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SCAFFULABRICKS: ENHANCING SKILLS IN FACTORING QUADRATIC EXPRESSIONS AMONG GRADE 9 STUDENTS OF KAPALONG NATIONAL HIGH SCHOOL

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ABSTRACT

This descriptive-quantitative study aimed to determine the effectiveness of the ScaffulaBricks intervention in enhancing the factoring skills of Grade 9 learners at Kapalong National High School in Maniki, Kapalong, Davao del Norte, Philippines. The ScaffulaBricks method, a scaffolded and hands-on instructional strategy, was implemented with 50 Grade 9 students during the 2024–2025 academic year. A researcher-made pre-test and post-test were used to assess students' proficiency before and after the intervention, while qualitative interviews with 10 selected students provided additional insight into their learning experiences. Pre-test results revealed that students had very low factoring skills, as measured by the Negative Number Subtraction Operation Test. Following the intervention, post-test results showed a marked improvement in performance. A paired sample t-test indicated a statistically significant difference between pre- and post-test scores, $t(49) = 23.08$, $p < .001$, confirming the substantial impact of ScaffulaBricks on student learning outcomes. Qualitative data further revealed that students found the method engaging, clear, and supportive of their understanding. These findings suggest that ScaffulaBricks is an effective strategy for improving factoring skills and promoting deeper mathematical understanding. The results support the value of integrating structured, interactive approaches into the secondary mathematics curriculum to address learning gaps and enhance overall numeracy. It is recommended that educators consider the adoption of similar evidence-based strategies to support mathematics instruction at the junior high school level.

KEYWORDS: *ScaffulaBricks, Factoring Quadratic Expressions, Grade 9 Learners, Mathematics Intervention, Quasi-Experimental*

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INTRODUCTION

Factoring quadratic expressions can be significantly enhanced through the use of inventory techniques that help students systematically identify and organize terms. According to Santos (2022), inventory-based strategies in mathematics instruction aid in breaking down complex expressions into simpler components, allowing learners to recognize factorable patterns more effectively. Likewise, Delos Reyes (2022) emphasized that incorporating structured inventories in solving algebraic expressions helps students track coefficients and constants, improving accuracy and confidence in factoring tasks. In addition, Ramirez (2022) highlighted that guided inventory checklists support learners in monitoring each step of the factoring process, reducing cognitive overload and promoting independent problem-solving. These approaches align well with the goal of simplifying quadratic expressions into binomial products using step-by-step analysis.

In Indonesia, according to Kuchemann (2024), students who have previously displayed proficiency at using algebraic techniques often have difficulty in applying these techniques in unfamiliar contexts like factoring polynomial. Specifically, it has been observed that many students are unable to use the formula $a^2 – b^2 = (a-b)(a+b)$, which is familiar to them, to factor the expression $(x-3)^2 - (x-4)^2$, which they have probably never met before. For instance, in accordance to Star et al. (2023), in the United States, students often rely heavily on procedural knowledge and struggle when asked to apply factoring in non-routine contexts. Whereas, in South Africa, research by Venkat and Adler (2022) highlighted that learners often misinterpret the structure of algebraic expressions, making it challenging for

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them to recognize factorable patterns. These studies collectively underscore the importance of fostering both procedural fluency and conceptual flexibility in teaching factoring across diverse educational settings.

In the Philippines, specifically in Kidapawan City, Ongao and Tan (2023) assert that, different schools have identified solving word problems involving factoring as one of the least learned competencies. Students must master the skills of factoring first, in order to solve more complex word problems. Many students have low proficiency and experience difficulty in factoring polynomials and the complexity of the process makes it more difficult to understand. Similar challenges have been reported in other parts of the country. In addition, in Cebu City, Delos Santos and Ramirez (2022) stated that learners often rely on rote memorization of factoring techniques without a deep understanding of underlying algebraic concepts, which hinders their ability to apply these skills in contextual problems. Consequently, in Baguio City, according to Garcia and Mendoza (2021), teachers observed that students struggle particularly with recognizing patterns in special products, such as the difference of squares, which are essential in both factoring and solving word problems.

In the Division of Davao del Norte, particularly at Kapalong National High School, many Grade 9 students encounter significant difficulties in factoring quadratic expressions. This mathematical topic presents a challenge due to its multiple steps, varying patterns, and abstract nature, which often leads to confusion among learners. A notable contributing factor is the students' limited mastery of fundamental arithmetic operations, such as multiplication and division, which serve as essential foundations for understanding factoring techniques. Moreover, the abstract presentation of polynomials and quadratic expressions in textbooks and classroom instruction often fails to establish a clear and meaningful context, making it difficult for students to grasp the relevance and application of factoring. This lack of conceptual clarity and real-world connection leads to reduced engagement, misunderstanding of objectives, and heightened levels of frustration. The combination of these cognitive and instructional challenges underscores the urgent need for innovative and scaffolded teaching strategies such as the ScaffulaBricks intervention to support students in developing stronger factoring skills and deeper algebraic understanding.

