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Treating Slow Learners in Learning Repeated Addition using Realistic Mathematics Education Approach

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Abstract. Mathematics is the queen of science, but many students struggle with this subject as slow learners. Slow learners can accomplish their full potentials with an appropriate learning approach. In this study, these slow learners were examined using Realistic Mathematics Education approach. Single subject research was employed in this study, with multiple baseline cross-conditional designs at home and in the classroom. For data analysis, an internal analysis approach and an analysis between curves of both conditions were conducted. The results revealed that slow learners had a higher tendency to perform better when studying at home compared to in class. In addition, after receiving, slow learners' score improved, but when being situated in another condition, the increase in score slowed or stagnated. The implication is that in order to optimize slow learners' learning potentials, teachers instruct them using the MRE approach at school based on home settings.

Keywords: slow learner, repeated addition, single-subject research, realistic mathematics education

1. Introduction

Cinekko Inpres Elementary School, Tanete Riaja Subdistrict, Barru Regency, South Sulawesi Province, Indonesia, showed that many of their students struggled with arithmetic, particularly in addition and subtraction. Despite having received repeated instructions, some students still had trouble understanding repeated counting. They seemed confused with the process of calculation as they struggle to solve whole number arithmetic operations, scoring an average of 6.1 out of 10. Among these students, one struggled with learning retention or was a slow learner. This subject had an average score of 2.

This particular subject required special treatment. To implement engaging learning in lower-grade classes, teachers must be creative and innovative. They are required to deliver mathematical material that is interesting, fun, and relates to contextual problems according to the slow learner ecosystem. The learning process will occur if the knowledge learned is attractive to students (Asari et al., 2021, Mirawati et al., 2018, Ministry of Education and Culture, 2020). Students learn meaning significantly when they engage in realistic problems (Primasari et al., 2021, Alim et al., 2021, Sari et al., 2021)

Realistic Mathematics Education (RME) Approach is a learning approach that begins with a real problem to direct students to understand a mathematical concept (Simamora, 2020, Fredriksen, 2021, Yilmaz, 2020). This approach makes use of reality and the environment that students are familiar with to facilitate the learning process in order to achieve the mathematics learning objective, namely improvement. Therefore, the RME approach to teach slow learners on repeated addition, specifically through Single Subject Research (SSR) can provide more opportunities for slow learners to learn optimally at school.

1.1. Problem Statement

Educators are concerned about the issue of slow learners due to the burden of the school system and the students' social and academic development. According to the initial assessment in the class, some students had difficulties with repeated addition. In comparison with other students, slow learner of the subject had an extreme disorder and was slow to respond when being asked in class. The subject was called three or more times called, responded, yet continued to inquire the teacher about the question being asked. According to the SSR study, the subject required a specific investigation in the form of treatment using the RME approach. How to improve the slow learner's ability during baseline and treatment using the RME approach under different conditions? How to improve the subject's ability during baseline and treatment using the RME model on slow learners between conditions?

1.2. Related Research

A study in elementary schools in Vietnam on mathematics subjects indicated both home- and school-based barriers to the academic success of slow-learning students, highlighting the need for individualized support and tailored teaching (Tran et al., 2020). The study employed the SSR approach by combining regular teachers and special teachers. It revealed that slow learners could be taught challenging subjects that required cognitive understanding. The success of this achievement cannot be separated from the collaboration between regular and special teachers. Special teachers play the role of delivering simple and concrete instructions. A calm learning atmosphere without audio-visual stimulation other than experimental media can make slow learner students more focused. The repetition of subject matter by special teachers during learning activities is very helpful because slow learners are more prone to have short-term memory (Widodo et al., 2020).

Studies using the Gamification application on slow learner students who lack motivation and interest in literacy and numeracy show that the application can help motivate learning and promote understanding of numeracy for slow learners. This approach may help students with special needs, and it may also reduce the number of students in remedial classes (Zulkifli et al., 2019). A qualitative study examines classroom teachers' self-efficacy in guiding slow learner students. Due to enactive mastery experience factors, vicarious experiences, verbal persuasion and physiological and affective states, and environmental settings, there are disparities in teacher efficacy in guiding slow learner students (Putri & Fakhruddiana, 2019).

1.3. Study Objectives

This study focuses on examining the cognitive abilities of slow learner students with the RME approach by paying attention to two settings. It aims at determining which learning environment can optimally improve the cognitive abilities of slow learner students, at school while studying with classmates or at home with parents. Expected outcomes include slow learner students who, despite attending school, can learn optimally with the RME approach given their circumstances.

2. Theoretical Framework

2.1. Realistic Mathematics Education Approach

Realistic Mathematics Education (RME) is an effort to help students develop their full potential through interaction with an environment that is deliberately created conducive to the learning ecosystem (Heuvel-Panhuizen, 1996; Streefland, 1991; Palinussa et al., 2021). RME stages are as follows: in preparation, the teacher prepares a real problem. The teacher must understand the problem and have a variety of strategies that students might take to solve it. In the opening, students are introduced to the learning strategies used and presented with real-world problems.

