

# The Efficacy of a Validated Strategic Intervention Material in Multiplication of Fractions

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## ABSTRACT

*This study investigated the efficacy of a Validated Strategic Intervention Material (SIM), in enhancing fifth-graders' proficiency in Multiplying Fractions. A pretest-posttest quasi-experimental design was employed with 43 learners of Hamogaway Elementary School as the participants of the study, divided into control and experimental groups. The learners in the experimental group were taught using the SIM, while the control group received traditional instruction. The results revealed significant improvement in the experimental group's multiplication skills compared to the control group. Learners exposed to SIM achieved a substantially higher mastery rate (62%) compared to the control group (23%). Analysis of gain scores further supported this finding. Learner feedback regarding the SIM was generally positive. The learners rated highly the content, clarity, applicability, usefulness, and format of the SIM. Areas for minor improvement included factual accuracy of information, promoting independent learning, and clarity in specific sections. Based on the findings, the study recommends widespread adoption of the SIM, teacher training for effective implementation, further research on learning styles and addressing challenges, and dissemination of the improved SIM for broader impact.*

## KEYWORDS

*strategic intervention material; control group; experimental group*

## INTRODUCTION

Mathematics is essential in education, providing foundational knowledge and problem-solving skills for success in various fields. Within mathematics, understanding and mastering fractions play a crucial role. Fractions are a fundamental component of mathematics, requiring learners to attain proficiency in this area (Wulandari et al., 2018; Hoyles, 2018). Prior to the outbreak of the COVID-19 pandemic, the Philippines struggled with challenges in Mathematics Education. Polong (2020) reported that the Philippines has one of the lowest rankings in reading, math, and science, based on a 2018 study. The Philippines ranked in the low 70s among 79 countries in the 2018 Program for International Student Assessment (PISA), an assessment taken by 15-year-old learners across the globe conducted by the Organization for Economic Cooperation and Development (OECD). Filipino learners ranked 79th in reading with a score of 340, compared to the OECD average of 487. Mathematics and science rankings were also low, with scores of 353 and 357 points, respectively, compared to an OECD average of 489 for both categories.

The declining Mathematics scores at Hamogaway Elementary School, particularly in the Multiplication of Fractions competency, highlight an urgent need for effective instructional strategies. Before the pandemic, the school maintained an average Mathematics score between 75 and 80 percent. Despite a notable improvement to an 81 percent average during

the pandemic, driven by parental support and online resources, the scores dropped to 70 percent when face-to-face classes resumed for the school years 2022-2023 and 2023-2024.

One of the critical issues identified at Hamogaway Elementary School was the struggle to solve fractions' multiplication problems among Mathematics 5 learners. These challenges underscore the necessity for innovative teaching methods to bridge the learning gaps made worse by the pandemic. Strategic Intervention Materials (SIMs) have been suggested as a potential solution to enhance understanding and learning outcomes in this area. However, there was a lack of empirical evidence supporting the effectiveness of SIMs in improving performance and comprehension in fraction multiplication.

This study aimed to address the specific educational challenges faced by Hamogaway Elementary School by investigating the impact of SIMs on learners' performance in multiplying fractions. By conducting this research, the researcher sought to provide empirical evidence on the efficacy of SIMs, thereby offering a data-driven approach to improving Mathematics education at Hamogaway Elementary School. This study's findings would inform instructional practices and contribute to closing the learning gaps, ultimately enhancing the educational achievement of the learners in Mathematics.

### ***Theoretical Framework of the Study***

This study was based on Piaget's constructivist learning theory. This theory proposed that individuals actively build knowledge and understanding of the world through their experiences and interactions with the environment. It also emphasized that learning is not simply the passive acquisition of information but rather an active process in which learners actively engage with new experiences and construct meaning from them.

According to Piaget, learners go through stages of cognitive development, and their understanding of concepts and ideas evolves as they interact with the world around them. Piaget's theory emphasized the role of learners' prior knowledge and experiences in shaping their understanding. This theory suggests that individuals build upon their knowledge and experiences when confronted with new information or situations. By actively engaging with new information, learners can assimilate it into their mental structures or schemas.

Additionally, constructivist learning complied with the SIM's design; it was hypothesized to involve active learning, building upon prior knowledge, and spreading scaffolding over time. SIM promoted the assimilation and accommodation of information, which leads to equilibrium- the state of balanced expertise. Interactive manipulatives and differentiated tasks exemplify these processes. Peer interaction and collaboration, aligned with social constructivism, further enrich learning. The study measured learners' performance, gains, and perceptions of the SIM to assess its efficacy in promoting constructivist learning.

### ***Objective of the study***

This study determined the Efficacy of a Validated Strategic Intervention Material (SIM) in Mathematics 5 on Multiplication of Fraction.

## **RESEARCH METHODS**

### ***Research Design***

A pretest-posttest quasi-experimental design was used in the study, which permitted the evaluation of the intervention mean without randomization. Quasi-experiments were based on standardized trials and were used to demonstrate a cause-and-effect link between an intervention and the outcome. In a quasi-experiment, the researcher organized the participants into experimental and control groups. The experimental group in this design

encountered the intervention materials using strategic intervention materials to teach the multiplication of fractions, while the control group experienced the traditional approach.