The purpose of this study is to assess the improvement in Grade 9 students' factoring skills after implementing ScaffulaBricks and to develop an intervention plan for further enhancement. A pre-test identified students at instructional and frustration levels, while a post-test measured the intervention's effectiveness. The difference between pre- and post-test results was analyzed to determine the impact of ScaffulaBricks. This action research is socially relevant as it addresses common challenges in learning to factor quadratic expressions. ScaffulaBricks makes abstract concepts more tangible through scaffolded, hands-on learning, boosting student engagement and understanding. It also fosters collaboration and is especially valuable in under-resourced settings due to its low cost and accessibility, promoting equity in education.

In review, several related studies have explored the use of innovative interventions to improve students' skills in factoring quadratic expressions. For instance, Valdez et al. (2024) introduced a game-based learning strategy through *Mathematic-Tac-Toe*, which significantly enhanced students' quadratic-solving abilities by incorporating engaging and competitive exercises. Similarly, Vicente (2024) examined the effectiveness of the *Lumi Program*, a digital platform that uses interactive visual aids to strengthen Grade 8 learners' conceptual understanding and performance in factoring polynomials. In another study, Lopez and Bautista (2023) demonstrated that peer tutoring not only improves factoring accuracy but also boosts student confidence, especially among those who find independent problem-solving in algebra challenging. These studies highlight the potential of varied instructional approaches including games, technology, and collaborative learning—to make abstract algebraic concepts more accessible and effective for learners.

Research Questions

The research questions below were to investigate reasons on how to enhance skills in factoring quadratic expressions among Grade 9 students. ScaffulaBricks was an intervention for the learners to address this problem. The research questions that guided this study were the following:

1. What is the level of students' skills in factoring quadratic expressions as measured by a pre-test before the implementation of the ScaffulaBricks intervention among Grade 9 students?
2. What is the level of students' skills in factoring quadratic expressions as measured by a post-test after the implementation of the ScaffulaBricks intervention among Grade 9 students?
3. Is there a significant difference in the quadratic expression factorization skills of Grade 9 students before and after the implementation ScaffulaBricks intervention?
4. What insights of ninth-grade students provide regarding the strengths and weaknesses of the ScaffulaBricks intervention?

PROPOSED INTERVENTION/PLAN

The researchers proposed an intervention plan called the ScaffulaBricks " Scaffolded Manipulating Bricks" is an innovative educational tool designed to enhance students' understanding of factoring quadratic expressions by transforming abstract mathematical ideas into hands-on, tangible experiences. This intervention, which took place over a four-week period from February 17 to March 7 during the National Mathematics Program (NMP), was implemented with fifty (50) Grade 9 students identified by the program head as having difficulties in mathematics, specifically in factoring. Sessions were conducted daily from 3:30 PM to 4:30 PM, with each week focusing on a progressive instructional approach to build comprehension, confidence, and engagement among learners.

During the first week, to evaluate their prior understanding of factoring quadratic expressions, students completed a 25-item pre-test. Following that, the instructor introduced and covered factoring methods such as the usage of the quadratic formula, binomials, and trinomials. Students were introduced to the

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fundamental ideas in order to pinpoint areas in which they required assistance.

In the second week, through supervised practice sessions, the ScaffulaBricks were introduced to the pupils. Students followed along with the teacher as she demonstrated each step, using the bricks as tangible examples. By building on prior knowledge, this scaffolded technique sought to improve learners' understanding of factoring.

In the third week, students worked to factor quadratic expressions in order to solve real-world challenges. They made abstract ideas more concrete by manipulating and visualizing aspects of the problem using ScaffulaBricks. This week's emphasis was on strengthening conceptual knowledge and using arithmetic in useful, meaningful ways.

In the fourth week, a 25-item post-test on factoring quadratic expressions was used to gauge the effect of the intervention. Under the guidance of the teacher, each student finished the test on their own. The objective was to assess the students' skill development and ascertain the efficacy of the ScaffulaBricks intervention.

Table 1: Matrix of the Intervention

Week	Activities	Description	Purpose/Outcome
1	Pre-test and Direct Instruction	Administered a 25-item pre-test on factoring quadratic expressions; discussed about factoring binomials, trinomials, and quadratic expressions using quadratic formula.	Assess baseline skills; familiarize students with the strategy.
2	Utilization of Manipulative Bricks and Scaffolded Learning	Teacher explained the content and let students utilize the manipulative bricks through guided practice.	Help students understand quadratic expression factorization concretely with the guidance of the more-knowledgeable-others.
3	Utilization of Manipulative Bricks and Scaffolded Learning with Real-Life Problems	Students solved problems using real-life problems and use the bricks to visualize the problem.	To use the ScaffulaBricks as a visual and manipulative tool and apply the concepts to real-world scenarios in order to assist students gain a deeper conceptual understanding of factoring.
4	Post-test and Application of Factorization of Quadratic Expressions	Administered a 25-item post-test on factoring quadratic expressions; refining students' knowledge through letting them manipulate the bricks and apply it in real-life problems.	To evaluate how well the ScaffulaBricks intervention has improved students' comprehension and proficiency with factoring quadratic expressions.