Subsequently, students are asked to solve the problem in their way. In the learning process, students try various strategies to solve problems according to their experiences, which can be

done individually or in groups. Then, each student or group presents their work in front of the class, and other students or groups give their responses. The teacher observes the course of the class discussion and provides feedback while directing students to find the best strategy and rules or principles that are more general. In closing, students are invited to conclude the lesson after reaching an agreement on the best strategy. At the end of the lesson, students must work on evaluation questions in the form of formal mathematics (Wubbels et al., 1997, M. Van den Heuvel-Panhuizen & Drijvers, 2014; Revina & Leung, 2021).

2.2. Slow learners

Theories on slow learners below include 1) definitions of slow learners, 2) characteristics of slow learners, 3) causes of slow learners, 4) Intelligence Quotient (IQ) for slow learners, and 5) cognitive development in slow learners, 6) education services for slow learners (Khaira & Herman, 2020; Setyawan et al., 2021).

The characteristics of slow learners are grouped into several categories: cognitive, language, auditory-perceptual, visual-motor and social-emotional. First, the characteristics of cognitive learning difficulties include, 1) slow learners need a long time to study and often do not understand what they have learned; 2) slow learners prefer to learn abstract knowledge rather than concrete; 3) they always want to learn what the teacher directly teaches them because it doesn't require a lot of skills and 4) typically perform poorly academically. Second, the characteristics of slow learner problems related to language include 1) having problems with verbal expressions; 2) struggling with reading aloud than reading silently; 3) having articulation problems. Third, characteristics of slow learner's auditory-perceptual problems include 1) difficulty during dictation, resulting in incomplete words; 2) failure to understand verbal commands, failure to give an immediate answer to a question; 3) preference for visual material over oral presentation; 4) when asked a verbal question, frequent failure to give a relevant response. Fourth, the characteristics of slow learner's visual-motor problems include, 1) slow learners prefer a visual stimulus; 2) they find it difficult to determine color, size and shape, and have difficulty recalling an object they have seen; 3) slow learners generally have poor handwriting, struggle with motor activities and often complain of pain. Fifth, the characteristics of slow learner's social and emotional problems 1) pinching or doing certain things to themselves. Sometimes, they also withdraw from social activities (antisocial); 2) having mood swings (moody), and their social-emotional level is still below par (Setyawan et al., 2021; Lerch & Kelly, 2020; Majid et al., 2017).

The distinguishing factor of slow learning students is actually in terms of learning, including 1) lack of sensitivity to the environment; 2) lack of enthusiasm in the learning process; 3) lack of focus in doing tasks; 4) lack of cognitive process; 5) lack of language fluency. In terms of factors causing slow learning barriers for students in the learning process at school, psychological factors play a significant role as they can cause school, health, and family problems (Majid et al., 2017; Lisa & Garcia, 2009). From a psychological perspective, students' slow learning problems can be caused by different cultures and students' emotional development. Difficulties at school, including unclear instructions, unqualified teaching staff, and school violence, contribute to the cause of students to learn slowly.

3. Method

3.1. Research Design

This study is experimental in nature with the RME approach while employing a Single Subject Research (SSR) to reveal the behavior of slow learner students in learning the whole number addition. The SSR design used is *Multiple Baseline Cross Condition* (MBC2) (Craig, 1980; Lahey, 1980; Cakiroglu, 2012; Zuidersma et al., 2020), in which the subject was an individual with one target behavior, namely a slow learner, treated using RME approach under two settings: when in class with peers and when at home with parents.

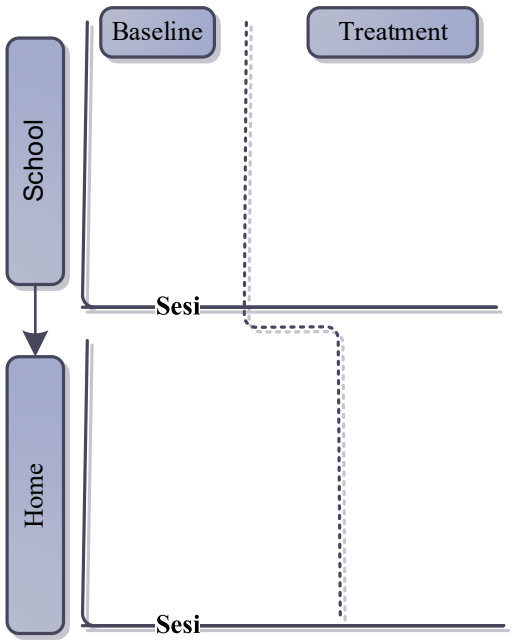

Figure 1. MBC2 Design

Figure 1 shows two stages, namely baseline and treatment. The baseline stage did not involve any treatments but it involved several tests. If the trend pattern is formed by paying attention to the test results, it can move to the treatment stage. The treatment stage consisted of two settings: the subject in class with peers and at home with parents. Each setting involved a session, and each stage and session was tested several times until a trend pattern was formed.

