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# THE KLR MODEL: MASTERING INTEGER ADDITION AND SUBTRACTION IN GRADE 7

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## ABSTRACT

*This study aimed to determine the effectiveness of the KLR Model as an intervention in mastering integer addition and subtraction among Grade 7 students. The purpose of this experimental-qualitative study was to address difficulties in mastering these operations. The participants were 15 Grade 7 students from Asuncion National High School. The study introduced an intervention called the KLR Model (Keep it Simple, Learn the Rules, Reach Mastery), a tutorial approach aimed at enhancing students' arithmetic skills through engaging learning strategies. The pre-test and post-test results showed a significant improvement: the pre-test had a mean score of 7.39, while the post-test showed a mean score of 12.61. A paired-samples t-test revealed a statistically significant difference between the two scores, $t(14) = 9.35$, $p < .001$, indicating a highly significant improvement in integer mastery following the intervention. These findings suggest that the KLR Model effectively improved students' performance in integer operations. To provide a comprehensive understanding of the students' experiences, the researchers conducted in-depth interviews with selected participants. From their responses, nine themes emerged: Active Participation Enhances Understanding, Visual Tools Support Concept Formation, Student-Constructed Rules Deepen Understanding, Solving Independently Builds Confidence, Peer Interaction Encourages Collaboration, Conflicting Ideas Within Groups Pose a Challenge, Need for Immediate Feedback, Learning Process Improves Self-Esteem, and Self-Discovery Boosts Interest.*

**KEYWORDS:** *KLR, Mastering İnteger, Addition, Subtraction, Philippines*

## INTRODUCTION

Most students find it difficult to solve integer problems since they are confused with the usage of positive and negative signs. It is essential to understand operations of integers, but most are still challenged, which impacts their mathematics skills and problem-solving skills daily. Confusion results in errors and diminishes their confidence in math learning. Educators also experience issues such as insufficient time, overcrowded classes, and insufficient materials, which make it challenging to provide every student with sufficient assistance. Employing explicit approaches such as sign rules, number lines, and visual aids can facilitate students to better comprehend and improve in operating with integers (Harun et al., 2023; Aguhayon et al., 2023; Flores et al., 2024).

Students everywhere have difficulties mastering integer operations due to instructional and system issues. In Africa, the primary areas of concern are poor foundational instruction, inadequate trained mathematics teachers, and insufficient learning materials. Large class sizes and a lack of hands-on activities also make students depend on memorization instead of real understanding (Young et al., 2023). In the U.S., middle school students often get confused with opposite operations like addition and subtraction because teaching focuses more on steps than on deeper understanding (Ding et al., 2024). In Turkey, some math teachers are not fully trained to use tools like number lines and counters, showing a need for better teacher training in teaching math concepts (Canogullari & Isiksal-Bostan, 2024).

In the Philippines, many students struggle with math, as shown by the country's low score in the 2018 PISA test, ranking second to the last with a score of 353 in Math. The Department of Education (2019) stressed the need to work together to improve basic education, especially in topics like integers that are key to learning higher math. Local studies support this concern. In Bulacan, students at Sulivan National High School had trouble with subtracting integers, but their performance improved after using a learning tool called Mathematics League of Integers (Felipe, 2024). In Marikina City, students at Marikit Normal School also had weak skills in basic operations, including integers, mostly because they had trouble understanding lessons and fractions (Lapisboro, 2024). In Allacapan, Cagayan, Grade 7 students at Matucay National High School improved their understanding of integers using the

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"SIGNS" intervention, which included guided notes and learning tools (Campanilla, 2024).

This study looks at how well the KLR Model helps Grade 7 students at Asuncion National High School improve their skills in working with integers. Given the essential role of correctly applying positive and negative signs in mathematics, the research addresses students' common struggles that impact their academic success. By employing collaborative tutoring and paper-based surveys, the study aims to improve students' understanding and support their overall mathematical growth, responding to the urgent need for stronger foundational skills in math.

