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KOKALI: AN INNOVATIVE METHOD FOR TEACHING MULTIPLICATION IN REMEDIAL PROGRAMS

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ABSTRACT

Multiplication remains a significant challenge for remedial students, particularly in understanding and applying its concepts due to complex representations that hinder comprehension. Furthermore, parents often expressed being unable to teach the concept at home. To address these challenges, the KOKALI technique—an acronym for "ko" (*kotak*, meaning box), "ka" (*kali*, meaning times), and "li" (*lidi*, meaning sticks)—was developed to simplify multiplication using simple and consistent representations. This innovative approach aims to facilitate learning comprehension and parents' involvement in teaching multiplication concept by utilizing boxes and sticks to represent multiplication factors. This classroom action research explores the efficacy of the KOKALI technique in enhancing students' understanding. Data were collected from classroom observations, diagnostics test and post-tests using single-blind testing methods among 20 remedial students (aged 8–9) at SK Membedai, WP Labuan, over 12 sessions. Feedback from 25 parents was gathered via a digital survey during a KOKALI workshop to assess the technique's effectiveness. Results indicated a significant improvement, with over 90% of students successfully solving single-digit by two-digit and three-digit multiplication sentences without regrouping using the KOKALI technique. Classroom observations revealed that students displayed increased confidence in their mathematical abilities, as they were able to complete multiplication tables from 1 to 9 using KOKALI. Additionally, over 90% of parents surveyed strongly agreed that KOKALI is highly beneficial in helping children understand multiplication, as its simplicity makes it easy to apply and explain at home. The findings show that the KOKALI technique is useful not only for remedial students but also for early mathematics education. By incorporating this approach, educators can overcome barriers to mastering multiplication and emphasize the need for innovative teaching methods to support students' mathematical development.

Keywords: Multiplication, remedial, innovative strategy, KOKALI

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INTRODUCTION

Multiplication in mathematics is a crucial numeracy skill among students for their intellectual and practical development. However, learners in remedial programs found it a challenging skill to acquire. Multiplication remains a challenge for its abstract concept and difficulties to apply it in problem-solving. The problems are apparent among remedial students in Sekolah Kebangsaan Membedai, Wilayah Persekutuan Labuan (SK Membedai, WP Labuan) from the teacher's observations during lessons and the Mathematics Diagnostics Test. Remedial students were observed unable to grasp the basic multiplication concept and thus unable to complete the multiplication chart of 1 until 9. This consequently affects their affinity to solve multiplication sentences and hinders development. Therefore, this research aims to examine the barriers faced by remedial students in multiplication and explore innovative methods to address the challenges effectively.

One major issue in multiplication is the complex pictorial diagrams often used to teach the concept. Overly detailed visuals can cause confusion during learning rather than clarity. In this study, students are observed to fail to comprehend detailed pictures and require simple and easy representations. In practice, pictorial diagrams that are complex and too detailed, for example, flowers, cause distractions during the process leaving the student unable to make meaningful connections between the visuals and the mathematical operation.

The next challenge is the inability to grasp the multiplication concept. Inadequate understanding of the concept being the fundamental factor for students to progress beyond rote memorization of multiplication tables. Additionally, many remedial students found it difficult to apply multiplication skills in diverse mathematical contexts. Because of these challenges, many remedial students' progress is delayed and unable to apply multiplication in problem-solving scenarios. Although over time the students manage to understand the concept, they often encounter difficulties applying multiplication in practical situations such as solving mathematical sentences or in multi-digit calculations.

This study finds these shortcomings in conceptual gaps concerning the remedial students' progress and development. The inability to transfer knowledge stresses the need to integrate conceptual understanding with practical applications. Hence, KOKALI was developed as an essential tailored strategy to close the bridge in these gaps. KOKALI is an abbreviation of ***ko*** – *kotak* (boxes), ***ka –*** *kali* (times/multiply), and ***li –*** *lidi* (sticks). The word *kali* is chosen in introducing multiplication process to the remedial students to emphasize repeated addition of the process. It is also to depict the repetition of the same act. For example, brushing teeth two times a day (1 + 1 = 2 x 1) or taking two tablets, three times a day (2 + 2 + 2 = 3 x 2). Additionally, sticks are chosen as the representative due to their simple nature, easy to draw, and most importantly removing distractions for concept understanding.

Innovation of KOKALI technique is based on three problems observed by the teachers that teaching mathematics to remedial students and other students at the school. The fundamental problems are i) remedial students found difficulties in grasping the multiplication concept due to complex representative, ii) students unable to get meaningful learning and iii) parents express difficulties in teaching multiplication to their children at home

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The first objective of this study is to examine the efficacy of the technique in improving understanding of multiplication concept by using simple representatives. This study further identifies if the students able to engage in meaningful learning after the introduction of innovative technique KOKALI. The final objective of this study is to investigate if the KOKALI technique manage to act as aid to parents to teach multiplication at home.

To summarise, the fundamental focus in this technique is to ensure remedial students being able to master the multiplication chart without memorization before transferring the skills into other mathematical problems. This technique combines simple tools using boxes and sticks with systematic, step-by-step guidance. Most importantly, this technique creates consistency in the concept by using simple visual representations and removes distraction in the process. Furthermore, this technique not only helps with conceptual understanding but also enhances students' confidence in solving multiplication sentences. This study pursues evidence-based insights into the tailored technique in transforming the learning experience for struggling students and hopes to foster mathematical confidence among remedial learners.

KOKALI: Steps to Apply KOKALI in Multiplication

This technique encourages students to use the grid exercise book. In this technique, the multiplier will be represented by ***ko - kotak*** (boxes), times symbol will be represented by ***ka*** – ***kali*** (times), and the multiplicand will be represented by ***li – lidi*** (sticks).

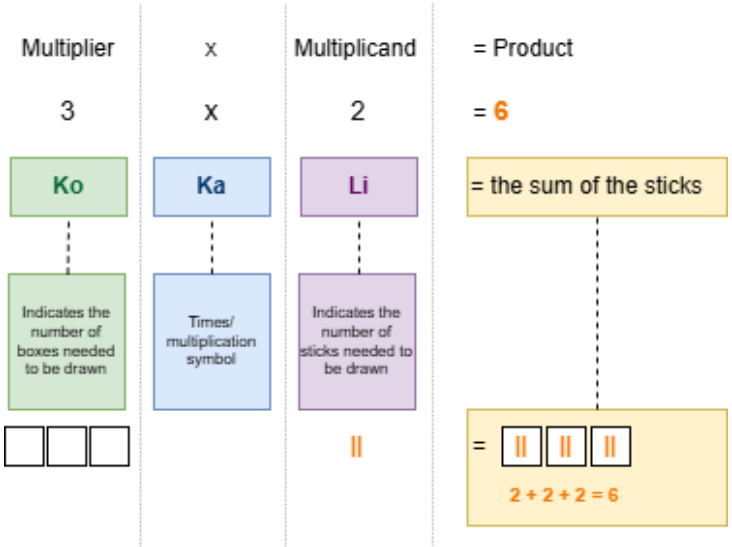
Step 1: The value in multiplier will indicate the number of boxes needed to be drawn, for example 3 is represented by 3 boxes (Figure 1).