Trend pattern between tests in both the baseline and the treatment was examined. Whether the first treatment was carried out at school or at home depended on the pattern of test results for the two conditions at the baseline stage of the test. The teacher intervened with the RME approach and then conducted a test, while in other conditions, the teacher did a test without treatment. This was done repeatedly until the test results were stable, followed by the next condition using similar treatment. The treatment and test flow chart are depicted in Figure 2.

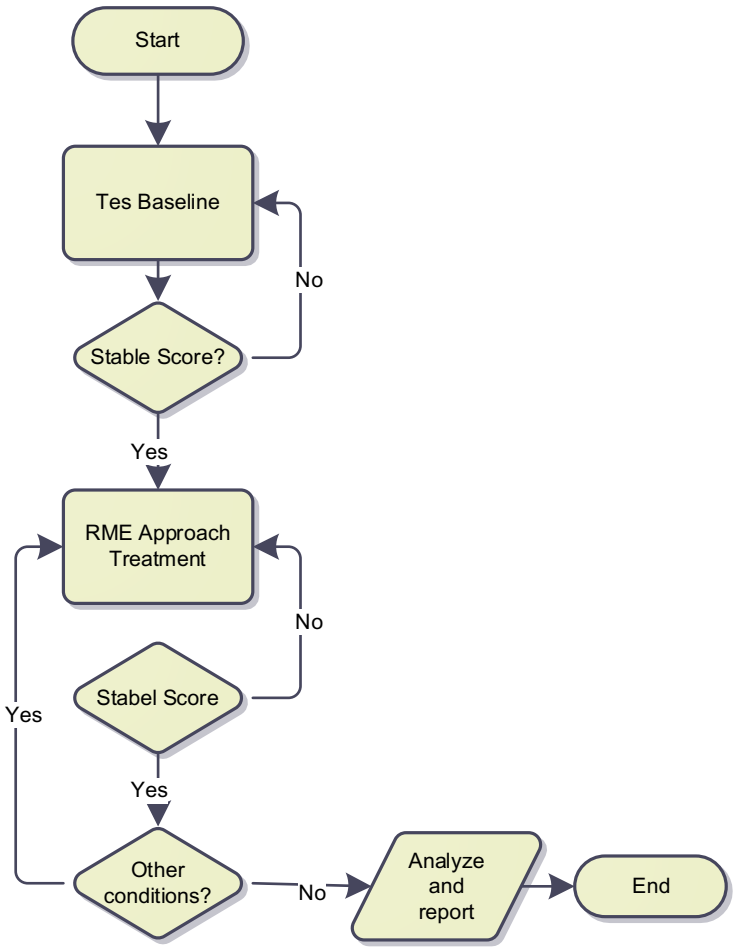

Figure 2. Treatments and Tests

The RME approach includes several stages. First, the teacher presents a stimulus related to repeated addition according to the student's environment. Second, the teacher then explain how the stimulus' might be understood according to the student's experience. Third, students solve contextual problems according to their experience. Fourth, based on their respective experiences, students discuss about how to solve contextual problems. Fifth, they negotiate to conclude contextual solutions. These activities take 30 minutes.

3.2. Participants/Respondents

The subject of this study was a nine-year-old female student from Tanete Riaja District, Barru Regency, South Sulawesi Province. Before conducting a treatment on the subject, the researcher visited the subject's school and home to express the aims and objectives of the study to her parents and ask for their consent. The researcher was the teacher, making it easier to adapt to the subject, including getting to know her parents better. Subject had a difficulty in repeated addition of whole numbers. Memory lapses occurred to the subject, particularly in recalling the previous materials. Subjects were called several times, reprimanded, and taught to understand what the teacher meant. She promptly forgot again. The subject was well acquainted her teacher at school, especially the second-grade teacher, although the subject played more on her own on the bench.

3.3. Data Collection

The study employed a description test, observation sheets to observe the subject's behavior, and RME learning tools which were all validated qualitatively by three experts. The learning achievement test for repeated addition of whole numbers consisted of three questions. The

test was duplicated into several equivalent packages. The time allotted for the task was 30 minutes for three essay questions. Each test item had a scoring table with the highest score of 30 and the lowest score of 0. Each package had three essay questions, so the maximum score was 90, while the lowest score was 0. Student observation sheets to observe student activities in the learning process were filled out by the observer. RME learning tools included lesson plans with the RME approach, syllabus, and repeated addition and time allocation materials.