Many studies today focus on remedial tools that help students learn skills they missed during regular classes. Several studies have looked into students' struggles with integer operations. For example, the study "Evaluating Grade 7 Students' Performance in Integer Operations" aimed to assess how well students solve integer problems to guide making a Strategic Intervention Material (Flores et al., 2024). Another study, "Identification of the Difficulties of Middle School Students in Understanding the Mixed Operations of Integers," focused on students' challenges in mixed operations (Hanida et al., 2024). Also, the national study "Assessing Students' Mastery and Misconceptions in the Fundamental Operations on Integers" explored how well students understand integer operations and the common errors they make (Harun et al., 2023). However, these studies do not focus on the specific struggles of Grade 7-Dahlia students at Asuncion National High School. To fill this gap, the current study uses the KLR collaborative tutoring method to help improve their skills in integer operations.

**Research Questions**

The study aimed to find out if the KLR Model is effective in helping Grade 7 students master addition of integers. It also collects important information to answer the following questions:

1. What is the pre-test result on the level of mastering integer addition and subtraction?
2. What is the post-test result on the level of mastering integer addition and subtraction?
3. Is there a significant difference between the pre-test and post-test scores?
4. What are the insights of the students in the implementation of KLR: (Keep it Simple, Learn the Rules, and Reach Mastery) intervention?

**Proposed Intervention**

The KLR Model is strategically organized into three progressive phases, Keep it Simple, Learn the Rules, and Reach Mastery with the objective of guiding students toward a comprehensive understanding and proficiency in integer addition and subtraction. Each phase is intentionally designed to build upon the previous one, ensuring that students not only grasp the foundational concepts but also apply them confidently and accurately.

The intervention started with a pre-test in the first week. This 30-item test, based on Nurnberger-Haag et al. (2022), checked what students already knew and what wrong ideas they had about integer operations. The results helped guide the first phase of teaching by showing which topics needed more focus and clearer explanations.

In the Keep it Simple phase, the goal was to make integers easier to understand. We started by teaching the number line, using simple explanations and visuals to show how it works. We showed how integers are placed on the line and how moving left or right represents positive and negative numbers. To make it relatable, we used real-life examples like temperature and elevation. After this, students did an activity where they plotted integers on a number line by themselves. Then, they worked in groups using a worksheet to plot more integers and study how they move. Each group then shared their work with the class and explained how they solved it.

The second phase, Learn the Rules, aimed to deepen students' understanding by allowing them to construct and use and apply the rules for adding and subtracting integers based on patterns observed in Phase 1. Rather than simply presenting the rules, we encouraged student-led discovery, promoting meaningful engagement with the concepts. We provided an activity in which students analyzed a series of integer operation examples. For each example, they had to identify the type of operation adding a positive, adding a negative, subtracting a positive, or subtracting a negative, and check their answer on a checklist. This helped them categorize and internalize the nature of each operation through analytical thinking. To enhance conceptual clarity, students were once again placed into groups for a collaborative activity, where they created sample problems and demonstrated how rules apply. They discussed their solutions among peers and then presented their group output to the class.

In the final phase, Reach Mastery, students worked on practice problems with integer addition and subtraction. The problems helped improve both their solving skills and understanding. Students took turns solving on the board and explained their answers to the class. This activity focused on getting correct answers and clearly explaining their thinking.

To check how effective the KLR Model was, a post-test similar to the pre-test was given at the end of the intervention. This test measured how well each student learned to solve integer problems. Comparing the pre- and post-test results showed how much the students improved.

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| Session | Estimated Time Duration | What will happen? |
|---|---|---|
| Session 1 (Orientation and Pre-test) | 1 hour | Students was informed of the things that they will be doing for the whole intervention period. After informing them, the Pre-Test are given. |
| Session 2 (Keep it Simple Phase) | 30 minutes to 1 hour | In this session, the first phase will be implemented which is the "Keep it Simple" that focuses on simplifying abstract mathematical ideas and making them more accessible to students. |
| Session 3 (Learn the Rules Phase) | 30 minutes to 1 hour | Next is the second phase, "Learn the Rules," which helps students understand better by letting them create and apply rules for adding and subtracting integers based on patterns they saw in Phase 1. |
| Session 4 (Reach Mastery Phase) | 30 minutes to 1 hour | İn this session, the final phase will be implemented which is the "Reach Mastery" that students were given a set of practice problems involving integer addition and subtraction. |
| Session 5 (Post-test) | 30 minutes | Students will take a post-test to see how much their knowledge and skills improved from the pre-test. |

## METHODS

### Study Design

This study used a quantitative method with a one-group pretest-posttest design, a type of pre-experiment. It measured changes by comparing results before and after the intervention. Unlike experimental designs, pre-experimental designs lack a control group for comparison; instead, they focus on changes within a single group over time. The observed differences between baseline and end-line values are attributed to the project, suggesting its impact on the outcomes (Wamunyima & Nyirenda, 2023).