The researcher collected data by administering both groups a pre-test and a post-test. The pre-test was administered before the intervention, and the post-test was administered after the intervention. Then, the researcher compared the mean gain scores of the two groups to determine the efficacy of the intervention.

### **Research Locale**

The research was conducted at Hamogaway Elementary School, East district, Bayugan City Division. Situated in the heart of Barangay Hamogaway, Bayugan City, Agusan del Sur, Philippines, with a coordinate of 8.71132° N 125.79398° E, the school served as the arterial route of the national highway, reflecting the interconnectedness of its educational mission with the broader community.

Hamogaway Elementary offered a comprehensive education committed to DepEd's goals by ensuring equitable, quality education. Selected for research on its innovative environment, it provided crucial access to study the efficacy of SIMs, reflecting the school's dedication to educational excellence.

### **Population as Respondents of the Study**

In the current school year 2023-2024, Hamogaway Elementary School has 237 officially enrolled learners, of which 43 were formally enrolled in the fifth grade and were the study's participants.

**Table 1.** The Sex Distribution of the Respondents of the Study

<b>Sex</b>	<b>Control Group</b>	<b>Experimental Group</b>	<b>Total</b>
Male	10	10	20
Female	12	11	23
<b>Total</b>	<b>22</b>	<b>21</b>	<b>43</b>

### **Sampling Design**

This study utilized intact groups as the participants of the study, thereby collecting data from the entire population of Grade 5 learners at Hamogaway Elementary School.

### **Research Instrument**

The study's research instruments consisted of a 20-item test questionnaire with a Table of Specifications (TOS) and the evaluation tool for the perception of learners regarding the SIM.

The 20-item test questionnaire focused on assessing the least mastered competency, which involves the multiplication of fractions. The TOS was provided, ensuring that the questions covered a range of cognitive levels according to Bloom's Taxonomy. This approach allowed researchers to evaluate the intervention's effectiveness across different cognitive complexity levels.

The Evaluation Tool provided data on how learners perceived the SIM regarding content and accuracy, clarity, appropriateness, applicability, usefulness, and format. The Likert Scale was utilized to measure participants' responses.

### **Validity and Reliability of the Research Instrument**

The researcher used a 20-item test questionnaire to assess the efficacy of the SIM and the evaluation tool on how learners perceived the SIM. The test questionnaire and the evaluation tool were adopted from the Learning Resource

Management System (LRMS) in Bayugan City, which underwent a content validation process by Master Teachers and an Education Program Supervisor in Mathematics from the Bayugan City Division.

These instruments were not subjected to reliability analysis since DepEd Bayugan City had previously used these instruments extensively; the researcher had assumed the reliability had already been established through past usage and feedback.

### **Data Gathering Procedure**

The researcher sought approval to conduct the research through a request letter to the Schools Division Superintendent (SDS). Once SDS approval was obtained, the researcher sought permission from the school principal. Subsequently, the researcher conducted an orientation for all Grade 5 learners. Following this orientation, the research commenced its testing phase. The pre-test and post-test administered to both groups consisted of identical questions. The pre-test was given before the intervention, and the post-test was given after the intervention.

### **Scoring and Quantification of Data**

This section explained the methods and procedures for quantifying the data on the Efficacy of a Validated Strategic Intervention Material in Multiplying Fractions. Quantifying the data facilitated the demonstration of the SIM's efficacy, the ascertainment of whether a significant difference was captured in the mean gain scores of the two groups, and the learners' perceptions regarding the SIM they used.

### **Statistical Treatment**

The data collected was analyzed and interpreted employing the following statistical tools:

The level of performance by each group on the pre-test and post-test was examined using descriptive statistics, mean, and standard deviations. The descriptive statistics analysis helped the study understand the two groups' performance levels.

A paired T-test was employed to establish the significant difference between the mean gain scores of the two-post-test data.

## **RESULTS AND DISCUSSION**

### **The Level of Pre-test Performance of the Learners in Both Groups**

The pre-test serves as a baseline, allowing researchers to assess whether the groups were similar in prior knowledge before the intervention. According to Hill (2020) pre-test scores provide an essential baseline for the study's internal validity, and the similar scores between the two groups reinforce this validity.