3.4. Data Analysis

Visual analysis was employed in data analysis to see the trend of the three conditions and tests. The analysis had several features, including the number of data scores from the test results in each condition, the number of dependent variables to be changed, the level of stability and changes in the level of data within a condition or between conditions, the direction of change within conditions or between conditions.

4. Findings

Findings were obtained from subject's observation sheet data and test results. The data was acquired from the baseline and treatment stages, both within and between conditions. The documentation of the subject is shown in Figures 3 and 4.

Figure 3. Researcher Teaching with MRE

Figure 4. Subject while doing the test

Figure 3 shows the subject sitting in the back corner enthusiastically learning with the MRE approach on repeated addition. Figure 4 shows the subject working on a test by trying to identify the problem to determine what she had known and what was being asked. This was how the problem was resolved, by using a scoring table that had been previously validated to evaluate the subject's work .

4.1. Baseline Stage Results within Condition

The results of the first day of the test at the baseline stage were as follows: when doing test 1, the subject was visibly not confident. For 25 minutes, nothing was done from the three essay questions. She started writing in the remaining five minutes of the allotted 45 minutes time. Firstly, she worked on question number three, followed by number two, then number one. However, her answers were only one or two words per question, in form of scribbles with irrelevant meaning to the three questions. For this, she scored 15 out of 90 that the subject should have obtained.

Meanwhile, the results of the second day of the test at the baseline stage were as follows: subject mostly experienced similar problems when given an equivalent test. The question sheet was turned over while looking at her friend. The subject shook her head, looked down, and

then tried to write on the question sheet. When asked why she did so, she shook her head. The subject admitted that she forgot about this again, same thing as the day before. The subject began to answer the second question, but the answer was similar to her answer from the previous test. The second test result was 17 out of 90. The result of the third day at the baseline stage was similar to the behavior and the previous test results. She scored 18 of 90 scores. Likewise, on the fourth day, the score was only 18. Behavior and test results of the four days are listed in Table 1.

Table 1. Review of the Results of the Baseline Stage

No	Date and time	Subject Behavior at Baseline	Score
1	Monday/ May 30, 2022	The subject worked on the problem. No progress was made for 20 minutes. She was confused and angry. In the remaining five minutes, the subject started working but only filled in the known, asked, and the completion questions, while the contents of each question were only numbers according to the number of questions so that the score was 15.	15
2	Tuesday/ May 31, 2022	Subjects worked on questions after 15 minutes. Until then, she did nothing other than feeling confused and angry. The subject shook her head and then tried to do the task but only filled in the known and then filled in the number. However, she did not know the symbol for each number, so she wrote what was asked and the solution. For each answer she only wrote numbers according to the number of questions so that the score was 17.	17
3	Wednesday/ June 1 2022	The subject worked on the question and then went blank for 12 minutes with nothing to do. She was confused and angry, then she started laughing. Nine minutes later, she started working but only filled in what was known, there were already numbers with symbols, while the contents of each answer were only numbers according to the number of questions, so the score was 18.	18
4	Thursday/ June 2, 2022	The subject worked on the questions and went blank for 10 minutes with nothing to do. She was confused and angry, then she started laughing. Eight minutes later, she started working but only filled in what was known, there were already numbers with symbols, but the contents of each answer were only numbers according to the number of questions, so the score was 18.	18

Table 1 shows that the baseline score of the subjects from the last four tests showed stability, namely 17, 18, and 18. The subject's response to the three essay questions was gradually faster, from 20 minutes on the first day to 10 minutes on the fourth day, despite the fact that the subject was still confused and did not understand the material. During this time, the subject displayed various movements and improved test results. Figure 5 shows the movement of the score.

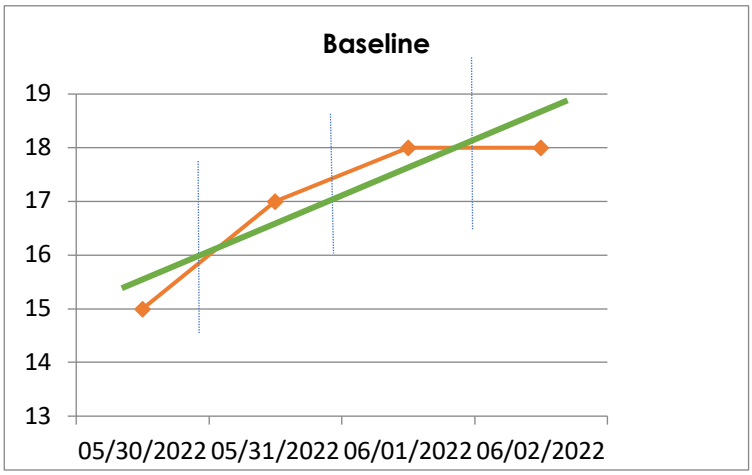

Figure 5. The trend of baseline test results

The trend of baseline test results for four consecutive days increased positively. The improvement stopped from session three to session four, where the subject's score was stagnant, namely 18. This meant that the intervention stage can be carried out using the RME approach.

