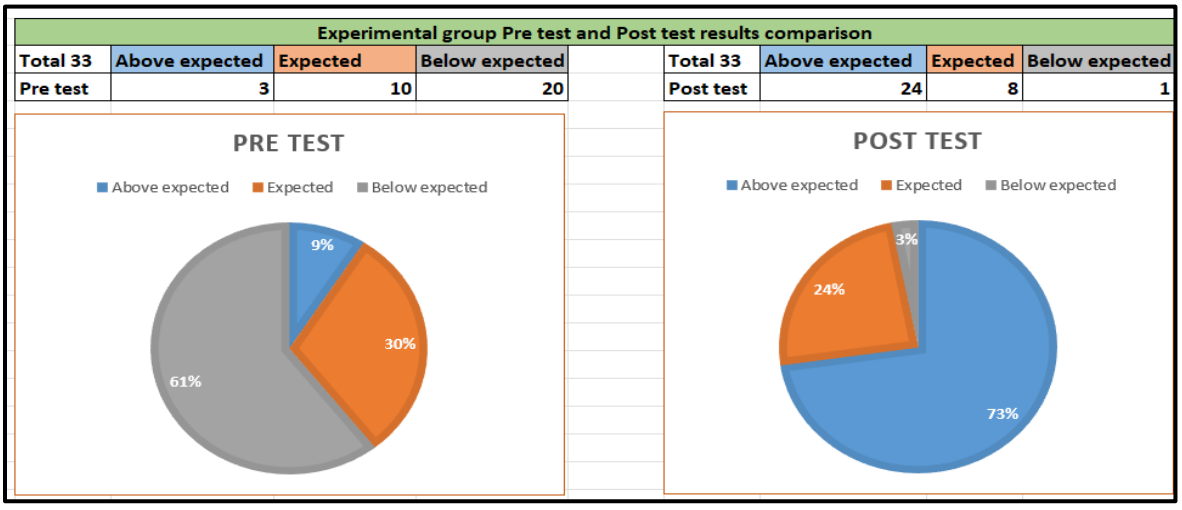


Figure 5: Pre and Post Test Results -Experimental Group

The data in Figure 5 shows that Above Expected: There has been a significant increase from 3 to 24 students in this category, indicating substantial improvement. Expected: The number of students in this category decreased from 10 to 8. While there's a slight decrease, it's not as drastic as the increase in the "above expected" category. Below Expected: The number of students in this category decreased notably from 20 to 1. This shows significant improvement, with most students moving up to higher categories. Pie Chart and Bar graph representations below illustrates the learning output of the students of controlled group.

Table 3: Control Group Pre and Post Test Data

Student	Pre test	Post test	Student	Pre test	Post test
C1	6	2	C18	2	4
C2	9	1	C19	3	1
C3	1	6	C20	0	5
C4	7	7	C21	6	6
C5	2	5	C22	4	8
C6	2	5	C23	2	3
C7	1	5	C24	7	2
C8	6	1	C25	3	3
C9	9	9	C26	6	11
C10	0	3	C27	1	5
C11	6	15	C28	8	11
C12	3	10	C29	3	5
C13	1	4	C30	5	3
C14	1	6	C31	13	9
C15	4	7	C32	7	14
C16	5	9	C33	5	6
C17	7	11			

C - Control group*

Table 4: Control Group Pre and Post Data

Group	Test	Mean	SD	N
Control Group	Pre-test	4.4	3.1	33
Control Group	Post-test	6.1	3.7	33

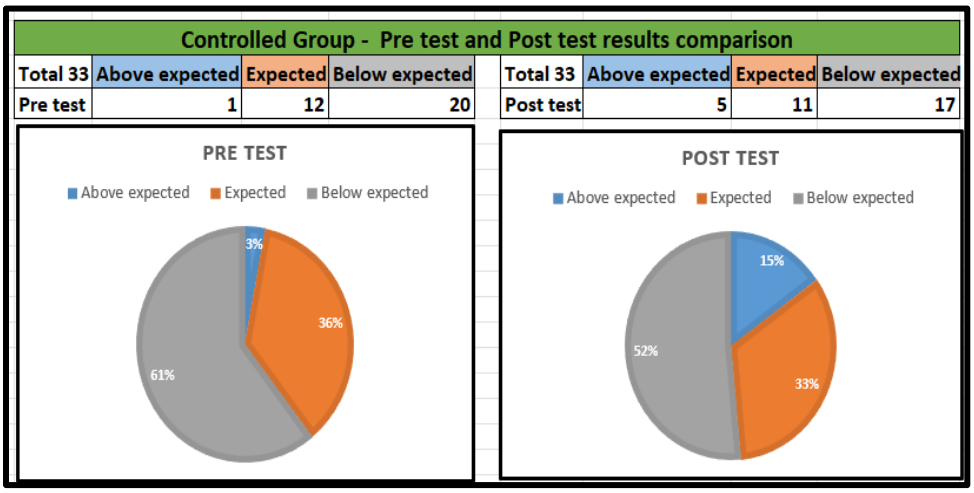
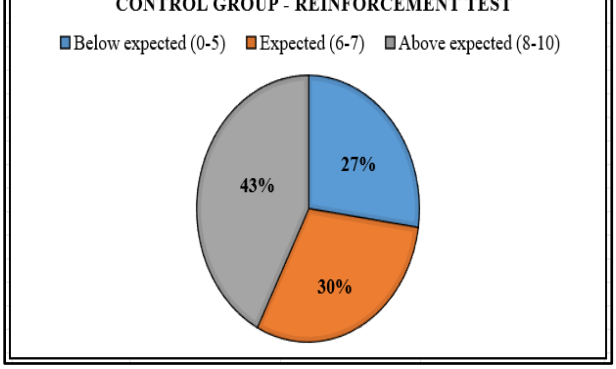