**Table 2.** Pretest Performance of the Learners in the Control Groups and in the Experimental Group

Score Ranges	Experimental Group		Control Group		Total		Descriptive Level
	<i>(Using SIM)</i>		<i>(chalk-talk)</i>		n	%	
	n	%	n	%	n	%	
18-20	0	0	0	0	0	0	Highly Mastered
15-17	0	0	0	0	0	0	Mastered
12-14	4	19	4	18	8	19	Nearly Mastered
0-11	17	81	18	82	35	81	Not Mastered
<b>Total</b>	<b>21</b>	<b>100</b>	<b>22</b>	<b>100</b>	<b>43</b>	<b>100</b>	

Table 2 shows the pre-test performance of the learners in the control group and the experimental group. It can be gleaned from the above that the pre-test performance of the learners in the (control group is presented in the "control

Group" column; 18% of the learners scored in the "Nearly Mastered" range 12-14, while 82% scored in the "Not Mastered" range 0-11. On the other hand, the "Experimental Group" column presents the pre-test performance of the learners using the SIM. The table shows that 19% of the learners scored in the "Nearly Mastered" range of 12-14, and 81% scored in the "Not Mastered" range of 0-11. The data from the Table portray a negligible difference in pre-test scores between the groups. This minimal difference (1%) suggests similar prior knowledge level among learners in both groups appropriate baseline data for the research design.

The similarity in prior knowledge strengthens the study's design by reducing potential threats to internal validity. The research can more accurately attribute any observed differences by accounting for pre-existing knowledge. The findings served as the basis for a more precise evaluation of the relative effectiveness of the two approaches.

These findings align with previous quasi-experimental studies by Dumape (2020) and Rosal et.al (2022), who also reported similar pre-test performance between the two groups and found no statistically significant differences.

### ***The Level of Post-test Performance of the Learners in Both Groups***

A post-test in a quasi-experiment is an assessment conducted after the intervention has been introduced. It aimed to measure the outcome variable and gauge the intervention's impact on the learners' performance in multiplying fractions.

Before the post-test was administered, the researcher conducted ten lecture sessions on both groups (control and experimental). Each session had formative assessments in which results were recorded and analyzed. For those sessions, the researcher observed that learners in the experimental group were more engaging and active during the discussion; they were eager to read, learn, and answer the activities given since the SIM was provided. On the other hand, learners in the control group were also active during the first two days of the sessions. In the later sessions, the researcher observed dull moments along the way, wherein some did not listen attentively to the chalk talk discussion maybe because of the traditional lecture format, relying solely on the teacher's voice, sessions might have become monotonous. This led to decreased focus and participation as the sessions progressed.

**Table 3.** Posttest Performance of the Learners in the Control Groups and in the Experimental Group

Score Ranges	Experimental Group		Control Group		Total		Descriptive Level
	<i>(using SIM)</i>		<i>(chalk-talk)</i>				
	n	%	n	%	n	%	
18-20	5	24	0	0	5	12	Highly Mastered
15-17	8	38	5	23	13	30	Mastered
12-14	7	33	3	13	10	23	Nearly Mastered
0-11	1	5	14	64	15	35	Not Mastered
<b>Total</b>	<b>21</b>	<b>100</b>	<b>22</b>	<b>100</b>	<b>43</b>	<b>100</b>	

Table 3 demonstrates the post-test performance of the learners in the control group, which was taught with the chalk-talk method, and the experimental group, which was taught using the SIM. In the experimental group, a significant

number of learners scored "Highly Mastered" and "Mastered," which is 24% and 38% of the learners, respectively. In the control group, a few learners scored "Highly Mastered" and "Mastered," which is 12% and 30% of the learners, respectively.

The results from Table 3 demonstrate a clear advantage for the experimental group. Significantly more learners in the experimental group scored within the "Highly Mastered" and "Mastered" categories compared to the control group. It aligns with the notion that SIM's interactive nature, incorporating visuals, activities, and differentiated instruction, caters to diverse learning styles and fosters a deeper understanding than rote memorization in chalk-talk methods. This engaging approach likely boosts motivation and allows learners to progress at their own pace.

These findings further strengthen the argument that SIM can be a valuable pedagogical tool, as supported by similar studies demonstrating improved learning outcomes in learners using SIM compared to traditional methods (Dumigsi & Cabrella, 2019; Aranda et al., 2019).

### ***TTest of Significant Difference Between Gain Scores of Both Groups***

Table 4 shows the result of the independent t-test which was employed to determine whether there was significant difference between the gain scores of the learners in the experimental group and in the control group. It can be gleaned from the above Table that the mean gain scores of the learners in the experimental groups is 6.57 and 2.18 in the Control group. The t-value of 6.976 at  $p=.000$  indicates a very significant difference in the gain scores of the learners in the two groups. Thus, the null hypothesis is rejected.

**Table 4.** Independent t-test on the Gain Scores of the Learners in the Control Group and in the Experimental Group

<b>Group</b>	<b>Mean Difference</b>	<b>t</b>	<b>p-value</b>	<b>Decision on H<sub>0</sub></b>	<b>Interpretation</b>
Experimental Group	6.57	6.976**	.000	Reject H <sub>0</sub>	Significant
Control Group	2.18				

\*\*significant @  $p<.01$

The independent t-test results provided compelling evidence for the efficacy of the SIM intervention. Learners in the experimental group achieved a significantly higher mean gain score than the control group, with a highly significant p-value (0.000), indicating an exceedingly low probability that the observed difference in mean gain scores between the experimental and control groups arose by chance. It indicates that the SIM effectively improved the learners' performance in the multiplication of fractions. A greater number of learners in the experimental group improved their performance in the posttest, contributing to the greater mean gain scores over the mean gain scores of the learners in the control group. Moreover, these observations suggested a broader positive impact of the intervention.