4.2. Intervention Stage Results

The first intervention stage was carried out at school with other students. The determination is based on the results of the two conditions when conducting tests at the baseline stage. Then, the teacher intervened with the RME approach and tested it several times. After five treatments, the test results showed that a pattern had been formed. The second intervention stage was carried out at home with parents.

4.2.1. Interventions at School

The first treatment with the RME approach lasted for 30 minutes with repeated addition material. With RPP concerning the RME approach, the teacher provided repeated addition material. The activity involved the whole class, but the study was focused on the subject. At the end of the meeting, the teacher gave test questions to all students in one class.

The subject sat in the back left corner. When the teacher was teaching, the subject was less focused, she looked at her friends once. The subject showed lack of confidence when working on the test. However, the subject did not cheat or ask a friend to come near her seat. The subject started working on question number one but had not yet reached the completion stage. She stopped and moved on to question number two. The same thing happened to question number two and question number three, so the score obtained by the subject was 19 out of 90.

On the second day of the treatment, the subject shook her head. When asked why she did so, the subject only laughed shyly while looking down. She admitted that there was a similarity to yesterday's question, but she had forgotten about it again. The subject answered the questions despite they were incorrect answers. The subject chose to work alone, regardless of the opportunity to ask her close friends. There had been several improvements in work results, especially regarding the stages of working on the questions that had begun to form a pattern. Likewise, the same thing occurred to questions two and three, resulting in the score of 23 out of 90. On the third day of treatment, an improvement in form of the speed of working and the accuracy of solving the three questions. This was similar to the fourth and fifth days, resulting in the subject scores of 19, 23, 30, 47, and 50 out of 90. The results of improved scores with treatment and without treatment at school are shown in Figure 6.

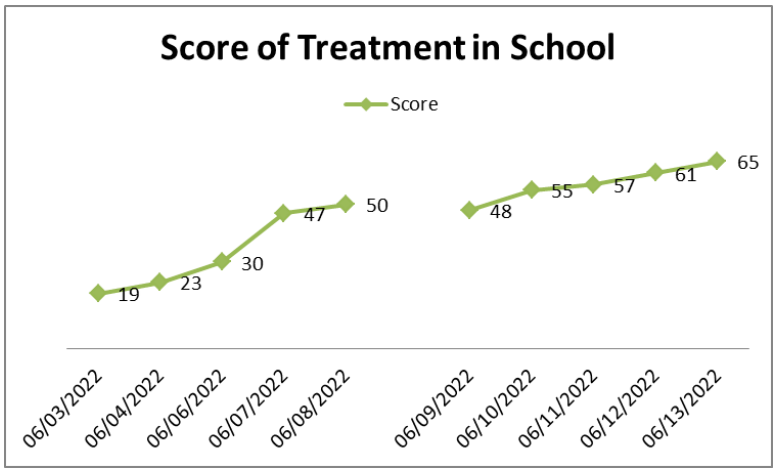

Figure 6. Treatment and No Treatment Scores

4.2.2. Interventions at Home

The scores of the intervention at home is shown in Figure 7. The intervention at home was under two conditions: with and without treatment. The first five days of the test were conducted without treatment. The result showed a gradual increase, especially from the third to the fourth day. Additionally, the treatment using the MRE approach was conducted for the following five days, showing slow increase. The slowdown occurs when there was an intervention. This suggests that the effectiveness of the intervention at school followed by a test at home was greater than the effectiveness of the intervention at home followed by a test.

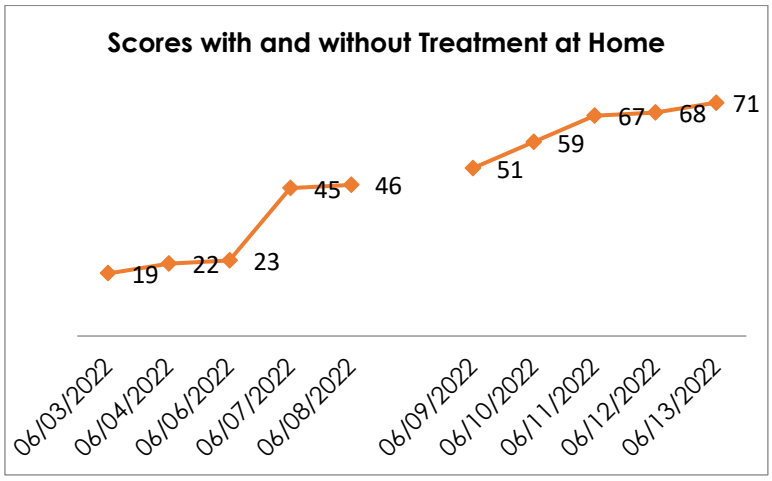

Figure 7. Trends in Score with Intervention

4.2.3. Between Baseline and Interventions at School

The baseline and school scores showed a positive increase, as shown in Figure 8. The scores between the baseline and school conditions showed an increase after the treatment. These results indicate that with or without any treatment, the score obtained by the subject remained higher. However, the treatment using the MRE approach showed more greater increase.