In this context, this method is necessary for conducting action research, aiming to evaluate the effectiveness of an intervention with an experimental group assigned to the study. The experimental group used the KLR model, a tested strategy for teaching basic integer operations.

Additionally, this study used an experimental-qualitative design, combining test results with students' personal experiences. A one-group pretest-posttest design was used to evaluate the effectiveness of the KLR model in teaching integer operations. It also gathered information on students' learning behaviors and struggles to better understand the outcomes and what caused them (Onwuegbuzie & Hitchcock, 2021).

In this study, combining numbers and personal feedback helped better understand real classroom situations. The KLR model was assessed not just through test scores, but also by observing students and listening to their reflections, which showed how their understanding and interest in learning improved.

Lastly, students shared their thoughts about the KLR model after the intervention. Their feedback was encouraged to understand their experience. Including student opinions in action research helps make teaching more focused on learners and supports ongoing improvement in teaching methods (de Vera & Ireneo, 2021).

### Participants

This research targeted Grade 7 learners through purposive sampling, a technique where particular participants are selected to align with the objectives of the research. It applied teaching techniques such as number lines and enjoyable activities such as color-coding to make students comprehend more. These tools helped make math ideas simpler and easier to understand. Because the lessons were fun, students felt more confident and improved their understanding of integers (Amini et al., 2023).

This study involved Grade 7 students from Asuncion National High School in the school year 2024–2025. Grade 7 was chosen because it is when students first learn to work with integers, making it the right time for an intervention. The KLR Model was used along with teaching strategies like number lines and fun, interactive activities. These helped students understand difficult concepts better and made learning integer operations more meaningful.

### Instrumentation

This study used one online-based questionnaire adapted from NurnbergerHaag et al. (2022) to assess students' skills in basic integer calculations. The test had 30 items, each worth 1 point, and focused on overall performance rather than specific types of problems. It showed high reliability, with Cronbach's alpha scores of 0.87 and 0.79, meaning the results are dependable.

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| Percentage Range | Rating Quality | Interpretation |
|---|---|---|
| 90% - 100% | Advance Mastery | This means that Grade 7 students showed a strong understanding of adding and subtracting integers, indicating an excellent level of mastery. |
| 72% - 89% | Mastered | This means that Grade 7 students have a strong understanding of adding and subtracting integers, showing a good level of mastery. |
| 54% - 71% | Nearly Mastered | This means that Grade 7 students have a basic understanding of adding and subtracting integers, but they still make some occasional errors. |
| 36% - 53% | Partially Mastered | This means that Grade 7 students have a limited understanding of adding and subtracting integers and often struggle to answer accurately. |
| 18% - 35% | Minimally Mastered | This means that Grade 7 students show little understanding of adding and subtracting integers and frequently make errors. |
| 0% - 17% | Not Mastered | This means the Grade 7 students lack foundational understanding in adding and subtracting integers and need significant support. |

**Statistical Treatment of Data**

The data gathered from the questionnaires were processed and analyzed using several statistical tools to identify patterns and relationships relevant to the study's goals. These analyses helped in drawing conclusions and forming recommendations based on the findings.

**Mean** was used to determine the average level of the students' mastery in operating integers.

**Standard Deviation** was used to assess how consistent the students' performances were in operating integers.

**Paired T-Test** was used to compare the students' pre-test and post-test scores, helping to determine if KLR Model had a statistically significant effect on their improvement.

**Cohen's d** was used to measure the effect size, showing how meaningful the improvement was between the pre-test and post-test scores, and evaluating the practical impact of KLR Model on the students' learning progress.