Step 2: The value in multiplicand will indicate the number of sticks needed, for example 2 is represented by 2 sticks (Figure 1).

Step 3: Then students will need to fill all the boxes with the number of sticks and add all the sticks.

Step 4: Students solve the multiplication problem using repeated addition.

Figure 1: *KOKALI technique*



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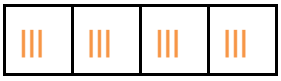
Below shows an example of KOKALI application.

Example:

4 x 3 = 12

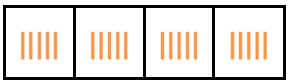


4 times 3 = 12

3 + 3 + 3 + 3 = 12

i. KOKALI multiplication of 1 digit to 1 digit number.

4 x 5 = 20



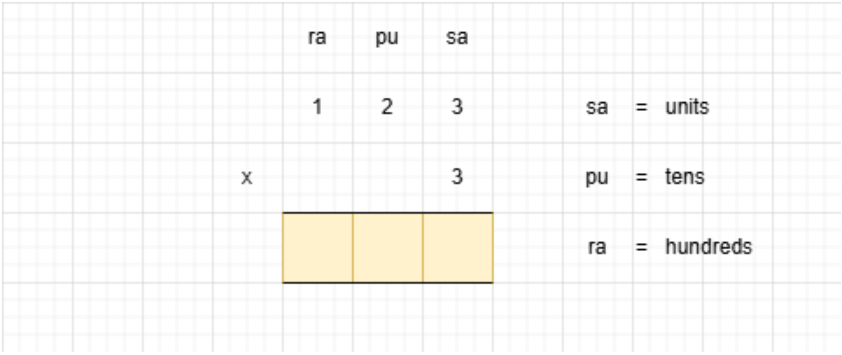
5 + 5 + 5 + 5 = 20

Using the basis of KOKALI, students will draw boxes and sticks according to the multiplier and multiplicand value. Students will repeatedly add the number of sticks and get the total of the sticks. Students solve the multiplication problem using repeated addition.

ii. KOKALI multiplication of 3 digits to 1 digit number without regrouping.

1 2 3 x 3 =

Step 1: Convert a mathematical sentence into standard form and state the place value.



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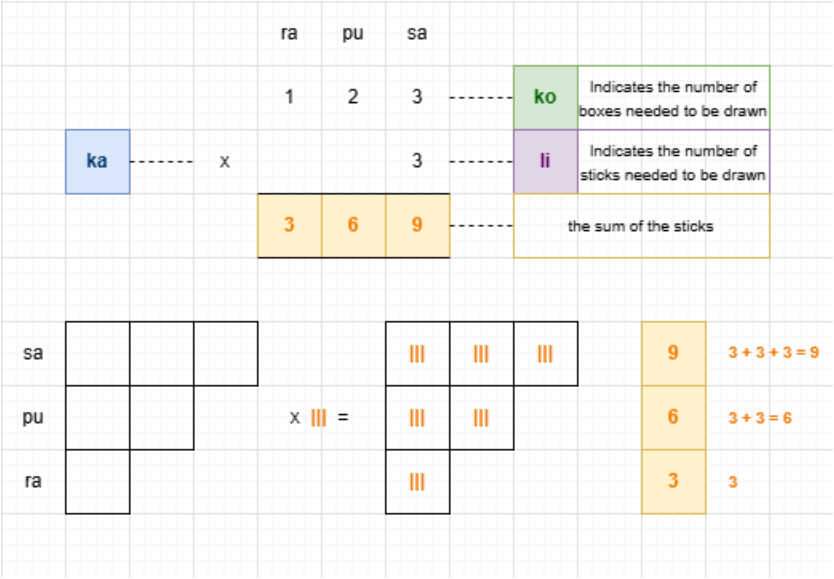
Step 2: Separate the calculation method according to place value, then complete the answer.

Figure 2: *KOKALI 3 digits with 1 digit number without regrouping*



Step 3: In this process, students will draw boxes according to the number in place value started with units, tens, and followed by hundreds.

Step 4: After identifying the number of the multiplicand, students then draw and insert the sticks into the boxes.

Step 5: Students will solve the multiplication problem using repeated addition, separately according to place value.

LITERATURE REVIEW

Visual Representations in Teaching Multiplication

Visual representations play a crucial role in helping students grasp mathematical concepts, particularly multiplication (Milton et al., 2018). Tools such as manipulatives, number lines, pictorial representations, and arrays enable learners to develop a deeper understanding of problems, enhancing problem-solving skills. Research suggests that employing visual aids leads to significant improvements in math achievement among elementary and middle school students (Williams and Wills 2020).

For instance, using equal groups, arrays, area models, and number lines provides students with concrete ways to model multiplication, which facilitates a transition from concrete to abstract thinking (Smith and Jones 2022). This approach is especially beneficial for students with mathematical learning difficulties, as it allows them to engage in meaningful mathematical discourse and develop a conceptual understanding of multiplication (Lopez et al. 2021).

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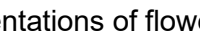
In addition, simple representation in teaching multiplication is thought to be helpful. It is important to note that some students are easily confused by a single object. For example, in a mathematical sentence using graphic representations of flowers ( + ), a normal student will immediately be able to give the correct answer of 8. However, some students or commonly observed among remedial students were easily distracted with the petals and calculated wrongly.

Using visual representations does help in teaching multiplication, however understanding the visual representations is crucial to ensure the students are able to progress in mathematics (Aladwan et al., 2023). Simple visual representations able to facilitate students' perception of the visual representations used in multiplication is important to ensure effective learning and storing information and experiences.

Challenges Among Remedial Learners in Multiplication

Remedial students often struggle with multiplication due to its abstract nature and reliance on rote memorization. Many learners face challenges in understanding the underlying concepts, making it difficult for them to apply multiplication skills in various mathematical contexts. Furthermore, complex visual representations can further hinder comprehension, causing confusion and impeding learning (Brown 2019).