The results of this study aligned with the findings of Dumigsi and Cabrella (2019), who also reported a significant difference in academic achievement between an experimental group receiving an intervention and a control group. A similar observation was made by Exconde & Briones (2023) in which users of SIM have a significant difference in the results between the pretest and post-test, which means that their performance was significantly affected by the SIM. A similar effect was reported by Exconde (2023) in Cookery 7. Consistent with this result is the study of Limbago-Bastida (2022), which found that learners' performance in senior high school learners showed a noticeable improvement through SIM. All the above revelations show that SIM is essential to learners' performance.

The present study explored the Efficacy of Strategic Intervention Material in teaching fraction multiplication. Learners who utilized the SIM performed better in the formative assessment, indicating a deeper understanding of the topic. Although the quiz revealed some initial struggles, other assessments displayed a definite upward pattern resulting from exposure to SIM activities and ensuring appropriate feedback.

**Learners’ assessment of the SIM in terms of: Content and Accuracy; Clarity; Appropriateness; Applicability; Usefulness; and Format**

**Learners’ Assessment of the SIM in terms of Content and Accuracy**

Table 5 shows how the learners assessed the SIM regarding content and accuracy. Indicators 1.1, 2, 3.1, 3.2, and 3.3 rated as “very adequate” with a mean of 3.19, 3.52, 3.62, 3.24 and 3.33 respectively. However, indicator 1.2, “the factual information,” rated adequate (mean 3.00), could have used slight modification. Overall, the SIM was rated very adequate (mean 3.32), meaning no revision or modification was needed, with a low standard deviation of (.333). This comprehensive rating reflected a strong consensus among learners that the SIM is very adequate, with minimal variation in their responses. The low standard deviation suggested that the learners' assessments are relatively consistent, reinforcing the reliability of the feedback.

**Table 5.** Learners’ Assessment of the SIM according to Content and Accuracy

Indicators	Mean	Std. Deviation	Verbal Description	Interpretation
1. The Strategic Intervention Material (SIM) uses:				
1.1 accurate information	3.19	.680	Very adequate	No modification or revision
1.2 factual information	3.00	.707	Adequate	Slight Modification
2. The topics and information are useful for me.	3.52	.750	Very adequate	No modification or revision
3. The activities are:				
3.1 clear	3.62	.590	Very adequate	No modification or revision
3.2 doable	3.24	.625	Very adequate	No modification or revision
3.3 make sense	3.33	.796	Very adequate	No modification or revision
<b>Overall Weighted Mean</b>	<b>3.32</b>	<b>.333</b>	<b>Very adequate</b>	<b>No modification or revision</b>

*Legend: 0-1.00-Features are absent/Lessons Need Rewriting and Reevaluation; 1.01-2.00-Features are not adequate/Lesson need much modification and revision; 2.01-3.00-Features are adequate/Lessons need slight modification and revision; 3.01-4.00-Features are very adequate/Lessons no longer need modification or revision*

The SIM was overall very adequate. The data supported the conclusion that the SIM effectively delivered accurate information, useful topics, and well-designed activities. However, the slightly lower score for factual information (Indicator 1.2) indicated a minor area for modification. A systematic review process to regularly update factual details and establish a feedback mechanism for continuous learner input are recommended to address this. Strengthening the verification processes by cross-checking facts with reliable sources can enhance accuracy. By addressing these issues, the SIM can be further refined to meet learners' needs and maintain high standards of content and accuracy.

These results underscore the importance of ensuring that the information in strategic intervention material is accurate, as it directly impacts the quality of the learning experience and the development of learners' scientific knowledge and skills. Dapitan and Caballes (2019) emphasized this point in their research, stating that such materials should convey reliable knowledge.

A study by Limbago-Bastida and Bastida (2022) examined whether strategic intervention material can help improve learners' performance in schools. The findings showed that the SIM had been rated highly for its content and accuracy, which aligns with the results in Table 5. This research highlights the need for teachers to provide learners with interesting but still factually correct information.

Another researcher, Zabala (2023), focused on strategic intervention materials related to stocks and bonds for senior high school learners. The main discovery of this investigation was that most participants found these teaching resources highly effective. Many rated the content coverage and the relevance of the SIM as "very adequate" for achieving the desired learning goals.

Correcting any inaccuracies within the SIM is crucial to maximizing its effectiveness. It ensures that learners receive accurate information essential for their learning process. Studies by Limbago-Bastida (2022) and Zabala (2023) provided conclusive evidence demonstrating the significant value of strategic intervention materials, especially regarding content coverage and accuracy.