**Data Analysis**

In this study, the researchers collected data from both pre-test and post-test results. They calculated the mean scores and compared them using a paired t-test to determine if there was a significant improvement. They also examined the standard deviation to understand how much the scores varied among the students. This analysis helped identify whether there was a noticeable increase in the mean score, which would suggest that the intervention was effective.

**Coding** was used to organize and group the students' responses into categories, helping to create a structured set of themes related to their answers.

**Thematic analysis**, based on Braun and Clarke (2013), was applied by coding and interpreting participant responses to identify recurring patterns or themes in the data.

**Data reduction** was also used to simplify and condense the collected information, making it easier to analyze and present without losing important details.

**Procedure**

The researchers conducted assessments before and after the intervention to evaluate its effectiveness. The pre-test aimed to measure the mastery to operate integers of students prior to the intervention, while the post-test was designed to assess their knowledge and progress by using the same set of problems as in the pre-test. To gather the necessary data, the researchers followed these steps: First, the researcher gave permission to conduct the study by providing a formal letter to the school principal. Next, they obtained approval from the school principals where the participants were enrolled. After securing the necessary permissions, they administered a pre-test to assess the students' initial challenges in operating integers. Afterward, the KLR Model was introduced, followed by a one-month intervention period. At the conclusion of the study, a post-test was given using the same set of mastering integer problems as the pre-test to evaluate any improvements in the students' ability to master the operation. The data from both the pre-test and post-test were then collected and analyzed.

**Ethical Considerations**

The participants of this study were Grade-7 students from Asuncion National High School to ensure the sound conduct of the study, ethical considerations were addressed and considered accordingly.

Informed Consent. Informed consent involves providing participants with clear details about the study, what tasks they will do, how data will be used, and any possible risks. They must give active, signed consent, acknowledging their rights to access their data and withdraw anytime. It is a formal agreement between researcher and participant (Denzin & Lincoln, 2011).

In this study, the researcher included an informed consent question in the printed survey form, allowing respondents to decide freely if they wished to participate despite any risks.

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Voluntary participation was emphasized, and students were encouraged to respond sincerely based on the survey provided.

Risk of Harm, Anonymity and Confidentiality. The respondent's information must be consistently safeguarded and treated with utmost confidentiality, extending beyond mere anonymity by refraining from disclosing their identity or related details. Ensuring anonymity and secrecy are crucial to protecting individuals from potential damage (Denzin & Lincoln, 2011).

To prevent risks such as social liabilities, the researcher ensured all data remained private and secure. Respondents were assured that their identities and personal information would be protected. Identifiable details were removed from the data, which was anonymized and stored securely. All collected data will be destroyed three years after the study concludes.

Conflict of Interest. The researcher's current affiliations or past activities may lead to a conflict of interest, which must be openly declared in an ethics approval application. This allows the committee to offer guidance on managing the conflict (Blanco, 2023).

Nevertheless, the study's researcher affirms that the research was conducted independently, without any affiliations or financial connections that may be seen as a conflict of interest. This perspective asserts that external variables did not influence the research outcomes since the participants were also students, and the researcher had no conflicting interests with the study.

## RESULTS AND DISCUSSION

This chapter presents the findings and results of KLR model as a strategy for mastering integer addition and subtraction among Grade 7 students of Asuncion National High School. Analyses and interpretations of data were done parallel to the research objectives.

**Research Question no. 1: What is the pre-test result on the level of mastering integer addition and subtraction?**

Presented in Table 1 were the results of the pre-test, which indicated the level of mastering integer addition and subtraction of 15 students before the implementation of KLR model. The overall mean score was 46.9%, with a descriptive level of partially mastered, indicating that the level of mastery in adding and subtracting integers among Grade 7 students have limited understanding and struggle with consistent accuracy. The standard deviation was 5.11, suggesting a moderate spread of scores around the mean. The highest score was 17 out of 30, which had an equivalent percentage of 56.7%, and was achieved by 1 student or 6.7% of the population. The lowest score was 11, achieved by 1 student or 6.7% of the population, with an equivalent percentage of 36.7%. Meanwhile, the most frequent score was 13, recorded by 5 students, accounting for 33.3% of the population (n = 15). This poor performance implied that the majority of the Grade 7 students struggled with the basic rules and procedures related to adding and subtracting integers.