RESEARCH METHODOLOGY

Research Design

This study employed quantitative research through a one-group pretest-posttest design, a type of pre-experimental approach. It assessed changes resulting from an intervention or project by comparing values before (baseline) and after the intervention (end-line evaluation). 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 the study assigned to the study. The group was undergo a pre-test and a post-test. The students was apply the tested strategy for teaching solving factorization and practice drills.

Participants

Purposive sampling, a non-random selection technique, empowers researchers to delve into specific populations by choosing individuals, cases, or events with key characteristics aligned with the research aims. This approach, also known as judgmental sampling, leverages the researcher's expertise to identify participants who can offer the most valuable insights, unlike random selection where chance dictates participant selection (Nikolopoulou, 2023).

This study was conducted at Kapalong National High School, a public secondary school located in Kapalong, Davao del Norte. Within this institution, fifty (50) students will be purposively selected as participants in this study in which it is based on their pre-test scores. This study included 14-15 year-old students from Kapalong, Davao del Norte. The intervention focused solely on quadratic expression factorization appropriate for the participants' grade level. The researchers specifically selected Grade 9 pupils, to enhance their reading quadratic expression factorization skills as it is needed for their Algebra knowledge.

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The research aims to enhance quadratic expression factorization skills. By the end of the study, students should improve their quadratic expression factorization skills and be able to factor quadratic expressions through ScaffulaBricks.

Research Instrument

The researchers used the Negative Number Subtraction Operation Test to assess learners' factoring quadratic expressions abilities before and after the implementation of ScaffulaBricks intervention. The instrument is derived from the study of Periasamy & Zaman (2011). The Kuder-Richardson (KR-20) reliability estimation value of this instrument is 0.919544. The test will consist of 25 factoring questions: 5 items for factoring difference of squares, 1 item for factoring common monomial, 1 item for factoring perfect square trinomials, 12 items for factoring general trinomials, 2 items for solving quadratic expressions, and 4 applying factoring in word problems. The test consists of 25 points with 1 point of each correct answer.

Range of Percentage Score	Descriptive Level	Interpretation
90% – 100%	Outstanding	This means the level of mastery in factoring quadratic expressions of Grade 9 students of KNHS is outstanding.
72% – 89%	Highly Satisfactory	This means the level of mastery in factoring quadratic expressions of Grade 9 students of KNHS is highly satisfactory.
54% – 71%	Satisfactory	This means the level of mastery in factoring quadratic expressions of Grade 9 students of KNHS is satisfactory.
36% - 53%	Fairly Satisfactory	This means the level of mastery in factoring quadratic expressions of Grade 9 students of KNHS is fairly satisfactory
16% – 35%	Needs Improvement	This means the level of mastery in factoring quadratic expressions of Grade 9 students of KNHS is needs improvement.
0% - 17%	Poor	This means the level of mastery in factoring quadratic expressions of Grade 9 students of KNHS is needs improvement.

Procedure

The researchers utilized questionnaires before and after the implementation of intervention and innovation. The pre-test questionnaire will measure the average of the students who are having difficulty with quadratic expressions factorization before the implementation. The post-test questionnaire will measure the knowledge of the pupils through answering questions and determine comprehension ability. To gather the necessary data, the researchers followed these steps: First, they obtained approval from the school principals where the participants were enrolled. Next, they administered a pre-test to determine the participants' initial quadratic expression factorization levels. At the conclusion of the study, a post-test was given using the same set of test questionnaires as the pre-test to evaluate any improvements in the students' problem-solving abilities. The data from both the pre-test and post-test were then collected and analyzed. The chart below shows the topics/competencies to be covered in each week of the study.

Table 2: Intervention Schedule

Week	Content	Material / Mode of Instruction
Week 1	**Pre-test**	
	• Factoring Binomials • Factoring Trinomials • Factoring Quadratic Expression using Quadratic Formula	Direct Instruction
Week 2	• Factoring Binomials • Factoring Trinomials • Factoring Quadratic Expression using Quadratic Formula	Manipulative Bricks and Scaffolded Learning
Week 3	• Factoring Binomials with Real-Life Problems • Factoring Trinomials with Real-Life Problems • Factoring Quadratic Expression using Quadratic Formula with Real-Life Problems	Manipulative Bricks and Scaffolded Learning
Week 4	Post-test	

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Statistical Treatment of Data

In analyzing the data, the researchers tabulated the raw scores of the students from both pre-test and post-test. The following statistical tools were used to compute the data and testing the results between the two tests.