To address these challenges, educators must simplify visual aids and provide systematic, step-by-step guidance. Techniques that emphasize consistent and straightforward visual representations help remedial students build a solid foundation in multiplication before progressing to more complex problem-solving scenarios (Green and Carter 2020).

Parental Involvement in Mathematics Learning

Parental involvement plays a crucial role in enhancing students' mathematical performance. Studies have shown that students who perceive greater support from parents tend to develop more positive attitudes toward math and achieve higher levels of success (Johnson 2023). This support can take various forms, including assisting with homework, fostering a positive attitude toward math, and setting high academic expectations.

A meta-analysis examining the influence of parental involvement on students' math performance found that positive parental engagement, such as encouraging students' autonomy in learning, enhances intrinsic motivation and learning engagement (Lee, Thompson, and Garcia 2024). Encouraging parents to participate actively in their children's mathematical education can be an effective strategy for supporting remedial learners.

Incorporating simplified visual representations and fostering parental involvement are effective strategies for supporting remedial students in mastering multiplication. By addressing the specific challenges these learners face and leveraging support from both educators and parents, it is possible to enhance their understanding and application of multiplication concepts, leading to improved mathematical performance.

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METHODOLOGY

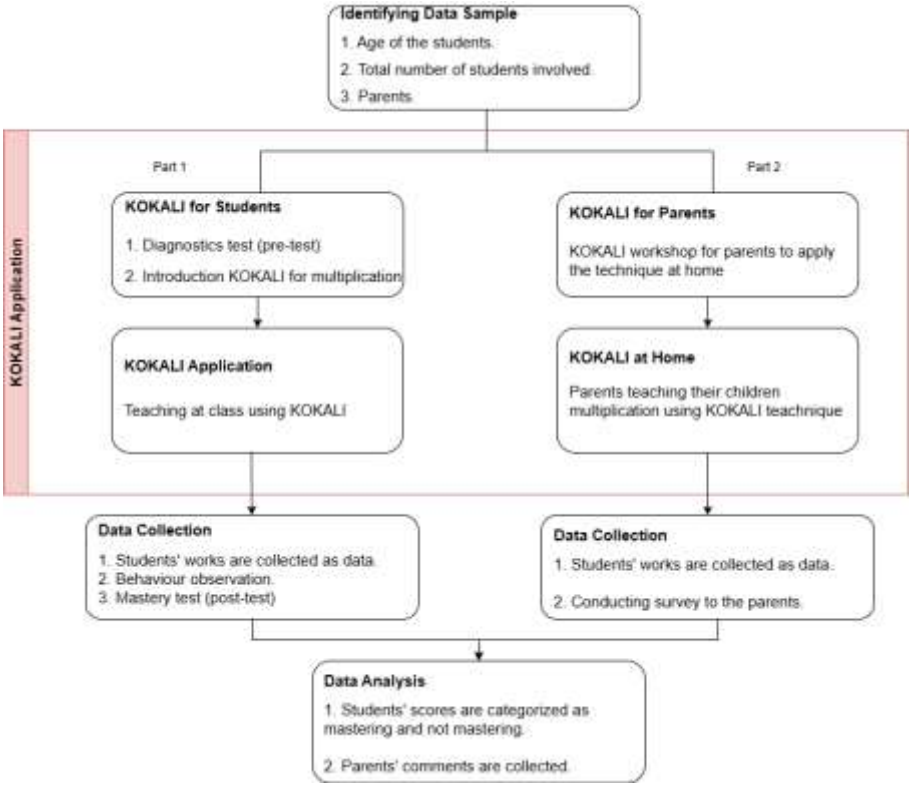
(a) Research background

For this study, qualitative methods are employed as data collection involved are observation during lessons and non-graded classroom practices. In this approach, students' work will be observed and analyzed whether the KOKALI techniques are working.

In the first part of the study, students will be introduced to KOKALI technique during lessons and classroom work will be given immediately after concept learning. The teacher will collect the work and mark it immediately for observation, in-situ analysis, and discussion. Close observation and analysis increased the reliability of data collection and perception of concept understanding. This approach also reduced external influences that could impact the perception of students' understanding of the concept.

For the second part of the study, a short survey was conducted involving the parents. This is to measure the efficacy of the KOKALI technique for the parents to teach their children at home.

Diagram 1 *Research Methodology*



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(b) Part 1: KOKALI for Students

i. Data sample

Single-blinded testing is incorporated in this part involving a total of 20 remedial students of SK Membedai, WP Labuan. Samples are of female and male students with the age ranging from 8 – 9 years old.

The age group is considered suitable for this study as in Malaysia syllabus, age 8 – 9 are the age group in which multiplication concept is introduced. The gender of the samples is irrelevant to the study thus disregarded.

ii. KOKALI application

A teaching plan was developed incorporating KOKALI techniques to teach multiplication class. The plan begins with the introduction of multiplication, concept of multiplication, how to apply the KOKALI technique in multiplication to the mastering of the technique.

The process takes over 12 sessions of teaching and learning, 30 minutes of every period. The samples are introduced with KOKALI technique during lessons and step-by-step guidance is provided. The sessions were divided into three (3) stages as follows:

Stage	Session	Teaching Plan
Stage 1	Session 1 – 4	KOKALI in multiplication tables 1 – 9
Stage 2	Session 5 – 8	KOKALI in multiplication of 2 digits with 1 digit without regrouping
Stage 3	Session 9 - 12	KOKALI in multiplication of 3 digits with 1 digit without regrouping

iii. Data collection

Data collection in this part involved class observations and classroom practices in-situ analysis. After completion of every lesson, mastery practices were given to measure the students' understanding and comprehension of the concept along with the efficacy of the KOKALI technique. Immediate in-situ analysis involving observation and marking of the practices were conducted.

Behaviour Observation

Observation is the process which the students are measured based on their behaviour throughout the 12 sessions. This process involves measuring 4 key behaviours that are adaptation, fluency and automation, engagement, and confidence. Adaptation assesses the student's ability to employ the KOKALI technique in multiplication and consistently successful in using the technique (Bognar et. al., 2025), which a high adaptation score indicates strong understanding of the technique. Fluency and automation express the student's ability to solve the classroom practices quickly and correctly that indicates a high level of proficiency of the technique (De Los Santos, 2021). Engagement involves the student's awareness of their own progress that they started to ask question and answering questions, which indicates progress in every stage (Bognar et. al., 2025). Positive attitudes such as enjoying the classroom practices, quick to answer question or questioning the teacher, eager to get new and challenging questions, as well as able to complete the classroom practice within time limit shows improved confidence in learning (Carr et al., 2024).

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All characteristics is measured by the Likert-scale with scores of 1 – 5 (very weak – excellent) (Table 1). Observation from the classroom practices (Appendix B) falls under the category of fluency and automation.