***Table 1. Level of mastering integer addition and subtraction of the Grade 7 students in Pre-Test***

| *Pre-Test Scores* | *Frequency* | *Percentage* |
|---|---|---|
| 11 | 1 | 6.7% |
| 13 | 5 | 33.3% |
| 14 | 4 | 26.7% |
| 15 | 2 | 13.3% |
| 16 | 2 | 13.3% |
| 17 | 1 | 6.7% |
| Total | 15 | 100.00% |
| Overall Mean | | 46.9% |
| Standard Deviation | | 5.11 |
| Description | | Partially Mastered |

To support the findings, students demonstrated only an average near mastery level in fundamental integer operations, with notable struggles particularly in addition and subtraction of integers. Their findings emphasized widespread misconceptions, such as confusion in subtracting negative numbers and applying rules for signed numbers, which directly affect students' ability to master these basic operations (Harun et al., 2023).

Similarly, many students rely heavily on memorized procedures without truly understanding the underlying concepts of integer operations. Their study revealed that this surface-level learning leads to frequent errors, especially when students are asked to solve problems involving both positive and negative numbers in varied contexts. They advocated for instructional strategies that use visual tools and contextual problems to develop a deeper conceptual grasp of integer rules (Pearn & Stephens, 2021).

In line with these findings, secondary school students often perform poorly in operations with integers due to a lack of foundational arithmetic skills and limited exposure to active learning approaches. Their study emphasized that without targeted intervention and consistent practice, students are likely to retain these gaps, which eventually hinder their overall performance in mathematics (Said et al., 2020).

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**Research Question no. 2: What is the post-test result on the level of mastering integer addition and subtraction?**

Presented in Table 2 were the results of the post-test, which indicated the level of mastering integer addition and subtraction of 15 students after the implementation of KLR model. The overall mean score was 67.56%, with a descriptive level of nearly mastered, indicating that the level of mastery in adding and subtracting integers among Grade 7 students show basic understanding but make occasional errors. The standard deviation of 6.72 in the post-test indicates a wider variation in student performance compared to the pretest. The highest score was 23 out of 30, equivalent to 76.7%, and was achieved by 3 students or 20% of the population. The lowest score was 17, achieved by 2 students or 13.3% of the population, with an equivalent percentage of 56.7%. Meanwhile, the most frequent score was 20,21, and 23, recorded by 3 students, accounting for 20% of the population (n = 15). These results showed that the students made progress in mastering addition and subtraction of integers. This improvement showed that the KLR model helped strengthen students' skills, although their overall performance still needed more improvement.

***Table 2. Level of mastering integer addition and subtraction of the Grade 7 students in Post-Test***

| *Post-Test Scores* | *Frequency* | *Percentage* |
|---|---|---|
| 17 | 2 | 13.3% |
| 18 | 1 | 6.7% |
| 19 | 2 | 13.3% |
| 20 | 3 | 20% |
| 21 | 3 | 20% |
| 22 | 1 | 6.7% |
| 23 | 3 | 20% |
| Total | 25 | 100.00% |
| Overall Mean | | 67.56% |
| Standard Deviation | | 6.72 |
| Description | | Nearly Mastered |

To support the post-test results, students shared that strategies like peer tutoring, teacher demonstrations, and self-learning really helped them improve in math. Many said that getting one-on-one help, working in groups, and watching video lessons made it easier to understand how to work with integers (Esparcia et al., 2024).

A study also explored using games to help students learn how to add and subtract integers. Games like Integer Math Maze and Intego Card Game made it easier for students to understand the topic and made learning more fun. The research indicated that interactive strategies such as these can clarify most misinterpretations and enhance integer operation skills (Jalandoni & Futalan, 2024).

In addition, there was a study concentrating on slow learners and their struggles with integer operations. It discovered that such students tend to struggle with simple concepts, such as addition and subtraction of integers. By using real-life examples and hands-on materials, the researchers saw clear improvements in the students' understanding and performance (Susilo & Prihatnani, 2022).