Mean. This statistical tool was used to determine the level of performance in inferential statistics among the students. The mean percentage score was also used to describe the overall performance of the students.

Standard Deviation. This statistical tool was used to measure the amount of variation or dispersion in students' scores.

Paired t-test. This statistical tool was utilized to determine the signifant difference between the pre-test and post-test scores.

Cohen's d. This statistial tool was used to assess the size of the effect of the intervention to the performance of the students in inferential statistics.

Data Analysis

In this study, data were collected through pre-test and post-test evaluations. The researchers calculated the mean scores and used a paired t-test and standard deviation to assess performance differences and variation. This analysis aimed to determine whether the intervention led to improved results.

After analyzing the test scores, interviews were conducted with students and teachers using open-ended questions. The responses were transcribed, translated, and analyzed through thematic analysis following Braun and Clarke's (2013) framework. Coding was used to identify recurring themes, allowing for a structured interpretation of participant insights.

Ethical Considerations

Adhering to ethical standards in research was crucial as it guides the true objectives of the study, such as the pursuit of knowledge, truth, and the prevention of errors, while also fostering important values like trust, accountability, mutual respect, and fairness in collaborative work. To maintain ethical research practices, this study adhered to the ethical principles outlined in the Belmont Report (2010), which include respecting individuals' autonomy, promoting beneficence and non-maleficence, ensuring justice, obtaining informed consent, safeguarding confidentiality and data protection, maintaining integrity, and addressing conflicts of interest.

RESULTS AND DISCUSSION

This section presents the findings and elaboration of results of ScafullaBricks as a strategy for factoring quadratic expressions among grade 9 pupils of Kapalong National High School. This section of the study presents the data gathered by the researchers, which was meticulously organized, presented, analyzed, and interpreted to achieve a comprehensive understanding of the collected information.

Research Question No.1: What is the level of students' skills in factoring quadratic expressions as measured by a pre-test before the implementation of the ScaffulaBricks intervention among Grade 9 students?

This chapter presents the summary of the findings about the results of enhancing grade 9 students' factoring quadratic expressions using ScaffulaBricks for solving quadratic expressions in Kapalong National High School. Analysis and interpretations of data were done parallel to the research objectives.

Table 2 presented the pre-test data on factoring quadratic expression of grade 9 learners. Out of 149 students in three different sections, there were 50 students considered as participants for this implementation. It revealed that it has an overall mean of 8.34 with a standard deviation of 3.86 indicating a wide variation in performance levels. The highest score (20) and the lowest score (1) were achieved by one student (2%), while the most frequent score was recorded by 9 students performing (18%). These results suggest diverse range of factoring abilities, with some students performing well below the average . Despite a small cluster around the mode, the overall low mean score confirms that students' factoring skills were generally weak prior to the intervention, highlighting the need for targeted and engaging instructional strategies.

Table 3. Pre-Test

Pre-Test Score	*Frequency*	*Percentage*
1	1	2%
4	5	10%
5	6	12%
6	4	8%
7	6	12%
8	9	18%
9	3	6%
10	8	16%

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11	2	4%
14	1	2%
15	1	2%
17	1	2%
18	2	4%
20	1	2%
Total	50	100.00%
Overall Mean		8.34
Mean Percentage Score		33.36%
Standard Deviation		3.86
Description		Very Low

To support the findings, Boudo and Bannor (2023) stated that, there are different ways that be effective remedies for students struggling with factoring quadratic expressions. Teachers and learners can create most of these ways in the learning process. Definitely, the struggling students in school who are not receiving remediation are making little no progress. Hence, it is essential for them to intensely take the intervention needed. Potentially, integrating solving strategies in factoring quadratic expressions into daily classroom routines could lead the improvement of the learners not only in solving, but across the curriculum. Similarly, Ramirez and Santos (2022) emphasized that targeted, scaffolded interventions help students develop stronger conceptual understanding and procedural fluency in algebra, resulting in better problem-solving performance. Moreover, Cruz and Lim (2024) found that consistent use of varied instructional approaches, including hands-on activities and collaborative learning, significantly improves students' ability to factor quadratic expressions and enhances their overall mathematical confidence.

Research Question No. 2: What is the level of students' skills in factoring quadratic expressions as measured by a post – test after the implementation of ScaffulaBricks intervention among Grade 9 students?

This chapter presents the summary of the findings about the results of factoring quadratic expressions using ScaffulaBricks in Kapalong National High School. Analysis and interpretations of data were done parallel to the research objectives.

Table 3 presents the post-test data on factoring quadratic expression of grade 9 learners. Out of 149 students in three different sections, there were 50 students considered as participants for this implementation. The group's average score was 23.08%, with 11 students (22%) achieving the highest score of 25, and one students (2%) obtaining the lowest score of 18. The most frequent score, achieved by eleven students (22%), was 25. These results highlight a range of performance levels within the group, but the majority of students performed above the group's average, reflecting overall improvement in ScaffulaBricks activities.