Table 1 *Likert-scale of Character Progress in Learning Multiplication using KOKALI technique*

Score	1	2	3	4	5
Scale	Very weak	Weak	Average	Good	Excellent

Mastery Test

Before introducing KOKALI technique in teaching multiplication, a diagnostic test was done as baseline. At the end of session 12, a post-test is done to measure the progress of each student mastery skill in multiplication. The marks are categorised as mastering and not mastering as in Table 2:

Table 2 *Post-test Minimum Scores*

Category	Mastering	Not-mastering
Minimum score	75% and above	Less than 75%

Data analysis

Behaviour observation

Likert-scale from the observation data was analysed using SPSS (v. 26, IBM Corp, Chicago, IL, USA) for one-way sample t-test (Boone & Boone, 2013; Sullivan & Artino, 2013).

Mastery test

For diagnostics test and post-test, a simple data analysis is used to compare the student's progress after the 12 sessions.

(c) Part 2: KOKALI for Parents

i. Data sample

In this part of the study, a KOKALI workshop was conducted for parents with children in the early stage of learning multiplication and those with children that are slow in learning the multiplication concept.

A total of 25 participants attended the workshop and were provided with a KOKALI module (Appendix A) to practice at home.

ii. KOKALI application

In the workshop, parents were introduced with the technique to teach their children multiplication of single digit numbers with 2-digit numbers and 2-digit numbers with 3-digit numbers without regrouping.

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The module provided facilitates the parents teaching the technique and lets their children practice them immediately. Parents are to mark their children's work and observe their comprehension of the technique.

iii. Data collection

The data for this study was collected through an online survey – Google Forms, which recorded participants' responses in a structured spreadsheet format. A total of 8 questions are included in the online survey. From the survey, 7 of them consists of multiple questions representing different aspects of the **KOKALI** technique, with responses provided on a five-point Likert scale. The Likert-scale was scored 1 – 5 (strongly disagree – strongly agree).

Table 3 *Parents' Feedback*

Score	1	2	3	4	5
Scale	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

Additionally, an open-ended section (question 8) allowed participants to provide qualitative feedback. The online survey was collected 7 days from the day of the workshop. Sample questions are attached to Appendix C.

iv. Data analysis

The raw data was extracted from the online form into a spreadsheet for a structured data processing environment. This ensured proper handling of timestamps, categorical responses, and numerical ratings. Any duplicate or incomplete entries were identified and addressed to maintain data integrity.

The frequency and percentage distributions of Likert-scale responses were calculated to determine overall trends in participant perceptions to assess the overall acceptance and perceived effectiveness of the KOKALI technique. This analysis uses the same analytical process in (b) iv.

Additionally, simple thematic analysis was done to accommodate the open-ended question (question 8). The comments from question 8 are categorised into 5 themes that are good, easy to understand, helpful, easy to practice, and others.

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RESULTS AND FINDING

Part 1: KOKALI for Students

Behaviour Observation

A steady pattern of behaviour changes in Table 4 was observed among 20 samples (N=20) of remedial students in learning multiplication using the KOKALI technique. Table 4 showing four key behaviours in understanding the student's progress that are adaptation, fluency and automation, engagement, and confidence, which are measured across three stages. The table also shows the consistent range of minimum score (1.00) and maximum score (4.25) that indicates the behaviour throughout all four sessions in every stage have no distinct variation in their behaviour as they progress through the stages.

Descriptive statistics from Table 4 also show the mean (4.0875) and standard deviation (0.72672) across all stages. The high mean value and standard deviation indicates the students generally showing positive experiences across the stages.

Table 4 *Descriptive Statistics of Behaviour Observation*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Adaptation_Stage 1	20	1.00	4.25	4.0875	.72672
Adaptation_Stage 2	20	1.00	4.25	4.0875	.72672
Adaptation_Stage 3	20	1.00	4.25	4.0875	.72672
Fluency and automation_Stage 1	20	1.00	4.25	4.0875	.72672
Fluency and automation_Stage 2	20	1.00	4.25	4.0875	.72672
Fluency and automation_Stage 3	20	1.00	4.25	4.0875	.72672
Engagement_Stage 1	20	1.00	4.25	4.0875	.72672
Engagement_Stage 2	20	1.00	4.25	4.0875	.72672
Engagement_Stage 3	20	1.00	4.25	4.0875	.72672
Confidence_Stage 1	20	1.00	4.25	4.0875	.72672
Confidence_Stage 2	20	1.00	4.25	4.0875	.72672
Confidence_Stage 3	20	1.00	4.25	4.0875	.72672
Valid N (listwise)	20				

One-sample T-test was conducted to further investigate the significance of the result. In Table 5, all key behaviours across all stages yielded a highly significant result (\$t(19) = 25.154$, $p < .001$). This indicates that the mean scores for key behaviours are significantly different from the test value of 0 at a 99.9% confidence level. The low p-value ($p < .001$) demonstrates robust evidence against the null hypothesis that there are significant changes in the key behaviours of the students.

The high mean difference from the test value showed overall positive behaviour across all stages. Meanwhile, the confidence interval 95% for the mean difference showed a narrow interval which also indicates that the true population mean is greater than 0.

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The t-test therefore supports the result from descriptive statistics in which there are significant differences in the students' behaviour across the stages.

Table 5 *One-Sample T-test Behaviour Observation*

One-Sample Test

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Adaptation_Stage 1	25.154	19	.000	4.08750	3.7474	4.4276
Adaptation_Stage 2	25.154	19	.000	4.08750	3.7474	4.4276
Adaptation_Stage 3	25.154	19	.000	4.08750	3.7474	4.4276
Fluency and automation_Stage 1	25.154	19	.000	4.08750	3.7474	4.4276
Fluency and automation_Stage 2	25.154	19	.000	4.08750	3.7474	4.4276
Fluency and automation_Stage 3	25.154	19	.000	4.08750	3.7474	4.4276
Engagement_Stage 1	25.154	19	.000	4.08750	3.7474	4.4276
Engagement_Stage 2	25.154	19	.000	4.08750	3.7474	4.4276
Engagement_Stage 3	25.154	19	.000	4.08750	3.7474	4.4276
Confidence_Stage 1	25.154	19	.000	4.08750	3.7474	4.4276
Confidence_Stage 2	25.154	19	.000	4.08750	3.7474	4.4276
Confidence_Stage 3	25.154	19	.000	4.08750	3.7474	4.4276

Mastery Test

Diagnostics test was done to determine the student's initial state in multiplication. Table 6 showed that all students (frequency=20) do not master the multiplication skill. Post-test was conducted to measure the student's mastery of multiplication using the KOKALI technique. Result from Table 7 showed 19 students showed improvement and mastering multiplication, which demonstrated a 95% of students successfully mastering multiplication of single digit with single digit. Whereas a 5% of the student (1 student) unsuccessful in mastering the skill.