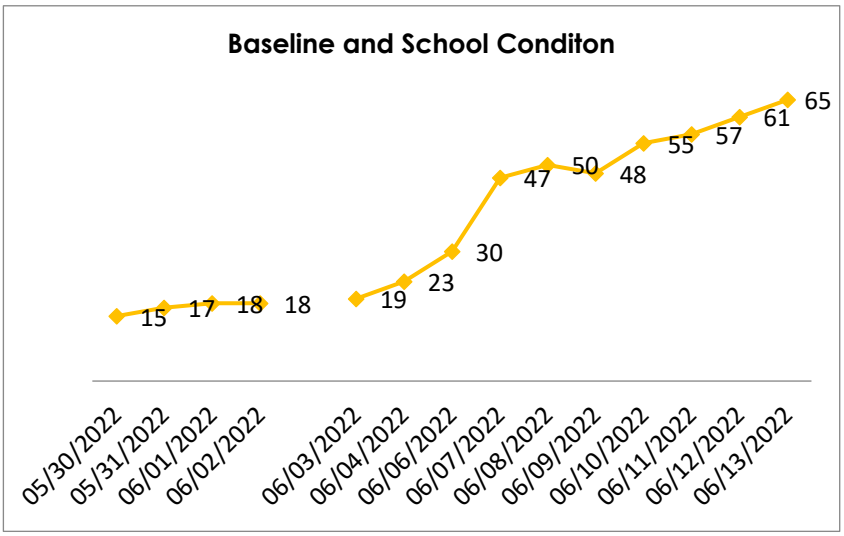

Figure 8. Trends in baseline and school scores

4.2.4. Between Baseline and Interventions at Home

Baseline scores and at-home conditions showed a positive increase, as shown in Figure 9. There was a similarity shown in Figure 8, but the increase in scores remained when there was no treatment in the first five days and after the treatment. These results indicate that the score obtained with or without any treatment, the upward trend remains higher, particularly when there was no treatment with the MRE approach.