The mean score of 23.08 in the post – test indicates a substantial improvement compared to the pre-test results, showing the the ScaffulaBricks intervention significantly enhanced Grade 9 students' factoring quadratic expression skills through the use of ScaffulaBricks. Specifically, the intervention led to gains in several areas: improved conceptual understanding, increased accuracy in factoring, greater confidence in solving problems, and more active engagement during math activities. These results suggest that ScaffulaBricks provided a supportive and structured approach that helped students grasp challenging algebraic concepts more effectively.

Table 4. Post-Test

Pre-Test Score	Frequency	Percentage
18	1	2%
20	1	10%
21	6	12%
22	9	18%
23	11	22%
24	11	22%
25	11	22%
Total	50	100.00%
Overall Mean		23.08
Mean Percentage Score		92.32%
Standard Deviation		1.58
Description		Outstanding

To support the findings, there are previous and recent research regarding factoring quadratic expressions. One case is the study emphasized by (Koskinen & Pitkäniemi, 2022), students benefit from meaningful learning experiences that help them make sense of mathematical structures and patterns. When learners are actively engaged and given opportunities to practice and apply their knowledge, their performance on evaluations tends to improve significantly.

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With ScaffulaBricks' layered and structured help, students can factor quadratic expressions with greater clarity and confidence. This method helps students retain problem-solving techniques and improves conceptual knowledge by progressively progressing from simpler ideas to more intricate applications.

Further, based on the result, the use of scaffolding and manipulatives for Grade 9 learners is a beneficial method that has been utilized to make factoring quadratic expressions easier. This is supported by Qetrani et al. (2021) that in order to assist students grasp abstract mathematical concepts like factoring quadratic expressions, guided learning and engaging manipulation exercises have been used to make learning simpler and more relevant. The project's goal of improving students' understanding of factoring quadratic expressions through scaffolded instruction and useful tools is supported by this approach. This method not only increases students' comprehension of the subject matter but also helps them become more self-assured and independent when solving mathematical problems. Similarly, Lee and Park (2022) found that the integration of manipulatives combined with step-by-step guided instruction significantly enhanced middle school students' ability to factor and solve quadratic equations. In addition, Alonzo and Garcia (2023) highlighted that scaffolded learning paired with physical tools promoted greater student engagement and improved conceptual understanding in algebraic topics, particularly factoring.

Research Question No.3: Is there a significant difference in the quadratic expression factorization skills of Grade 9 students before and after the implementation of ScaffulaBricks intervention?

Presented in the table 4 was the result of the significant difference between the pre-test and post-test scores of the grade 9 students, $t(49) = 26.2$, $p<.001$. Since the p-value is significantly lower than the alpha level of 0.05 ($\alpha = 0.05$), the null hypothesis is being rejected. The result indicates that there is a significant difference between pre-test and post-test results of the grade 9 students. In addition, this also means that the intervention, Scaffulabricks can significantly influence the scores of the experiment group on factoring quadratic expressions.

Table 5. Significant Difference Between Pretest and Post-Test

Type of Test	*df*	*Mean difference*	*SE difference*	*t-value*	*P-value*		*Effect Size*	*Decision α=0.05*
Pre-Test		14.7	0.562	26.2	< .001	Cohen's d	3.71	Significant
Post-Test	49							

A total of 50 students participated in this study, where their factorization in quadratic expression is measured both before and after using the ScaffulaBricks. As presented in Table 3, the pre-test and post-test scores were compared to determine the effectiveness of this intervention. The mean score for the pre-test is 8.34 with a standard deviation of 3.86. This shows a moderate variability in students' skills in factoring quadratic expressions before the conducted intervention. After the application of the ScaffulaBricks, the mean score increased substantially to 23.08 with a standard deviation of 1.58, showing not only an increase in scores but also a decrease in variability, suggesting a more consistent improvement among the students.

The use of ScaffulaBricks as a teaching tool has improved students' arithmetic abilities with encouraging results. The study by Tompong and Tanudtanud (2022) found that students' comprehension and proficiency of factoring quadratic expressions were greatly enhanced by the application of scaffolded and organized learning methodologies. According to their findings, learners were considerably assisted in understanding complex factoring procedures more easily and accurately via step-by-step guided techniques. The findings of the current study lend credence to ScaffulaBricks' ability to enhance student performance and produce more reliable learning outcomes. This implies that ScaffulaBricks' structured learning pathway successfully filled in each student's learning gaps and promoted a more thorough, consistent comprehension of the material. Similarly, Bautista (2020) demonstrated that the use of scaffolded instructional tools significantly increased high school students' problem-solving skills in Algebra, emphasizing the effectiveness of structured learning in mathematics instruction. In addition, Ramos and De Leon (2021) highlighted that scaffolded interventions using visual aids and manipulatives led to higher retention and engagement levels among junior high school students, particularly in lessons involving abstract mathematical concepts.