While in Table 8, 90% (18 students) have successfully mastering the skill while 10% (2 students) did not master the skill for multiplication of single digit with 2 digit and single digit with 3 digits without regrouping.

Table 6 *Diagnostics Test for Multiplication Mastery*

DIAGNOSTICS TEST

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NOT MASTERING	20	100.0	100.0	100.0

Table 7 *Post-test Multiplication Mastery 1 Digit with 1 Digit (Multiplication table)*

POST-TEST 1 DIGIT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MASTERING	19	95.0	95.0	95.0
	NOT MASTERING	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

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Table 8 *Post-test Multiplication Mastery 1 Digit with 2 Digit and 1 Digit with 3 Digit*

POST-TEST 2 and 3 DIGIT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MASTERING	18	90.0	90.0	90.0
	NOT MASTERING	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

Part 2: KOKALI for Parents

Online Survey

The online survey consists of 8 questions with 7 questions are measured with Likert-scale of score 1 – 5 (Strongly disagree – strongly agree), refer Table 3. Table 9 showed the results for the online survey for the parents. The overall feedback from the survey showed mean score (4.84 – 4.92) indicating a favourable assessment of the KOKALI technique method. The mean score also indicates that all respondents give a rating between 4 (agree) and 5 (strongly agree) score suggesting positive perception of the technique. Furthermore, the small value in standard deviation (0.277 – 0.374) indicating low variability in responses that suggest the respondents rated the technique consistently high.

Four questions of the survey, which are Question 2, Question 3, Question 4, and Question 5, scores highest mean score of 4.92. Question 2 (KOKALI method is easy to apply) scored 4.92 indicating that the respondents agree that KOKALI is highly practical and user friendly. Similarly, other statements from Question 3 (the KOKALI method is very useful for parents and children) and Question 5 (the components in the module are easy to understand) scored 4.92 suggesting respondents agree of KOKALI method demonstrating accessibility and utility. Question 4 (KOKALI method is impactful to the children in facilitating understanding of multiplication for children) also scored the same establishing strong perception from the respondents on KOKALI technique in improving their children progress in multiplication for being impactful.

Question 6 (The KOKALI method simplifies mastering multiplication tables without early memorization) scored a slightly lower score but remain highly positive mean value 4.84. This indicate that respondents mostly agree that their children able to solve multiplication table without memorization.

Table 9 *Descriptive Statistics Online Survey*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Question 1	25	4	5	4.88	.332
Question 2	25	4	5	4.92	.277
Question 3	25	4	5	4.92	.277
Question 4	25	4	5	4.92	.277
Question 5	25	4	5	4.92	.277
Question 6	25	4	5	4.84	.374
Question 7	25	4	5	4.88	.332
Valid N (listwise)	25				

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In Table 10, one-way sample t-test for the online survey showed a low p-value ($p < .001$) demonstrating that all questions are significant. It also showed a high mean difference with the test value (test value=0) indicating a positive perception from the respondents to the KOKALI technique. Furthermore, an overall narrow spread of all questions for confidence interval suggesting a true positive population for all the variation.

Table 10 *One-sample T-test Online Survey*

One-Sample Test

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Question 1	73.569	24	.000	4.880	4.74	5.02
Question 2	88.845	24	.000	4.920	4.81	5.03
Question 3	88.845	24	.000	4.920	4.81	5.03
Question 4	88.845	24	.000	4.920	4.81	5.03
Question 5	88.845	24	.000	4.920	4.81	5.03
Question 6	64.677	24	.000	4.840	4.69	4.99
Question 7	73.569	24	.000	4.880	4.74	5.02

Thematic Comments

For Question 8 (open-ended feedback), in 25 respondents only 24 parents responded with comments and 1 left the question blank. Among the 24 responds, a total of 29 comments were received. A few of the respondents provide a long comment that expresses more than one comment. After careful selection, five themes were able to be extracted as showed in Table 11. The themes were extracted based on the similar keyword used and the implied context of the sentence. For example, *kaedah mudah faham dan terbaik setakat ini* (the technique is easy to understand, and all is well so far) – in this single sentence, the respondent shared two different keywords, which are 1) easy to understand and 2) well which implied good adaptation. Many of the comments expressed good as demonstrated in Table 11 with most frequency (9 comments). Followed by other responses that have mixed feedback with 8 comments. The least theme expressed in the comments are tied with 3 comments are easy to practice and helpful.

Table 11 *Open ended question thematic comments*

Theme	Frequency	Percentage
Good	9	31
Easy to understand	6	21
Helpful	3	10
Easy to practice	3	10
Others	8	28
N=25		

Good Adaptation

From the analysis, 9 of 29 comments mentioned *good* which represent a general good appraisal of KOKALI technique. The comment might want to express that the technique in general is good, in terms of understanding, application, clear direction, and clear technique. In overall, the parents are welcoming the simple concept of box and sticks.

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Constructive Feedback

This theme comprised of mixed feedback from the parents that provide constructive feedback for the improvement of the technique. Some of the comments are as follows:

More of activity (workshop) like this.
Provide more boxes.
Keep sharing this technique especially for students for lower grade to ease their progress.
Keep this teacher author) at this school.
No comment.

Such comments are recorded for future reference. Parents with such comments are interpreted as agreeing to all survey questions.

Helpfulness and Easy

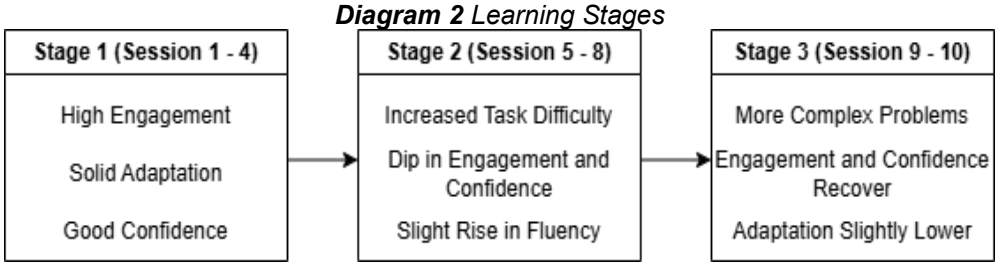
From the analysis, 6 comments mentioned easy to understand, 3 mentioned helpfulness, and 3 mentioned easy to practice. This theme expressed an overall purpose of KOKALI technique. KOKALI technique highlights the usage of repeated addition in multiplication without regrouping with 1-digit, 2-digit, and 3-digit. A systematic step-by-step guidance provided in the KOKALI module helps parents to teach multiplication to their children.