### ***Learners' Assessment of the SIM in terms of Clarity***

**Table 6.** Learners' Assessment of the SIM according to Clarity

Indicators	Mean	Std. Deviation	Verbal Description	Interpretation
1. The lessons are easy for me to understand.	2.90	.625	Adequate	Slight Modification
2. The instructions are easy to follow.	3.14	.655	Very adequate	No modification or revision
3. The writing is:				
3.1 clear	3.57	.507	Very adequate	No modification or revision
3.2 not too small	3.57	.598	Very adequate	No modification or revision
<b>Overall Weighted Mean</b>	<b>3.30</b>	<b>.322</b>	<b>Very adequate</b>	<b>No modification or revision</b>

*Legend: 0-1.00-Features are absent/Lessons Need Rewriting and Reevaluation; 1.01-2.00-Features are not adequate/Lesson need much modification and revision; 2.01-3.00-Features are adequate/Lessons need slight modification and revision; 3.01-4.00-Features are very adequate/Lessons no longer need modification or revision*

Table 6 shows the learners' assessment in terms of SIMs clarity. They rated the indicators "The instructions are easy to follow," "The writing is clear," and "The writing is not too small," with means above 3.00 ("Very Adequate"). However, they rated "The lessons are easy for me to understand" with a mean of 2.90 ("Adequate"). Overall, learners rated the SIM as "very adequate," with a weighted mean 3.30, indicating no major revisions were needed, and a low standard deviation (.322).

The analysis of Table 6 revealed several insights into the learners' assessment of the clarity of SIM. Specifically, learners found the instructions straightforward and the language appropriate for their level, contributing to effective engagement with the material. The readability in terms of font size also met learners' needs, ensuring that physical readability does not hinder comprehension. However, the indicator "The lessons are easy for me to understand" was categorized as "adequate." While this rating still indicated a reasonable level of clarity, it suggested that some concepts or explanations within the lessons could benefit from further slight modifications and revisions were necessary to enhance understanding. Overall, learners rated the SIMs as "very adequate," indicating that the

materials were perceived as very adequately and that no major revisions were necessary. The low standard deviation further suggested a consistent perception among the learners, reinforcing the reliability of the overall assessment.

This finding supports the study of Purnomo et al. (2022) reported that learners often must fully grasp that fractions represent parts of a whole. The foundational misunderstanding hindered learners' grasp of advanced concepts like fraction multiplication. Struggling with these concepts leads to difficulties and misconceptions. This study underscored the importance of clear foundational knowledge in teaching fractions, as a lack of understanding of basic concepts can hinder learning more advanced operations. It suggested that instructional strategies specifically targeting these misconceptions, such as using visual aids and real-life examples, were necessary. Additionally, the research pointed to the need for refinements in educational materials and curricula to address areas of difficulty, alongside continuous assessment and tailored feedback for learners. It also highlighted the value of professional development for teachers in effectively conveying fraction concepts through diverse teaching methods.

Aranda et al. (2019) argue that good instructions and clear writing in middle school foster productive thinking in various subjects, including Science. They propose using structured materials with definite guidelines to enhance information processing, improving language skills, social studies knowledge, and more. The learners' "very adequate" ratings for "The instructions are easy to follow" and "The writing is clear" support our clarity assessment of the SIM materials used in this study.

Suarez and Casinillo (2020) investigated how Strategic Intervention Materials (SIM) can improve academic performance among Science VI learners. They found that well-designed SIMs enhance learning outcomes in various subjects, especially Science. Educators and researchers emphasize the importance of clarity in teaching fraction multiplication using SIM and suggest minor adjustments to enhance learner understanding.

To address this, various explanation styles, including visuals, should be incorporated to cater to diverse learner needs. Additionally, feedback from learners about their understanding of multiplying fractions should be gathered to guide future improvements and ensure the clarity of the SIM's content.

### ***Learners' Assessment of the SIM in terms of Appropriateness***

Table 7 presents how learners assess the SIM's appropriateness. The table shows learners rated all indicators as "very adequate," with means above 3.0. They gave the highest rating to Indicator 3.1, "The activities are well-designed" (mean 3.67), followed by Indicator 1, "It makes me interested in learning how to multiply fractions" (mean 3.52). They rated Indicator 2, "It encourages me to learn on my own," the lowest (mean 3.05). Overall, learners rated the SIM's appropriateness as "very adequate," with a weighted mean of 3.39 and a low standard deviation of .367, indicating no need for modification or revision.

**Table 7.** Learners' Assessment of the SIM according to Appropriateness

Indicators	Mean	Std. Deviation	Verbal Description	Interpretation
1. It makes me interested in learning how to multiply fractions.	3.52	.512	Very adequate	No modification or revision
2. It encourages me to learn on my own.	3.05	.590	Very adequate	No modification or revision
3. The activities are:				

3.1 well designed	3.67	.577	Very adequate	No modification or revision
3.2 suited to my learning capabilities	3.33	.658	Very adequate	No modification or revision
<b>Overall Weighted Mean</b>	<b>3.39</b>	<b>.367</b>	<b>Very adequate</b>	<b>No modification or revision</b>

*Legend: 0-1.00-Features are absent/Lessons Need Rewriting ang Reevaluation; 1.01-2.00-Features are not adequate/Lesson need much modification and revision; 2.01-3.00-Features are adequate/Lessons need slight modification and revision; 3.01-4.00-Features are very adequate/Lessons no longer need modification or revision*

The data from Table 7 indicated that learners rated the SIM's appropriateness as "very adequate." The highest ratings were for well-designed activities and the ability to generate interest in multiplying fractions, highlighting the effectiveness of engaging content. However, the encouragement of self-directed learning received the lowest rating. Although still considered "very adequate," this lower score suggested that the SIM may be less effective in fostering autonomous learning than other indicators. It presented a potential area for improvement, where enhancements could be made to better support and encourage self-directed learning among learners. The low standard deviation signified consistent positive perceptions among learners, indicating no immediate need for modifications. While the SIM was well-received, enhancements to foster autonomous learning could further optimize its effectiveness.