Research Question No.4: What insights did the feedback from ninth-grade students provide regarding the strengths and weaknesses of the ScaffulaBricks intervention?

Presented in this table are the themes and sample statements of Grade 9 students of Kapalong National High School regarding their insights, recommendations, and suggestions about the implementation of the intervention of this study, which is ScaffulaBricks.

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Table 4. Themes and Sample Statements on the Insights of Grade 9 Students Regarding the Use of ScaffulaBricks in Factoring Quadratic Expressions

Emerging Themes	*Sample Statements*
Made Factoring Quadratic Expressions Easier	• "ScaffulaBricks made factoring quadratic expressions easier to understand, because it broke the steps into smaller pieces." (IDI 01) • "I understood factoring better because ScaffulaBricks helped me focus on one part at a time instead of trying to do everything at once." (IDI 03) • "At first, it was really very difficult for me because I did not know what to do or what its use was or what it was really for, sir, and it was really very confusing for me. So for me, ScaffulaBricks is very helpful and useful, sir, because it helped me learn factoring polynomials. I became more familiar with the ways to solve or arrange the variables and numbers, and I understood its value better." (IDI 05) • "ScaffulaBricks made it easier for me to understand and solve factoring quadratic expressions. I realized that it is actually an easy topic, it just really needs a more concrete approach for us to better understand factoring." (IDI 10)
Provided an Engaging Learning Experience	• "Compared to our regular lessons, it felt less overwhelming and more hands-on." (IDI 01) • "I felt like I was solving a puzzle, which made the activity more engaging and the friendly competition with classmates added an extra layer of fun." (IDI 02) • "It encouraged me to work harder because it felt more like a game. I did not feel scared of making mistakes because I could fix them easily." (IDI 03) • "It motivated me because I understood more about the ScaffulaBricks intervention, and it also made the lesson fun." (IDI 04) • "We were already manipulating the mini bricks, sir, together with my classmates. It was a very interesting and fun way for me to learn about that topic." (IDI 05)
Clarified the Essence of Factoring Quadratic Expressions	• "At first, I really found this difficult, sir, because I did not know how to do it or what its purpose was. But when I started using ScaffulaBricks, that is when I truly understood factoring polynomials." (IDI 06) • "At first, I really did not understand what this was for or if it could be applied to daily situations, and I wondered why we needed to study it. But now that I have learned how to solve using ScaffulaBricks, that is when I truly understood factoring quadratic expressions." (IDI 07) • "At first, I really found this difficult because I did not understand its purpose or if it could be applied as entertainment. But when we started using ScaffulaBricks, that is when I really understood factoring." (IDI 09)
Helped Learners Visualize Factoring Problems	• "The part or steps where we had to build the expressions step-by-step using the colored bricks helped a lot. Seeing the factors visually made it stick in my mind better, and it really clarified how each part of the expression comes together." (IDI 01) • "This intervention really motivated me to factor quadratic expressions because it made things easier and helped me visualize in my mind what happens in the expression. Like when factoring polynomials, it actually becomes easier once you understand it, you even start to enjoy it while at the same time learning how to factor polynomials." (IDI 06) • "For me, it really had an impact because I understood factoring polynomials better since I could visualize the expressions more clearly compared to regular activities that are hard to understand." (IDI 07) • "For me, ScaffulaBricks made factoring quadratic expressions more visual and easier compared to just reading from a book or textbook." (IDI 08) • "In a way, it allowed us to visualize factoring, and it was engaging for us since there was collaboration involved." (IDI 10)
Step-by-Step Process Enhanced Understanding of Factoring Quadratic Expressions	• "The step-by-step building guide was the best part. It showed me clearly which parts multiplied to make the middle term." (IDI 02) • "The ScaffulaBricks intervention helped in factoring polynomials and made it easier through the use of a structured, multi-step approach that built on previous knowledge." (IDI 06) • "For me, the step-by-step process really helped me understand factoring quadratic expressions, from introducing the lesson all the way to the part where we manipulated the mini bricks." (IDI 10)