**Research Question No. 3: Is there a significant difference between the pre-test and post-test scores?**

Table 3 shows the result of the paired t-test that was conducted to determine whether there was a significant difference in the scores before and after the intervention, $t\ (14) = 9.35$, $p < .001$. Since the p-value (p<.001) less than the level of significance (d=0.05), the null hypothesis was being rejected. The results indicates that there is a statistically significant difference between the students' scores before and after the intervention. Therefore, it can be concluded that the intervention was effective in improving the learners' performance in integer addition and subtraction. Furthermore, the Cohen's d of 2.41 indicates a large effect size, meaning the intervention had a very strong impact on students' mastery of integer addition and subtraction

***Table 3. Significant Difference Between Pre-test and Post-test Scores of the Grade 7 Students***

| Paired Sample T-test | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **t** | **df** | **p** | **Mean difference** | **SE difference** | | **Effect Size** |
| Post-test | Pre-test | 9.35 | 14 | 0.001 | 20.7 | 2.21 | Cohen's d | 2.41 |

This supports the findings of a study showing a big improvement in first-grade students' addition and subtraction skills after a structured intervention. The results showed much higher post-test scores compared to pre-test scores, proving that focused teaching methods can lead to real and lasting progress in math (Kullberg et al., 2024).

Likewise, a study found a clear rise in students' pre- and post-test scores after using video lessons to teach subtracting

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integers. Those who watched the videos did much better after the intervention, showing that multimedia tools can effectively help improve math skills (Mabborang & Hilario, 2024).

In addition, a study showed that children with low attention improved a lot in solving math problems after a cognitive-based intervention. Their pre- and post-test scores showed clear progress, suggesting that thinking-skill strategies can help boost math performance (Cai et al., 2024).

**Research Question No. 4: What are the insights of the students in the implementation of KLR: (Keep it Simple, Learn the Rules, and Reach Mastery) intervention?**

To answer this research question, in-depth interviews were conducted with the participants. Probing questions were asked to elicit their concept regarding the insights about KLR Model. Table 4 shows the main themes that came out of the interviews, along with sample responses from the students. From their insights, nine major themes emerged: (1) active participation enhances understanding; (2) visual tools support concept formation; (3) student-constructed rules deepen understanding; (4) solving independently builds confidence; (5) peer interaction encourages collaboration; (6) conflicting ideas within groups pose a challenge; (7) need for immediate feedback; (8) learning process improves self-esteem; and (9) self-discovery boosts interest.

***Table 4: Insights of Students in the Implementation of KLR: (Keep it Simple, Learn the Rules, and Reach Mastery) Intervention***

| Emerging Themes | Supporting Statements |
|---|---|
| **Active Participation Enhances Understanding** | • *"We were the ones doing the tasks, so it was easier to understand." IDI-01*<br>• *"We were the ones exploring." IDI-02*<br>• *"We were the ones leading the learning." IDI-05*<br>• *"We were the ones doing everything." IDI-06*<br>• *"We were the ones leading, not just listening." IDI-10* |
| **Visual Tools Support Concept Formation** | • *"When we plotted on the number line, I could visualize things better." IDI-01*<br>• *"Group plotting helped, it looked easy to understand." IDI-03*<br>• *"Just from the plotting stage, it already felt lighter." IDI-04*<br>• *"Plotting part was fun and helpful." IDI-06*<br>• *"In the plotting phase, you could clearly see the pattern." IDI-09* |
| **Student-Constructed Rules Deepen Understanding** | • *"Making our own rules helped me understand." IDI-02*<br>• *"We made the rules based on our understanding." IDI-05*<br>• *"I clearly understood what to do when we made our own rules." IDI-08*<br>• *"Making the rules really made my brain work." IDI-05* |
| **Solving Independently Builds Confidence** | • *"It felt rewarding to do it on my own." IDI-03*<br>• *"I felt proud that I answered correctly on my own." IDI-05*<br>• *"I was able to do things on my own." IDI-06*<br>• *"It tested what I really knew." IDI-10* |
| **Peer Interaction Encourages Collaboration** | • *""We always worked as a team, it wasn't boring." IDI-03*<br>• *"Teamwork helped me enjoy the activities." IDI-04*<br>• *"Our group really worked together." IDI-07*<br>• *"We saw our mistakes together during solving." IDI-07* |
| **Conflicting Ideas Within Groups Pose a Challenge** | • *"We had different understandings or ideas." IDI-02*<br>• *"It was hard when others didn't cooperate." IDI-09*<br>• *"Only a few were active in the group." IDI-04*<br>• *"When we had different understandings in the group, it was difficult." IDI-08* |
| **Need for Immediate Feedback** | • *"It was hard with no immediate feedback." IDI-06*<br>• *"I wasn't sure if what we did was right." IDI-05*<br>• *"We didn't understand right away if our answers were wrong." IDI-07*<br>• *"There should be instant feedback so we know if we're right." IDI-10* |
| **Learning Process Improves Self-Esteem** | • *"I understood it myself, and now I feel more confident." IDI-01*<br>• *"I started believing in my own abilities." IDI-03*<br>• *"I trust myself more now than before." IDI-10* |
| **Self-Discovery Boosts Interest** | • *"I was the one who discovered things." IDI-02*<br>• *"This approach made me excited." IDI-04*<br>• *"I became more interested." IDI-04*<br>• *"I became more motivated because I wasn't just listening, I was actually doing something." IDI-07*<br>• *"My eagerness to learn became stronger." IDI-08* |