DISCUSSIONS, RECOMMENDATIONS AND CONCLUSIONS

Part 1: KOKALI for Students

This part divides the learning stages into three (Diagram 2). Every stage takes four sessions to complete incorporating the beginning and introduction of new challenges, familiarization of the learning stage, and ends with complete comprehension of the skill appropriate in each learning stage. As indicated in the Diagram 2, the difficulty of the learning increases with stage. Throughout these stages, students are observed on their behaviour during the learning process and how it impacted their learning progress. Understanding their behaviour could explain the efficacy of the KOKALI technique as an innovative approach in teaching multiplication. These key behaviours are also the key determinants of exploring the remedial student's acceptance, understanding, comprehension, articulacy, and ability to perform and solve multiplication sentence to establish meaningful learning.

Diagram 2 *Learning Stages*



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Behaviour Changes to Impact Positive Mastery Learning Progress

The first key behaviour measured is adaptation which measures the student's ability to employ the skill and consistently successful in applying it. In this study, students were provided assessments according to learning stages. Formative assessment not only benefit the students to continuously practice the technique but also helps teachers to continuously monitor the progress of each student and gather immediate data on student progress (Karaman, 2021; August et al., 2023). In the first stage, students were assessed for their adaptation in applying the KOKALI technique for multiplication of single digit with single digit admittedly by assessing the multiplication table of 1 – 9. In this stage, the classroom practice mainly focusing on completing multiplication table from session 1 until session 4. The same process applied in stage 2 and stage 3. Continuous practice and assessment help to ensuring sufficient practice and familiarization of the technique in multiplication. As the students' progress in in every session of each stage, the students developed an adaptation to the KOKALI technique and therefore score maximum score of 5 in the Adaptation behaviour scale.

The second key behaviour is fluency and automation which highlights the students' ability to fully comprehend and solve the multiplication question quickly and correctly. Students with high score for this key behaviour indicates that they have a strong proficiency in multiplication after using the KOKALI technique. To measure this behaviour, the students were observed on how quickly they can complete the classroom practice and submitted it to the teacher for immediate assessment. Apart from that, students were also observed by how quickly they can respond to direct impromptu question during conceptual teaching and learning. A strong fluency and automation behaviour indicates that the student has a complete mastery of the technique leading to mastery of multiplication skill (De Los Santos, 2021; D'Ettorre, 2019). Students managed to develop and improve this behaviour due to the apparent advantage of KOKALI by the usage of *ko* and *li* which enable the students to visualize and help them to compute multiplication as quickly. The technical simplicity of this technique allows the students to quickly visualize or draw the box and sticks and solve the question which improve fluency of the multiplication skill (Kaufmann, 2019). Furthermore, the technique explores the process by repeated addition based on place value which student can easily compute without the need to memorize the multiplication table.

Engagement score involves student's awareness of their own progress that they started to ask question for any confusion, asking for verification, and willingness to involve in class activity. At every stage of this study, students will be reminded of the KOKALI technique before guiding them on how to apply the technique in multiplication with 2-digit and 3-digit numbers. In this session, students that have shown progress have the capacity to express their confusion and able to ask questions. This is a positive behaviour in learning mathematics, especially in learning basics of multiplication.

Confidence in learning is the showcase of all positive attitude a student can has that can be eager to learn, enjoying the learning and practice session, able to explain to friend, able to engage in short question and answer session with the teacher, or eager to get new challenging questions. Confidence developed after a student aware of their own progress when they observed all the correct answers, they solve during the classroom practice (Grøtan et al., 2019). This positive behaviour not only boosts their self-esteem in learning mathematics but also overall character building in learning. One of the possible reasons is due to the simple and consistent approach of the KOKALI technique which help the students to easily comprehend the technique and apply it correctly. In KOKALI technique, a systematic process of repeated addition is used increasing students understanding in the fundamental concepts of multiplication. This innovative approach

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facilitates students solving multiplication sentence easily and developed the sense of accomplishment.

The results in Table 4 and Table 5 both demonstrated that there is significant positive behaviour displayed by the students throughout the 12 sessions. In the beginning of the sessions, majority of the students started with average score of 3 for all the key behaviours and finished the sessions with a strong behaviour score of 5. Consequently, these positive behaviours are translated into significant improvement in their post-test scores. Diagnostics tests serve as the primary source to identify the students' prior knowledge in multiplication and continuously monitoring their progress through formative assessment – classroom practice, before advancing to the post-test (Sönmez & Alptekin, 2020; Akmar et. al., 2020). Identifying the students' prior condition is the determining factor of the approach to introducing new concept learning to mastery the abstract concept of multiplication. In addition, by understanding the students' prior knowledge also help the teacher in planning the teaching strategy to scaffold meaningful learning. In the post-test among the 20 students, 95% of the students manage to score above minimum score of 75% for single digit with single digit multiplication and able to solve multiplication table using the KOKALI technique. Additionally, 90% of the students manage to score above 75% minimum score for single digit with 2-digit multiplication and single digit with 3-digit multiplication using the KOKALI technique. The achievement is a representation of successful teaching innovation to remedial students learning progress especially in multiplication.

Positive behaviour in learning gives major impact in developing meaningful learning. As the students' progress through all the stages, they develop new behaviour and improves in every chances. Students were observed to have a difficulty in the beginning of every stage but showed gradual improvement after completing all four sessions of every stages. In learning multiplication in which many students find it difficult, positive behaviour helps them to manoeuvre and remain motivated throughout the learning process. The innovative approach of KOKALI technique forms a strategic approach in dealing with remedial students in learning multiplication demonstrating as an efficient technique. The improvement in mastery test and behaviour changes showed in this study reflect the effectiveness of KOKALI techniques in improving understanding in learning multiplication and getting a meaningful learning from it.

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Part 2: KOKALI for Parents

The KOKALI technique was developed not only as an innovative for teachers to teach at school, but also for parents to teach at home as preparation for school or as revision at home. Therefore, the technique was also introduced to parents to apply it at home. The online survey was done to acquire feedback and opinion from the parents for any improvement in the future.

The feedback showed a range of high scores for all questions 1 – 7, with scores 4.84 – 4.92. The t-test showed p-value < 0.001 rejecting the null hypothesis and showing significant verdict of all survey items, validating the positive impact of KOKALI technique in multiplication. The KOKALI technique explores the fundamental essence of multiplication involving multiplier and multiplicand that it is a repeated addition. By scaffolding the basics, KOKALI technique developed a simple and systematic approach to solve multiplication involving single digit, 2-digit, and 3-digit without regrouping. The thematic comments analysed evidently showed support to effectiveness of KOKALI technique. Apart from that, the parents' comments interpret the effective guidance step-by-step provided in KOKALI technique as aids in teaching multiplication to their children at home.