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Scaffolding Strategies Supported Students in Factoring Quadratic Expressions	• "It was a great help when you introduced the concept to us and taught us about polynomials. We became more interested because it was fun, and we learned a lot from what you taught us." (IDI 04) • "Your teaching on the concept of factoring quadratic expression really helped me, and the step that helped me understand the concept better was when we started using the mini bricks." (IDI 08) • "For me, what really helped was when you first taught us the meaning or concept of factoring. It was during that part when I started to focus more." (IDI 09)
Learners Experienced Confusion with Numerical Coefficients and Variables	• ...I was also confused about how to approach it because there were so many numbers and variables, and I did not fully understand the main use of ScaffulaBricks." (IDI 05) • "For me, at the beginning, when the lesson was still new, I struggled and got confused about where to place the letters and numbers." (IDI 06) • "Maybe it was when we started solving those expressions that we got confused because it was a new topic that was just introduced to us, and we were kind of shocked by the variables because it became much harder." (IDI 08) • "For me, it was just at the beginning, when the lesson was still being taught, sir. It was a bit confusing because we only saw letters and numbers." (IDI 09)
Need to Incorporate More Complex Factoring Problems	• "I would suggest having more examples with harder quadratics, like when $a \neq 1$, so we get even better practice." (IDI 03) • "Maybe making the bricks more numerous and more challenging would help, so that it would be easier to see how far the students' knowledge and abilities go." (IDI 05) • "What I want to improve is the bricks; I want them to be more numerous because the more bricks there are, the more challenging it becomes, and you can understand it better that way." (IDI 08) • "There should be more complex or challenging items added so that students can immerse themselves in different kinds of problems in factoring quadratic expressions." (IDI 10)
Include More Practice Problems and Bricks During the Intervention	• "For me, if there is something I would improve in the ScaffulaBricks intervention, it would be to increase the number of problems, like how to factor quadratic expressions, because I think it would make it more fun if there are more to solve." (IDI 04) • "My suggestion to improve ScaffulaBricks is to add more problems so that our knowledge about factoring quadratic expressions can be further improved." (IDI 07) • "For me, what I want to improve is that the bricks should be more numerous." (IDI 09)

The study found that the intervention effectively improved students' proficiency in factoring quadratic expressions. Using scaffolding and manipulatives proved to be a beneficial strategy for Grade 9 learners, making the topic easier to understand. According to Lange (2021), guided learning and engaging manipulation exercises help students grasp abstract mathematical concepts more meaningfully. This aligns with the project's goal of enhancing students' comprehension of factoring through scaffolded instruction and hands-on resources. Similarly, Shatri and Sejdiu (2021) emphasized that visual and tactile tools support conceptual understanding, particularly for students who struggle with abstract reasoning. Musa and Ahmad (2022) also reported that structured manipulatives in algebra lessons significantly boosted student engagement and problem-solving accuracy.

Additionally, ScaffulaBricks transformed traditional teaching by using interactive, student-centered strategies that promoted active participation. It combined scaffolded learning with manipulatives, creating an engaging environment for Grade 9 students to understand factoring quadratic expressions. Merle (2024) highlighted that gamification elements, like interactive tasks and challenges, enhance student motivation and engagement. Similarly, Adom and Opoku (2022) emphasized that manipulative-based, student-centered instruction improves conceptual understanding and problem-solving confidence. These findings support the effectiveness of ScaffulaBricks in making abstract algebra concepts more accessible and engaging.

Moreover, clarifying abstract mathematical concepts, such as factoring quadratic expressions, is essential in helping students build a strong foundation in algebra. In connection, according to Staff (2024), learning strategies that are structured and scaffolded aid in the clarification of difficult mathematical ideas by decomposing them into digestible steps. This idea was demonstrated by ScaffulaBricks, which helped students comprehend the factoring process by combining visual aids and manipulatives to make each step more tangible. Students were consequently better equipped to understand the fundamentals of factoring quadratic expressions with more assurance and clarity. Supporting this, Cheng and Tsai (2021) found that when learners interact with physical and visual representations of abstract math concepts, their cognitive load is reduced, leading to increased comprehension and retention of mathematical procedures.

Furthermore, ScaffulaBricks is a method that was created to assist Grade 9 students in visualizing and comprehending the factoring process of quadratic expressions. It mixes scaffolding approaches with manipulatives. Scaffolded education enables pupils to understand mathematical tasks progressively, leading

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to improved comprehension, according to Lei et al. (2020). Furthermore, manipulatives work as tangible examples that assist connect abstract ideas and make them simpler to understand. It was also underlined that this method improves students' capacity to properly conceptualize and solve factoring problems while promoting active learning. Similarly, Kabaca and Kose (2021) emphasized that using structured manipulatives in algebra instruction boosts learners' engagement and significantly improves their procedural and conceptual fluency in solving quadratic expressions.

Likewise, ScaffulaBricks emphasized a methodical teaching strategy to help Grade 9 students develop a structured understanding of factoring quadratic expressions. Herawaty et al. (2021) noted that breaking the process into sequential steps reduces cognitive overload and improves procedural fluency. Ayu and Kartinah (2022) supported this by showing that step-by-step strategies enhance problem-solving accuracy and lower math anxiety.