Learners found the SIM's appropriateness to be "very adequate," as evidenced by the positive feedback across all aspects in Table 7. The SIM effectively engages learners with well-designed activities (Indicator 3.1) and sparks their interest in the subject (Indicator 1). According to Exconde and Briones (2023), well-designed SIM activities significantly improve learners' understanding and performance, enhancing the SIM's overall appropriateness.

Makhubele (2021) emphasized mastering prerequisite concepts when teaching fractions. Learners must understand multiplication before effectively multiplying fractions using symbols or numbers. This foundational knowledge is essential for handling related topics at all educational levels, including higher education, where such knowledge is often required for admission and success in certain courses.

Moreover, promoting independent learning through self-study resources outside traditional classrooms is crucial (Indicator 2). Cagape et al. (2023) demonstrated that learners found the SIM accessible and comprehensible, facilitating independent learning and effectively enhancing learners' understanding and interest in mathematical concepts. Although the references do not directly address whether the SIM encourages independent learning, its engaging nature and ability to spark curiosity and provide appropriate activities may indirectly promote learners' independent investigation of various topics.

*Learners' assessment of the SIM in terms Applicability*

**Table 8.** Learners' Assessment of the SIM according to Applicability

<b>Indicators</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Verbal Description</b>	<b>Interpretation</b>
1. The SIM directly relate to what I want to learn.	3.24	.625	Very adequate	No modification or revision
2. The SIM accommodates different learning styles.	3.24	.768	Very adequate	No modification or revision

3. The SIM encourages me to provide honest responses during activities, even when answer keys are available.	3.29	.717	Very adequate	No modification or revision
<b>Overall Weighted Mean</b>	<b>3.25</b>	<b>.527</b>	<b>Very adequate</b>	<b>No modification or revision</b>

*Legend: 0-1.00-Features are absent/Lessons Need Rewriting and Reevaluation; 1.01-2.00-Features are not adequate/Lesson need much modification and revision; 2.01-3.00-Features are adequate/Lessons need slight modification and revision; 3.01-4.00-Features are very adequate/Lessons no longer need modification or revision*

Table 8 illustrates the learners' assessment of the applicability of SIM. It can be observed from the table that all indicators were rated very adequate, with a mean above 3.0. The highest score was given to indicator 3: "The SIM encourages me to provide honest responses during activities, even when answer keys are available" (mean=3.29). The learners' assessment indicated that the SIM fostered academic integrity and genuine engagement, promoting accurate self-assessment. The positive reception suggested trust in the SIM's quality and reliability. It implied that the SIM includes interactive and reflective activities that enhance deep learning and self-regulation. Moreover, the data suggested a potential positive impact on learning outcomes, as materials encouraging honest responses improved understanding and knowledge retention. This result is congruent with Exconde and Briones's study (2023), which used SIM to enhance Grade 7 learners' performance in Technology and Livelihood Education (TLE). Their investigation revealed that through this tool, learners were motivated to give truthful answers while participating in different tasks, which helped them perform better in the subject.

Further, it can be deduced from Table 8 that indicator 1 and 2, having identical mean scores of 3.24, suggested that learners equally value the SIM's relevance to their learning objectives and its adaptability to various learning styles. The SIM was deemed "very adequate" in fulfilling these requirements, implying that it was effectively designed to cater to individual learning preferences. Reflecting a learner-centered SIM development approach, emphasizing a supportive learning environment that recognizes diverse learning styles.

Suarez and Casinillo's (2020) findings supported indicator number 1: "The SIM directly relates to what I want to learn." The authors found that using SIM enhanced the academic achievement of Science VI learners significantly. It directly relates to their desired knowledge area, as it contributes to the success of the subject's grades.

On another note, Limbago-Bastida and Bastida (2022) researched how effective SIM can be towards different learning outcomes among learners; therefore, this aligns with indicator 2: "The SIM accommodates different learning styles." According to their study design, various methods were employed by learners during teaching sessions to cater to diverse abilities, hence making such a rating "very adequate."

In general terms, no modification or revision was needed to modify the SIM since it showed "very adequate" ratings (weighted mean = 3.25) with a low standard deviation (.527). All three sources used also support this wider applicability of SIM across subjects at all levels because they involve multiple areas where learners' academic performance can improve greatly through its use: Suarez & Casinillo (2020) Science VI; Limbago-Bastida & Bastida (2022) any subject in any level; Exconde & Briones (2023) Grade 7 TLE.