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The KLR model had a strong positive impact on students' understanding, motivation, and confidence in learning mathematics. The following section highlights the main themes that came out from students' reflections during the intervention.

The first theme, Active Participation Enhances Understanding, shows that students learned integer concepts better when they took part in hands-on tasks. Activities like plotting number lines and creating their own rules in the KLR model made the lessons clearer. This agrees with Sundstrom et al. (2025), who found that student-centered methods such as SCALE-UP and Tutorials improve learning. Similarly, Vozzo et al. (2024) noted that peer instruction helps students think more deeply and work together, making it easier to apply math concepts even in large classes.

The second theme, Visual Tools Support Concept Formation, emphasizes that using diagrams and number lines helped students better understand abstract ideas by making them easier to see and follow. In the KLR model, these images aided learners to visualize patterns and relations in integer operation and hence make the lessons simpler to learn and retain. Johnny (2024) agrees that visual aids enhance understanding, reasoning, and math fluency. In the same manner, Atit et al. (2020) reported that visual and manipulative use enhances spatial abilities, enhancing algebra and geometry performance with more sophisticated math thinking.

The third theme, Student-Constructed Rules Deepen Understanding, emphasizes how providing opportunities for students to construct their own mathematical rules results in more profound learning and increased motivation. Students in the KLR model learned the formal rules only after they had investigated the patterns and ideas behind them, thereby feeling more engaged with the lesson. Cao (2024) revealed that students who create their own solutions better retain the material and learn it more thoroughly. Zhang and Hwang (2023) also observed that peer-assessment promotes reflection, confidence-building, and enhanced critical thinking capabilities which are important in working through more advanced math problems.

The fourth theme, Solving Independently Builds Confidence, captures how allowing students to work independently in solving problems makes them confident in their capacity. During the "Reach Mastery" stage in the KLR model, students worked without immediate assistance, which solidified their abilities and gave them increased confidence. Moliner et al. (2022) discovered that independent working with adequate guidance enhances math confidence and makes the students more resilient. In the same way, Intaratat et al. (2024) explained that an organized but autonomous learning setting develops confidence and competence essential components for school success.

The fifth theme, Peer Interaction Encourages Collaboration, illustrates how collaboration in groups assisted students to assist one another throughout the KLR activities. They exchanged ideas and approaches, and this made learning enjoyable and not stressful. As per Jaya et al. (2023), peer interaction facilitates students in understanding better, being motivated, and performing well through the encouragement of explanation and critical thinking. Likewise, Abdul Rahman and Lee Abdullah (2024) found that peer discussions create safe and inclusive spaces where students feel comfortable asking questions, learning from each other, and building confidence.

The sixth theme, Conflicting Ideas Within Groups Pose a Challenge, highlights the struggles some students experienced during group work in the KLR activities, especially when opinions differed or when group members didn't contribute equally. While teamwork has benefits, unresolved conflicts can affect learning. Zhang and Hwang (2023) note that peer assessment can help develop critical thinking, but only when students have clear guidelines and communicate respectfully. Intaratat et al. (2024) add that teachers should build a safe and inclusive classroom atmosphere where students feel supported emotionally and can improve their social skills to handle group challenges better.