Besides, ScaffulaBricks employed scaffolding techniques to give pupils the crucial assistance they needed to successfully negotiate the challenges of factoring quadratic expressions. According to Ihechukwu (2020), scaffolding strategies that include giving students signals, hints, and detailed instructions greatly enhance their capacity to participate in difficult mathematics assignments. These techniques were used in the ScaffulaBricks context to help Grade 9 pupils factor quadratic expressions at each step and make sure they fully grasped the procedure. ScaffulaBricks provided students with organized assistance, which helped them gain confidence and progressively move toward problem-solving on their own. Similarly, Santos and Mendoza (2022) emphasized that scaffolding boosts learners' ability to retain conceptual knowledge and apply it independently when gradually released from teacher guidance.

In another study, Wulandari and Hidayat (2023) found that students taught through scaffolded learning in algebra showed significantly higher engagement and accuracy than those taught through traditional lectures. ScaffulaBricks aimed to support students who struggled with factoring quadratic expressions, particularly due to confusion between numerical coefficients and variables. Baybayon and Lapinid (2024) emphasized that this confusion often leads to errors and misconceptions in solving quadratic expressions.

Further, ScaffulaBricks provided a foundational method for factoring quadratic expressions, incorporating more complex tasks is essential to further challenge students and enhance their skills. Çelebi (2023) emphasized that while initial scaffolding supports understanding of basic concepts, increasing task difficulty promotes deeper critical thinking and problem-solving abilities. Main (2023) found that students given structured support improved their problem-solving skills, especially when progressing from simple to complex problems. Their study highlighted the value of scaffolding in guiding learners through various stages of difficulty with appropriate support. Similarly, Tay and Toh (2023) proposed a scaffolding model that stresses the importance of planning in mathematical problem-solving. Their research showed that structured guidance during the planning phase helps students effectively approach and solve complex tasks. Incorporating these strategies can strengthen students' comprehension and performance in advanced mathematical challenges.

Added to that, ScaffulaBricks aimed to enhance student learning through structured exercises, but its effectiveness could be improved by integrating more practice problems and the use of actual bricks. Cowan (2021) emphasized that consistent practice and repetition are essential for reinforcing mathematical skills and supporting long-term retention. Increasing the use of physical learning tools can also boost student engagement and deepen conceptual understanding. In the ScaffulaBricks setting, expanding the range of problem sets and manipulatives would give students more opportunities to apply their knowledge and refine their factoring skills. Baruiz and Dioso (2023) found that, students who used manipulatives scored significantly higher on math assessments, concluding that tangible materials help make abstract concepts more understandable and enhance overall achievement.

CONCLUSION

The study confirms that Scaffulabricks is an effective tool for strengthening students' mathematical proficiency, particularly in factoring. The program's structured approach—which emphasizes guided steps, conceptual understanding, and procedural accuracy provides students with the necessary tools to approach factoring with confidence. Even within a short time frame, learners showed marked improvements, proving the efficiency and effectiveness of the intervention.

Additionally, the positive outcomes of Scaffulabricks suggest that similar structured learning strategies may be useful for other students who find factoring and related algebraic concepts difficult. When students are given clear, step-by-step support and engaging learning activities, they are more likely to build confidence, improve academically, and become better prepared for more complex mathematics in the future. Developing a strong foundation in algebra is essential for success in higher levels of education.

In summary, Scaffulabricks has proven to be an effective instructional technique in teaching factoring quadratic expressions. It significantly enhances students' understanding and problem-solving skills in this area. This improvement contributes to their overall performance in mathematics. Moreover, it prepares them to meet future academic challenges with greater confidence.

One of the main challenges students face with factoring is the absence of structured support and engaging instruction. For this reason, sustaining student interest and building understanding through scaffolded methods is critical. Based on the study's results, interactive and step-based approaches like Scaffulabricks are seen as effective ways to enhance mathematical learning.

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The participants in this study were Grade 9 students from Kapalong National High School. They were selected to assess the effectiveness of the intervention. The focus was on factoring quadratic expressions, which is both a foundational and challenging topic in mathematics. Many students at this level often struggle with understanding and applying factoring techniques. The intervention aimed to address these difficulties through targeted instructional strategies.

The researchers concluded that Scaffulabricks is a beneficial approach for helping students strengthen their factoring skills. They suggest using this strategy for students who are struggling, as well as those who are developing or mastering their skills. The team intends to continue implementing this approach and recommends that the Schools Division consider adopting it more broadly. Future research should also explore applying this strategy to other areas of algebra and involve a larger and more diverse group of learners for broader applicability.

RECOMMENDATION

Based on the findings of the study, it is recommended that educators integrate ScaffulaBricks into classroom instruction to enhance students' skills in factoring quadratic expressions, particularly for those struggling with abstract mathematical concepts. Teachers should receive training to effectively implement this scaffolded, hands-on strategy and adapt it to varying learner needs. School administrators are encouraged to support its integration into remedial and regular mathematics programs, while continuous monitoring and feedback collection should be conducted to evaluate and refine its effectiveness. Future researchers may also replicate the study in different settings or apply the method to other algebraic topics to broaden its impact and validate its applicability.

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