**Learners' assessment of the SIM in terms of Usefulness**

**Table 9.** Learners' Assessment of the SIM according to Usefulness

Indicators	Mean	Std. Deviation	Verbal Description	Interpretation
1. The SIM helps me achieve the objectives of the lesson (Multiplication of Fractions).	3.24	.436	Very adequate	No modification or revision
2. The SIM helps me understand better on the basic concepts of Multiplication of Fractions	3.29	.784	Very adequate	No modification or revision
3. The SIM help me in developing and enhancing my higher-order thinking skills.	3.62	.669	Very adequate	No modification or revision
<b>Overall Weighted Mean</b>	<b>3.38</b>	<b>.465</b>	<b>Very adequate</b>	<b>No modification or revision</b>

*Legend: 0-1.00-Features are absent/Lessons Need Rewriting and Reevaluation; 1.01-2.00-Features are not adequate/Lesson need much modification and revision; 2.01-3.00-Features are adequate/Lessons need slight modification and revision; 3.01-4.00-Features are very adequate/Lessons no longer need modification or revision*

Table 9 shows how learners assessed the SIM's usefulness. It can be gleaned from the table that all indicators were rated as very adequate, with a mean above 3.0. Indicator 3, "The SIM helps me in developing and enhancing my higher-order thinking skills," scored the highest (mean 3.62), followed by indicator 2 (mean 3.29), and the lowest score was for indicator 1, "The SIM helps me achieve the objectives of the lesson (Multiplication of Fractions)" (mean 3.24). The overall weighted mean of 3.38 categorized the SIM as "very adequate," meaning no revision or modification is required. Coupled with a low standard deviation of 0.465, this signifies consistent agreement among learners regarding the SIM's usefulness.

The data provides a comprehensive analysis of learners' perceptions of SIMs designed for teaching the multiplication of fractions. It indicates a high level of learner satisfaction, with an overall weighted mean above 3.0 and a low standard deviation. The results revealed that learners generally find the SIM very adequate in helping them understand the multiplication of fractions, with a strong consensus on its effectiveness. Further, the learners' assessment underscored the SIM's high effectiveness in promoting higher-order thinking and understanding basic concepts.

The findings indicated that the Strategic Intervention Material (SIM) significantly enhanced learners' understanding of fraction multiplication. Rated as "very adequate" for learning, SIM is an effective educational tool that aligns well with learners' needs and learning styles, making complex concepts more accessible. The research by Suarez and Casinillo (2020) further supports this, showing that SIM is associated with good academic performance in Science VI, suggesting its utility across various subjects. This intervention not only aids in understanding fraction multiplication but also reinforces fundamental concepts, highlighting its role in strengthening foundational knowledge crucial for long-term academic success. The broad applicability and positive outcomes in mathematics and science imply that SIM can be generalized to other curriculum areas, making it a valuable resource for teachers.

This observation is supported by the study of Suarez and Casinillo (2020), which further indicated an improvement in basic knowledge acquisition for those studying Science VI

subjects through the application of SIM. What stands out the most is the SIM's ability to stimulate higher-order thinking skills, with an average score of 3.62 for the item "The SIM aids in developing and enhancing higher-order thinking skills." Similarly, Dumigsi et al. (2019) explored math remediation strategies using SIM for Grade 9 quadratic functions problem-solving. The study revealed that these skills can be developed more effectively when learners critically engage with different mathematical problems.

To sum up, both references affirm that the strategic intervention material works best to improve academic achievements and enhance problem-solving capacity among learners while tackling different mathematical tasks.

### ***Learners' assessment of the SIM in terms of Format***

Table 10 shows the learner assessment of SIM's format. Learners rated the SIM as "very adequate," with a mean score exceeding 3.38 for all indicators. They found the writing style and spacing between words conducive to ease of reading (mean: 3.38, SD=0.498). Similarly, learners perceived the SIM as visually appealing (mean: 3.38, SD=0.590). Notably, learners strongly agreed that the illustrations and text seamlessly harmonized (mean: 3.90, SD=0.301), the highest mean score among all indicators. The overall weighted mean for the format was 3.56 (SD=0.305), under the "very adequate" rating. This result reflected an acknowledgment of the SIM's readability and aesthetic quality, even though there was some variability in opinions regarding its visual appeal. The low standard deviations observed across all indicators indicated a consensus among learners, underlining a shared positive perception. The feedback implies that learners do not need modifications or revisions, affirming that the current SIM design and structure effectively meet their educational needs.