The seventh theme, Need for Immediate Feedback, points out the importance of getting timely responses, especially in math, where small mistakes can grow into bigger problems. In the KLR model, students sometimes felt unsure during independent tasks because feedback came too late. Quick feedback helps clear up confusion, reinforce learning, and avoid misunderstandings. Uchiyama et al. (2023) describe how technology has the potential to offer immediate, interactive feedback that holds students' interest. In the same vein, Porter and Bozkaya (2020) discovered that immediate feedback in online and blended learning increases student satisfaction, motivation, and academic performance through constant guidance.

The eighth theme, Learning Process Improves Self-Esteem, highlights how engaged learning helps learners develop a better perception of their intellectual capacity. According to the KLR model, students moved from supportive activities to independent problem solving, and this made them feel accomplished. Moliner et al. (2022) established that the integration of peer tutoring and technology not only enhances academic achievement but also aids in the development of emotions. When students are educated in well-organized settings with peer support, they develop self-esteem, which enables them to perceive themselves as competent learners. Intaratat et al. (2024) add that learning environments focused on progress and collaboration help build students' self-efficacy, which boosts their motivation to keep trying and leads to better academic performance.

Finally, the ninth and last theme, Self-Discovery Boosts Interest, highlights how exploring and figuring things out on their own increased students' interest in math. Through the KLR model, students worked on problems, made their own rules, and checked their understanding, which sparked curiosity and made them more engaged in learning mathematics. Tang and Tang (2021) confirm that self-discovery strengthens motivation by

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enabling students to create sense-making links with the material, which results in increased confidence and enjoyment. Additionally, Lopez and Chen (2023) emphasize that providing autonomy in learning fosters intrinsic motivation, supporting students' ability to reflect, persist, and develop critical thinking skills, key to success in more advanced mathematical concepts.

## CONCLUSION

The results showed that Grade 7 students had a low understanding of integer addition and subtraction at the start, with a pre-test average score of 46.9%, which means they only partially mastered the topic. This low score showed they often made mistakes and were confused about sign rules and basic concepts. It proved the need for an intervention to strengthen their skills in integer operations.

After using the KLR Model, students' post-test scores improved to 67.56%, showing they were close to mastering integer operations. This means they made fewer mistakes and better understood the topic. The KLR steps, Keep it Simple, Learn the Rules, and Reach Mastery helped students understand the concepts, learn the rules, and practice on their own.

Statistical analysis further confirmed the effectiveness of the intervention. A paired-samples t-test revealed a statistically significant difference between the pre-test and post-test scores, $t(14) = 9.35$, $p < .001$, indicating that students' performance significantly improved after the implementation of the KLR model. Furthermore, the Cohen's d of 2.41 indicates a large effect size, meaning the intervention had a strong positive impact on students' mastery of adding and subtracting integers. These results support the importance of using structured, student-centered approaches to help address basic math difficulties.

The interviews with students also showed the positive impact of the KLR model. Students shared that being active in class, using visual aids, making their own rules, and working with peers made math more engaging and boosted their confidence. While some faced issues like group disagreements and delays in getting feedback, most said the step-by-step approach helped them feel better about themselves and understand the lessons more. Overall, the KLR model not only improved their test scores but also their attitude and motivation to learn integers.

## RECOMMENDATION

Since the success of this intervention in resolving difficulties with integer operations among students, the researchers suggest that mathematics educators apply the KLR model to their teaching practice. This model not only enhances students' basic skills but also enhances their engagement, confidence, and interest in mathematics learning. The three distinct phases of the KLR model, Keep it Simple, Learn the Rules, and Reach Mastery can be applied to other areas of mathematics that involve robust conceptual understanding. All three phases must be incorporated into lesson plans by teachers and ensured that they are executed clearly. Also, the intervention needs to be prolonged to allow students ample time to drill, particularly in concepts such as subtraction and application of sign rules, which most students found challenging.

In the current educational environment, employing effective teaching strategies is important to meet students' various learning needs. Employing techniques such as the KLR model enables teachers to design engaging and inclusive classrooms, supporting students in overcoming challenges and establishing a solid foundation for higher-order math concepts.

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