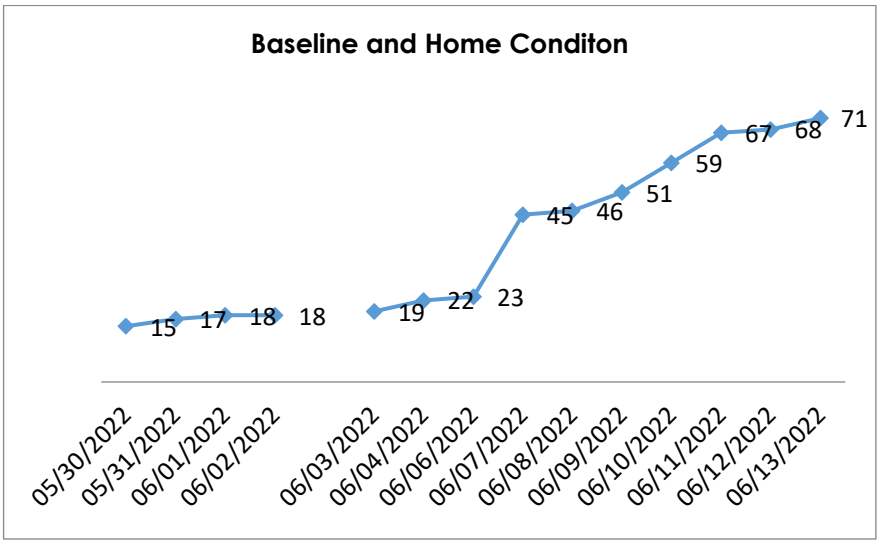

Figure 9. Baseline and Home Score Trends

4.2.5. Interventions Between School and Home Conditions

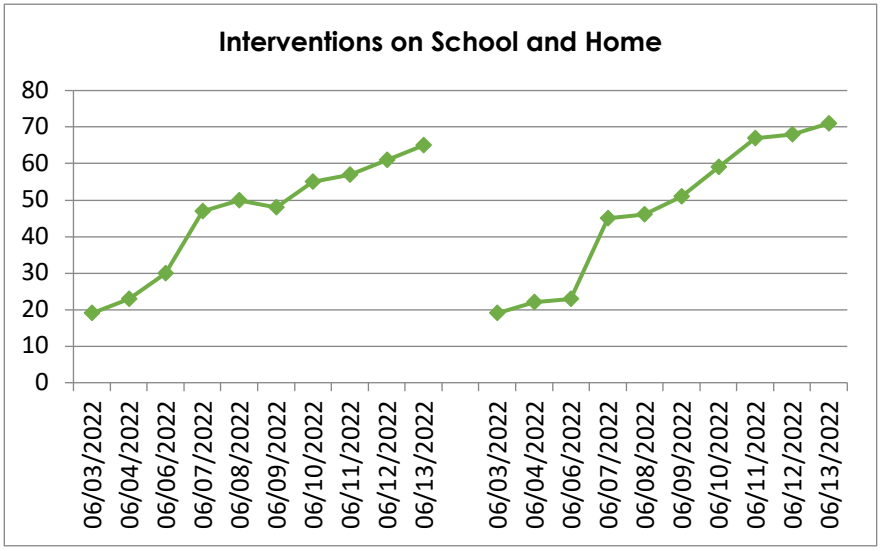

Figure 10. Scores in school and home conditions

Figure 10 compares the treatments in school and home conditions with the RME approach. The data was the total data of the two interventions. First, the treatment was done then the subject was tested in school conditions, followed by a test without treatment at home. This was done five times. Second, the treatment was done at home and tested at school but without treatment. Overall, the subject earned a higher score at home than at school. In short, subjects with slow learner behavior scored higher in home conditions than in school conditions.

4.2.4. Baseline Stage and Intervention Between Three Conditions

The comparison of slow learner scores on repeated addition materials between baseline, treatment at school, and treatment at home are depicted in Figure 11.

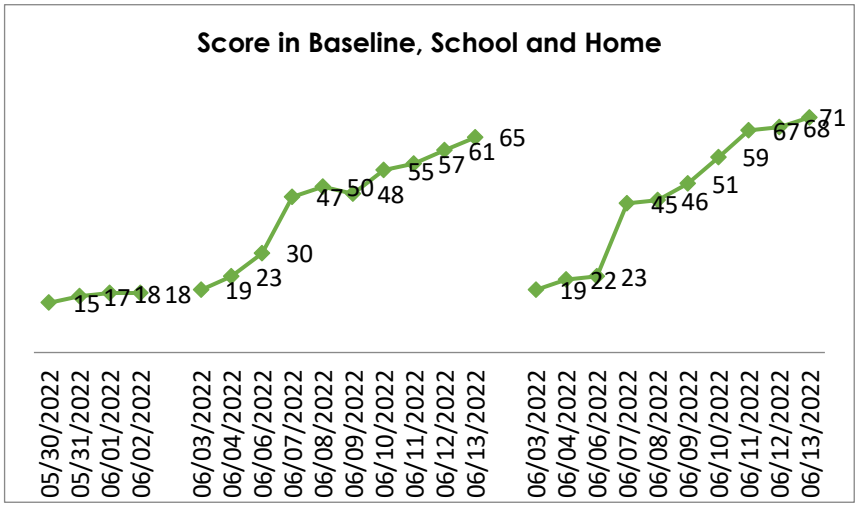

Figure 11. The trend of scores in baseline, school, and home

Figure 11 shows an increase in scores in a positive direction both at baseline and home, except at school. The exception occurred following a test at school after home treatments and tests in which the score decreased from 50 to 48. Following five treatment sessions, scores at school increased significantly higher, from 19 to 50. At home, the score also increased from 19 to 46.

In comparison, the last score was higher at school. Furthermore, following five treatment sessions at home, a slowdown occurred even though the scores continued to increase compared to schools, since the final score at home was 71, while at school it was only 65.

5. Discussion

The subject of the study was a slow learner. Slow learners need an extraordinary and special approach (Macdonald Cobb, 1961). The subject had with poor writing skills and was slow to respond as she also appeared to have poor memory. Her scores stabilized faster at school when the test was conducted at the baseline stage as she had a stable ability over time in a few minutes in one day. Repeated but meaningful exercises in her daily activities provide a strong stimulus for learning, in accordance with the stages of the MRE approach (Ferreira & Bisognin, 2020) (Do et al., 2021).

When the subject received a treatment using the MRE approach, which is an approach that provides stimulus related to daily problems, accelerated significantly compared to the baseline. In other words, the subject gave a positive response when given a treatment according to their daily experiences at home. However, every student has his or her own learning style that must be understood by teachers and parents at home. Every child has unique characteristics that teachers need to be aware of in the classroom (Munje et al., 2021).