Furthermore, the parents demonstrated a strong assurance that KOKALI technique provide a simple and consistent alternative to teaching multiplication to their children. High scores observed for questions 2,3,4, and 5. Concisely, questions 2 – 5 investigated the confidence rating of the parents for understanding and application of the technique. The parents in majority agree that the KOKALI technique is easy to understand and easy to apply. By factoring simplicity and consistency, the KOKALI technique emphasizes on easy learning curve and ease the process to understand the fundamental basics of learning multiplication. Furthermore, the parents expressed undemanding effort in teaching multiplication to their children after using KOKALI technique.

In summary, parents find that the KOKALI technique module has been helpful in facilitating their effort in teaching multiplication to their children. Articulating the fundamental multiplication skills help the children to progress through meaningful learning.

Conclusions

In overall, the KOKALI is an efficient technique as an innovation in teaching multiplication proven by in-situ mastery practice and parents' feedback. Success in this innovation are demonstrated through students' improvement in learning behaviour, high score in mastery test, as well as strong agreement and satisfaction from the parents. This study provides valuable insights into the potential of structured learning interventions for improving foundational mathematical skills among remedial learners.

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REFERENCE

Akmar, N., Khalid, A., & Maat, S.M. Increasing the Mastery of Multiplication for Primary School Students Increase the Mastery of Multiplication by Pupils.

Aladwan, S., Awamleh, W., Alfayez, M. Q. E., Shaheen, H. R. A., & Abutaha, M. S. T. (2023). Visual Perceptions Skills and its Association with Written Mathematical Communication Skills among Learning Disabilities Students in Jordan. *Health Psychology Research*, *11*. https://doi.org/10.52965/001c.89427

August, D., Barr, C., Carlson, C., Cárdenas-Hagan, E., Johnston, W. T., & Marken, A. (2023). A promising intervention designed to improve EAL learners' mathematics skills and associated academic language. *Bilingual Research Journal*, *46*(1–2), 117–141. https://doi.org/10.1080/15235882.2023.2225459

Bognar, B., Mužar Horvat, S., & Jukić Matić, L. (2025). Characteristics of Effective Elementary Mathematics Instruction: A Scoping Review of Experimental Studies. *Education sciences*, *15*(1), 76.

Boone Jr, H. N., & Boone, D. A. (2012). Analyzing likert data. *The Journal of extension*, *50*(2), 48.

Carr, J. M., Schoephoerster, K., & Riegel, C. (2024). The impact of kinesthetic instructional strategies and manipulatives on fourth grader's self-efficacy and self-confidence toward multiplication. *Mathematical Thinking and Learning*, 1–17. https://doi.org/10.1080/10986065.2024.2343036

De Los Santos, E. (2021). Special needs student developing automaticity with multiplication facts six to nine. *Deleted Journal*, *9*(12), 221–237. https://doi.org/10.31686/ijier.vol9.iss12.3582

D'Ettorre, J. (2009). Mastering the Multiplication Facts. *Online Submission*.

Grøtan, K., Sund, E. R., & Bjerkeset, O. (2019). Mental Health, Academic Self-Efficacy and Study Progress among College Students – the SHOT Study, Norway. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.00045

Kaufmann, O.T. (2019). Students' reasoning on multiplication in the context of a primary school classroom. REDIMAT – Journal of Research in Mathematics Education, 8(1), 6-29. doi: 10.4471/redimat.2019.2822

Karaman, P. (2021). The Effect of formative assessment Practices on Student Learning: A Meta-Analysis Study. *International Journal of Assessment Tools in Education*, *8*(4), 801–817. https://doi.org/10.21449/ijate.870300

Milton, J. H., Flores, M. M., Moore, A. J., Taylor, J. L. J., & Burton, M. E. (2019). Using the concrete–representational–abstract sequence to teach conceptual understanding of basic multiplication and division. *Learning Disability Quarterly*, *42*(1), 32-45.

Sönmez, N., & Alptekin, S. (2020). Teaching a Student with Poor Performance in Mathematics to Recall of Multiplication Facts Using Simultaneous Prompting with Systematic Review and Corrective Feedback. *World Journal of Education*, *10*(3), 33. https://doi.org/10.5430/wje.v10n3p33

Sullivan, G. M., & Artino Jr, A. R. (2013). Analyzing and interpreting data from Likert-type scales. *Journal of graduate medical education*, *5*(4), 541-542.

Kosko, K. W. (2020). The multiplicative meaning conveyed by visual representations. *The Journal of Mathematical Behavior*, *60*, 100800.

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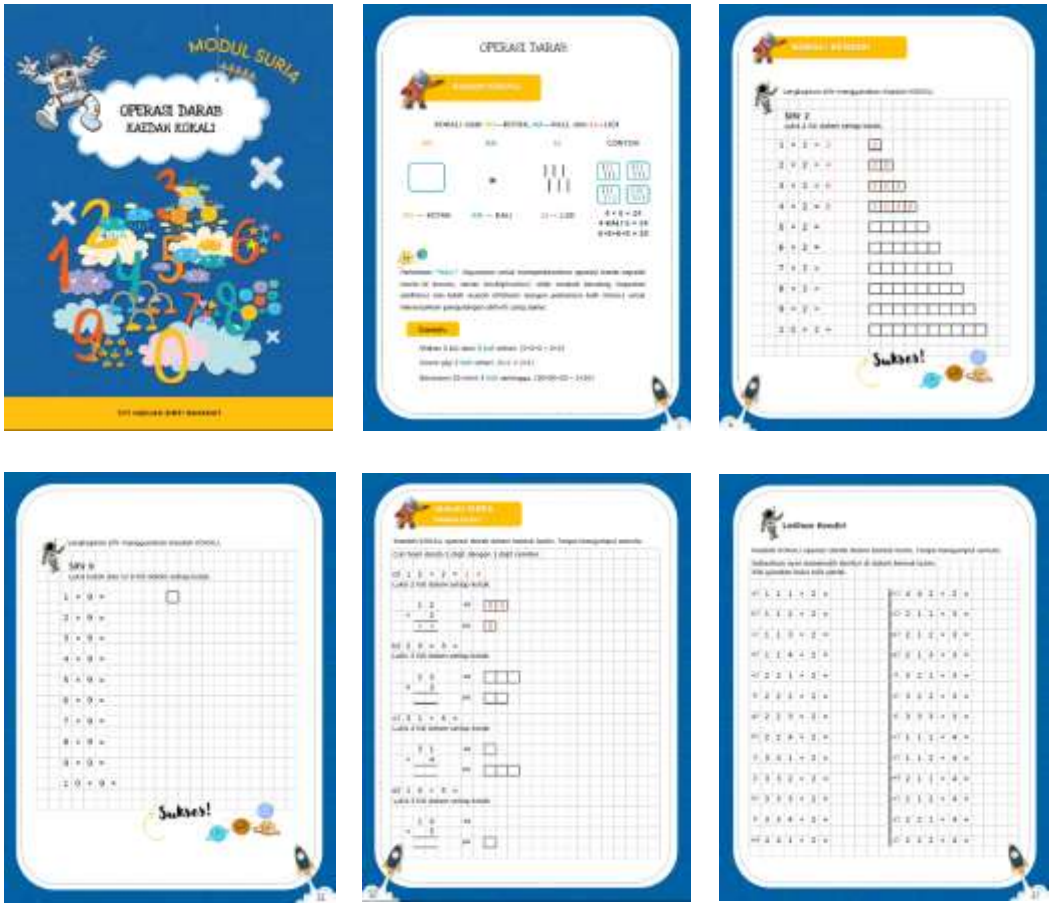
APPENDIX A – SAMPLE OF KOKALI MODULE