Figure 6: Comparison of Control Group Pre and Post Test

Total 33	Below expected (0-5)	Expected (6-7)	Above expected (8-10)
3H Reinforcement Test	9	10	14



Total 33	Below expected (0-5)	Expected (6-7)	Above expected (8-10)
3M Reinforcement Test	4	5	24

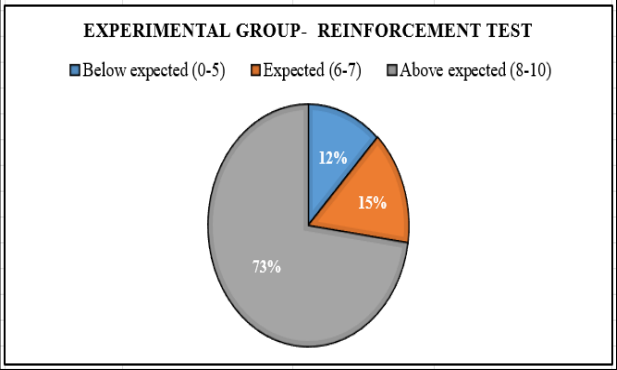


Figure 7: Reinforcement Test Results of Control and Experimental Group

The data on figures 6 and 7 shows that improvement in control group students performing above expected levels increased from 1 in the pre-test to 5 in the post-test, showing improvement. The number of students performing at the expected level remained the same at 12 students in both the pre-test and post-test and the number of students performing below expected levels decreased from 20 in the pre-test to 17 in the post-test. The Improvement in the experimental group, the number of students performing above expected levels increased significantly from 3 in the pre-test to 24 in the post-test, indicating a substantial improvement. A decline in the number of students performing at the expected level decreased from 10 in the pre-test to 8 in the post-test is noticed. The number of students performing below expected levels decreased significantly from 20 in the pre-test to 1 in the post-test, showing a significant improvement.

Table 5: Comparison of Control Group with Experimental Group

Group	Number of Students	Pre-test Mean Score	Post-test Mean Score	Standard Deviation
Control (Traditional)	33	4.4	6.1	3.9
Experimental (Rhymes)	33	5.2	11.9	3.9

Based on the data from table 7, the experimental group, which received the rhyme-based strategy, had a higher proportion of students performing above expected levels (24 out of 33) compared to the control group (14 out of 33). The control group had a higher number of students performing below expected levels (9 students) compared to the experimental group (4 students) that received the rhyme-based strategy. The performance of students at the expected level was similar in both groups (5 students in the experimental group and 10 students in the control group). The experimental group that received the rhyme-based strategy showed a stronger performance in the reinforcement test, with a higher number of students achieving above expected levels. The control group that received the traditional method had a higher number of students performing below expected levels, indicating a potential benefit of implementing alternative teaching strategies such as the rhyme-based approach.

Conclusion

Based on the research results using rhymes to improve and sustain the learning of multiplication times tables in Year 3 students has yielded successful results. The findings of this study indicate that incorporating rhymes into the teaching and learning process can greatly enhance students' understanding and retention of multiplication facts. Throughout the research process, it was observed that students actively engaged with the rhymes and demonstrated a higher level of enthusiasm and motivation towards learning their times tables. The use of rhymes provided a fun and interactive approach, making the learning experience enjoyable for the students. Additionally, the rhymes served as effective mnemonic devices, enabling students to easily recall and apply the multiplication facts in various contexts. Notably, the sustained improvement in students' multiplication skills was evident through regular assessments and classroom observations. Students consistently demonstrated a higher level of accuracy and fluency in solving multiplication problems. Moreover, the positive impact of the rhymes was reflected in students' increased confidence and willingness to actively participate in multiplication-related activities. Overall, incorporating rhymes into the teaching of multiplication timetables in Year 3 can be a creative and effective method to improve student engagement, retention, and understanding of mathematical concepts. By making learning fun and interactive, educators can help students develop a strong foundation in multiplication that will benefit them throughout their academic journey.

Declarations

Ethics Approval and Consent to Participate: Ethical approval was obtained from the Westminster School in Dubai before the study started.

Conflicts of Interest: Not applicable.

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