**Table 10.** Learners' Assessment of the SIM according to Format

Indicators	Mean	Std. Deviation	Verbal Description	Interpretation
1. The writing and spaces between words make it easy to read.	3.38	.498	Very adequate	No modification or revision
2. The SIM is attractive and appealing.	3.38	.590	Very adequate	No modification or revision
3. Illustrations and words harmonize seamlessly.	3.90	.301	Very adequate	No modification or revision
<b>Overall Weighted Mean</b>	<b>3.56</b>	<b>.305</b>	<b>Very adequate</b>	<b>No modification or revision</b>

*Legend: 0-1.00-Features are absent/Lessons Need Rewriting and Reevaluation; 1.01-2.00-Features are not adequate/Lesson need much modification and revision; 2.01-3.00-Features are adequate/Lessons need slight modification and revision; 3.01-4.00-Features are very adequate/Lessons no longer need modification or revision*

Results show that learners rated the SIM format as "very adequate." They described the writing style and spacing between words as reader-friendly (M=3.38, SD=0.498). Dapitan and Caballes (2019) supported this finding when they investigated the effects of SIM in General Biology 2, where it was revealed that materials used should have clear formats, including writing styles. This supports the importance of clear formats, including writing styles, in educational materials, as highlighted in the investigation of the effects of SIM in General Biology 2. The positive feedback on the readability and user-friendliness of the materials underscores the significance of designing educational resources that are easily

comprehensible and engaging for learners, ultimately contributing to improved learning outcomes and student engagement.

Moreover, learners also felt that the design was visually appealing ( $M = 3.38$ ,  $SD = 0.590$ ). It can be understood from Aranda et al.'s (2019) study about productive thinking in middle school science learners' design conversations during a design-based engineering challenge, where they argued that best learning happens when students are engaged through good-looking designs or any other well-thought-out visual materials.

Of particular note was that learners expressed strong agreement around pictures seamlessly matching text ( $M=3.90$ ,  $SD=0.301$ ), which had the highest mean score compared to other indicators. However, these papers have not discussed how words should blend with images. According to Makhubele's (2021) analysis, mistakes made by grade eight mathematics pupils while dealing with fractions due to a lack of understanding of prerequisite concepts represent an error prevention strategy through integration between pictures and text.

Although not all elements were covered by the given references, they collectively identified well-designed SIM's relevance towards engaging learners in their studies, leading them to achieve better results. (Dapitan & Caballes, 2019; Makhubele, 2021).

## **CONCLUSION**

Based on the findings of the study, the following conclusions were drawn:

The pretest analysis indicated a promising foundation for conducting a controlled experiment. Examining pretest scores revealed similar performance distributions between the experimental and control groups. This finding suggested that both groups started the study with comparable levels of understanding, reducing concerns about pre-existing differences affecting the results. However, a significant observation was the overall low baseline knowledge. None of the participants achieved scores indicating "Highly Mastered" or "Mastered" understanding, and the majority (over 80% in each group) fell into the "Not Mastered" category. This highlighted a clear need for intervention, which the quasi-experiment was designed to address.

The post-test results revealed a significant difference in learning outcomes between the control and experimental groups. The substantial difference in mastery rates observed between the two groups strongly suggested the effectiveness of SIM, particularly for topics that could benefit from visualization and interactivity. Using SIM was significantly more effective in improving learners' mastery of fraction multiplication. The considerable difference in mastery rates suggested that SIM positively impacted learning outcomes.

The gain score analysis further confirmed the efficacy of SIM in teaching fraction multiplication. The experimental group showed a significantly greater improvement, as evidenced by the higher mean gain score and the statistically significant t-value and p-value. It indicates that the learning method used in the experimental group (SIM) enhanced learners' understanding and mastery of the subject matter.

Learners rated the content, accuracy, clarity, appropriateness, applicability, usefulness, and format of the SIM as "very adequate." This positive feedback suggests that the SIM was well-received and considered a beneficial educational tool. However, minor revisions or modifications were needed to ensure the factual information and clarity of the lessons were easier to understand.

## **Recommendations**

Based on the findings and conclusions of the study, the researcher recommends as follows:

1. For teachers, it is recommended to implement Strategic Intervention Material (SIM) into the curriculum for teaching fraction multiplication, as the study has demonstrated its significant impact on learners' mastery compared to the traditional chalk-talk method. Additionally, education program supervisors should be provided to train teachers on effectively utilizing SIM, ensuring they are well-equipped to maximize its benefits in the classroom.
2. School administrators are encouraged to allocate budget and resources to acquire and integrate SIM into the teaching process. This financial and material support is crucial for effectively implementing new educational tools. Furthermore, establishing a system to monitor and evaluate the effectiveness of SIM and other teaching methods regularly will help understand their impact and make necessary adjustments for sustained improvement.
3. Researchers may conduct further studies to explore the long-term effects of SIM on various learning outcomes. While the current study shows promising results, long-term data will provide deeper insights into SIM's sustained effectiveness. Additionally, investigating SIM's applicability in teaching other subjects and grade levels will help understand its versatility and create a broader impact on educational practices.
4. Policymakers are encouraged to promote the adoption of evidence-based teaching methods like SIM in educational policies and guidelines. By endorsing methods with proven effectiveness, overall educational quality and student performance can be enhanced. Furthermore, providing funding and support for research initiatives focused on innovative educational tools and methods is essential. Investing in research helps discover and validate new approaches that can improve learning outcomes.

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