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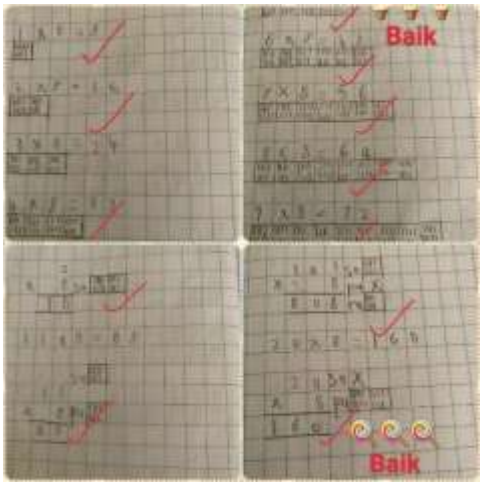
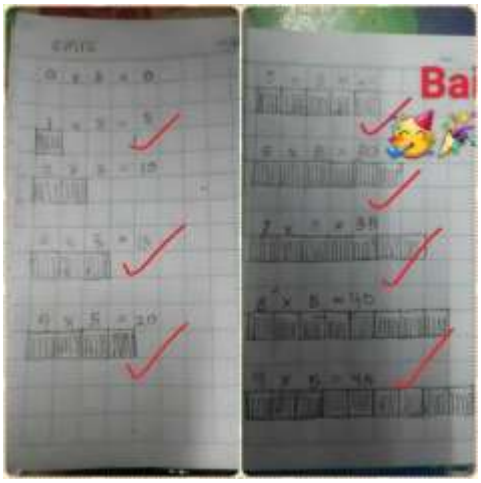
APPENDIX B – SAMPLE OF STUDENTS' WORK





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APPENDIX C - ONLINE SURVEY QUESTIONS AND RESPONSES

Maklum balas atas talian: Respons Ibu-bapa

Soalan	1. Kaedah KOKALI mempunyai hala tuju yang jelas.	2. Kaedah KOKALI mudah diaplikasikan.	3. Kaedah KOKALI amat berguna kepada ibu bapa dan anak.	4. Kaedah KOKALI dapat memberikan impak yang tinggi dalam pemahaman anak-anak bagi konsep asas operasi darab.	5. Komponen yang terkandung dalam Modul Kaedah KOKALI mudah difahami.	6. Kaedah KOKALI memudahkan murid melengkapkan Sifir 1 hingga 9 tanpa hafalan di peringkat awal.	7. Kaedah KOKALI memudahkan murid menyelesaikan operasi darab ayat matematik 2 atau 3 digit dengan 1 digit tanpa mengumpul semula.	8. Maklum balas dan cadangan dalam penambahbaikan Kaedah KOKALI - Operasi Darab.
Respondent 1	5	5	5	5	5	5	5	-
Respondent 2	5	5	5	5	5	5	5	Terbaik
Respondent 3	5	5	5	5	5	5	5	mudah buat dan senang difahami
Respondent 4	5	5	5	5	5	5	5	KEKAL CIKGU DI SEKOLAH MEMBUDAI DAN LABUAN
Respondent 5	5	5	5	5	5	5	5	BAGUS
Respondent 6	5	5	5	5	5	5	5	Kaedah mudah faham dan terbaik setakat ini
Respondent 7	5	5	5	5	5	5	5	Amat membantu
Respondent 8	5	5	5	5	5	5	5	Terbaik
Respondent 9	5	5	5	5	5	4	5	Terbaik...
Respondent 10	5	5	5	5	5	5	5	Kaedah Kokali ni boleh mudah untuk dipraktikkan. Terima kasih cikgu kerana memperkenalkan kaedah ini.
Respondent 11	5	5	5	5	5	5	5	Kaedah ini sangat mudah untuk anak2 menguasai operasi darab
Respondent 12	5	5	5	5	5	5	5	MUDAH DI FAHAMI DAN MEMBANTU ANAK2 DALAM PEMBELAJARAN
Respondent 13	5	5	5	5	5	5	5	Boleh buat lagi aktiviti macam ini.
Respondent 14	5	5	5	5	5	5	5	Saya teruja dapat menyertai program ini kerana saya juga dapat mempelajari kaedah baru yang mudah untuk mengajar anak saya di rumah.
Respondent 15	5	5	5	5	5	5	5	Sangat bagus
Respondent 16	4	5	5	5	4	4	4	Banyakan kotak pengiraan
Respondent 17	5	5	5	5	5	5	5	Sangat membantu dalam pelajaran anak-anak
Respondent 18	5	5	5	5	5	5	5	Kaedah yg baik utk anak2 yg lemah dlm sifir..
Respondent 19	5	5	5	5	5	5	5	terbaik
Respondent 20	5	5	5	5	5	5	5	teruskan usaha menyebarluaskan kaedah ini terutamanya bg ank anak tahap 1 supaya dipermudahkan urusan mereka selanjutnya
Respondent 21	4	4	4	4	5	4	4	Tiada
Respondent 22	5	5	5	5	5	5	5	Tiada
Respondent 23	4	4	4	4	4	4	4	Sangat mudah di fahami & menarik minat murid
Respondent 24	5	5	5	5	5	5	5	A
Respondent 25	5	5	5	5	5	5	5	Tiada cadangan

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