When given treatments at school and then tested at home, the subject's significantly improved, especially from the third to fourth day. However, when given treatments at home and tested at school, the subject's score decreased. It implies that the subject's ability has reached saturation point despite the given treatment, as proven by less-significant; even at the end of the fifth-day treatment, the score only reached one point, and the score on the fourth day was higher. The subject's ability was stable and had reached a breaking point. The same thing happened to the treatment at school when the peak was reached in the 10th test without treatment. Generally, slow learners have poor learning achievement and their performances are below average. Currently, slow learners are found not only in inclusive schools but also in regular schools. Teachers who lack experience will find it difficult to deal with slow learners in the classroom.

Slow learners can improve using project-based learning (Hartini et al., 2017). In addition, they need to be intrinsically and extrinsically motivated. Studying intrinsic and extrinsic learning motivation in slow Learner students improve their performance. Intrinsic motivation of slow learner students include passion and desire to succeed, enthusiasm for learning, as evidenced by their active involvement during learning process, and aspirations or dreams for the future. Meanwhile, students' extrinsic motivation consists of rewards in learning, exciting learning activities and a conducive learning environment (Amdany et al., 2018).

Furthermore, pedagogical lesson plans can help students with poor math skills in class. By using a detailed instructional treatment approach analyzed quantitatively, it can be concluded that the enhanced instructional treatment positively affects learners in the upper middle group. Studies in secondary schools on algebraic material show that enhanced instructional treatment positively affects learners in the middle group (Yoo, 2020).

A comparison of the curves of the two treatments, comprising five treatment sessions at school followed by a test, then five treatment sessions at home followed by a test at school, shows that the final score was higher at home than at school. It signifies that the subject was more capable of writing the MRE approach at home than at school. Therefore, mathematics teachers in schools can apply the MRE approach under the condition that learning is carried out centrally for subjects with slow learning disabilities. The teacher pays special attention to the subject as much as she does at home. Slow learners can level their competence when the teacher deliver the material adjusting to their characteristics (Sovia & Herman, 2019).

Furthermore, school teachers need to understand each student's personality, which can affect cognitive performance and trigger the tradeoff of increasing cognitive speed under the next new context (Chen et al., 2022). The study results align with the study in Vietnamese elementary schools with an emphasis on special learning but they do not provide a detailed approach (Tran et al., 2020). The study results provide recommendations for teachers to use the MRE approach in teaching mathematics in schools but with the feel of a home situation so that slow learner students can still study at school without barriers. Slow learner students' activities can be well received by the surrounding community despite their occasional unique and different behavior from their peers (Budiarti et al., 2021). Studies show that grouping provides another alternative of dealing with them (Z. & Mahmoud, 2014). However, slow learners can be handled effectively if the teacher carefully observes student behavior. Early recognition of symptoms can lead to an accurate diagnosis, improved understanding and the provision of appropriate supportive interventions (Winson & Fourie, 2020). The slow learner element of autistic children needs special attention, including learning basic math concepts (including fractions). Children with autism can be taught basic mathematics with the help of media and concrete games because it has been proven to help them think fast (Triwahyuningtyas et al., 2020). If a slow learner child is given a condition that he thinks is safe and supports him, it will be easier for him to manage his abilities optimally. Personalization is good for the learning process, it has been claimed to have great potential in providing solutions to facilitate learning pathways based on children's abilities and preferences.

This study on slow learners is limited to the use of RME method with two stages (baseline and intervention) with two settings: school and home. Studies related to the assistance of other media have not been reviewed. Slow learners can improve optimally with the aid of media or other tools, such as augmented reality or Newman's Error Analysis (Novitasari et al., 2018). Personalization with the construction of user-profiles and scenarios that represent personalization for reading has not been studied as a finding of the study. The said construction use profiles and procedures that represent personalization for reading (Mansor et al., 2019). Likewise, increasing students' understanding of direct and inverse comparison material using the Contextual Teaching and Learning (CTL) approach shows that using the CTL approach can improve slow learners' understanding of natural and inverse comparisons and minimize slow learning difficulties during learning activities (Manikmaya & Prahmana, 2021).

6. Conclusion

Employing the MRE approach for slow learners in learning repeated addition was proven able to improve their abilities consistently and positively. Slow learners have a high acceleration of improvement when given treatment under school conditions. However, slow learners generally have a better chance of improving when there is no intervention, followed by a treatment at home. Therefore, teachers can teach repeated addition for slow learners at school according to home treatment with the MRE approach.

Limitations

This study is limited to the use of MRE approach in teaching repeated addition in elementary schools with two stages, namely baseline and treatment, while the treatment involves two settings, namely school and home. Studies on other approaches have not been conducted, including using media or other applications. Therefore, other researchers can conduct studies on slow learners employing other approaches or conditions, for example, self-study with various other learning media or other learning applications so that slow learners can improve their abilities optimally.

Recommendation

The results showed that slow learner students performed best at home at home. Therefore, mathematics teachers must treat slow learner students using the MRE approach at school according to conditions at home.

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Conflict of Interest

The authors declare that there are no conflicts of interest to disclose in this study.

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