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Development of Strategic Intervention Materials (SIMs) In Grade 7 Science in Kitcharao District

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Abstract

This study focused on the development and evaluation of Strategic Intervention Materials (SIMs) for Grade 7 Science in Kitcharao District to address the least-mastered competencies among learners under the MATATAG Curriculum. Employing a descriptive-developmental research design with a quasi-experimental approach, the study identified the least-learned competencies across the four science domains: matter and solubility; cellular processes and heredity; force and motion; and Earth and space science. Based on these identified learning gaps, four competency-based SIMs were systematically developed using the ADDIE Model and evaluated using the Department of Education Learning Resource Management and Development System (LRMDS) Evaluation Tool for Print Resources. Participants included five expert validators, thirteen Science teachers, and thirty Grade 7 learners. Findings revealed that the developed SIMs attained a "Very Satisfactory" rating for content, format, presentation, organization, and information accuracy. Learners likewise expressed strong agreement regarding the clarity, usability, attractiveness, and effectiveness of the materials. Results of the paired t-test demonstrated statistically significant improvements in learners' post-test scores, indicating the effectiveness of the SIMs in enhancing science competencies. The study recommends the institutionalization and integration of validated SIMs as supplemental learning resources at the school, district, and division levels to improve Science instruction and address persistent learning gaps.

Keywords: Strategic Intervention Materials, Grade 7 Science, Least Mastered Competencies, Instructional Material Development, MATATAG Curriculum

Introduction

The reforms to the Philippine education system are designed to improve learner outcomes and close long-standing learning gaps. The MATATAG Curriculum, developed to help implement the aforementioned reforms, is one of the key components of the effort made to improve educational use of resources. The MATATAG Curriculum has been designed to strengthen the foundational skills of each student through: (1) creating a smaller, more focused set of competencies for the learner; (2) providing instruction that is based on competencies and is therefore mastery-oriented; and (3) honoring the diverse needs of learners.

By using this system, teachers can help students develop a solid understanding of the foundations of learning before moving on to doing more complex tasks. It is up to the teacher to help connect the curriculum objectives to effective classroom practice. The MATATAG Curriculum includes expectations for using responsive strategies with the types of materials used to support students who demonstrate learning difficulties (Department of Education Order No. 10, s 2024). Current research indicates that curriculum improvement alone is insufficient to improve student learning unless combined with effective instructional intervention (Darling-Hammond et al., 2022; UNESCO, 2023).

Teaching and learning science in the Philippines have been a challenge for some time. The latest evidence of how poor the teaching and learning of science in this country are comes from the 2022 PISA test. Filipino students did not perform as well as students from other countries on this test and therefore did not achieve an average score comparable to that of students worldwide (OECD, 2023).

There is consistent national research confirming that Filipino students lack basic scientific literacy or conceptual understanding and have not demonstrated adequate knowledge retention across all areas of scientific literacy. Consistently, the performance of the Filipino education system is significantly lower than that of most countries across a variety of international tests and local evaluations (Gabatino, 2025). Local data support the assertion that students have difficulty retaining their understanding of science concepts over time and are unable to develop their higher-order scientific reasoning skills, especially in settings with limited instructional support (Aguanta et al., 2024).

The MATATAG Curriculum for Science for 7th graders in the Kitcharao District is implemented across four domains: Earth Science, Biology, Chemistry, and Physics. An analysis of the least-learned competencies at the district level shows that students consistently failed to reach expected achievement levels in some core areas of science. District data show that students have consistently achieved low levels of competency across all identified Science areas. These persistent learning deficiencies demonstrate the need for data-driven instructional interventions, such as SIMS, aligned with the MATATAG Curriculum and designed to support the identified least-learned competencies for 7th graders in the Kitcharao district.

While previous research indicates that Strategic Intervention Materials (SIMs) have helped support learners, key knowledge gaps remain. One such gap concerns the systematic development and validation of SIMs using data on the district's least-learned competencies (i.e., data collected at the district level). This lack of systematic development and validation of SIM using district-level data is a methodological gap. For example, most studies evaluating the effectiveness of SIM were conducted after implementation, thereby limiting research on the development or validation of SIM prior to implementation. The lack of systematic development and validation of SIM and the limited evidence to date on its effectiveness constrain teachers' ability to implement responsive, data-informed remediation practices. Bajarias et al. (2024) found that many teachers experience difficulties aligning the curriculum, which affects their ability to plan lessons for students and ultimately results in poor student achievement. Wabingga and Tomaquin (2025) reported that teachers in remote locations face challenges in modifying instructional materials to meet the needs of local learners. Additionally, Cayabas Jr. and Sumeg-ang (2023) identified that instructional resources developed specifically for the context are needed to address learning gaps and support remediation efforts.

There are several ways to help students build the knowledge and comprehension needed to address persistent learning gaps. Moreover, through structured, learner-paced, and competency-based activities, SIM has proven helpful in providing students with the necessary support by expanding their knowledge, helping them master difficult concepts, and ultimately bridging gaps in understanding (San Isidro & Dio, 2025; Gabucan & Sanchez, 2024). In the MATATAG Curriculum, SIM provides teachers with an opportunity to

identify areas of difficulty and create customized learning experiences to meet individual students' needs, ensuring that students receive the instructional strategies and resources to understand better and acquire the competencies required for their grade levels.

This study is connected to the UN Sustainable Development Goals (SDGs). With Goal 4 (Provide Quality Education), it aims to provide quality education to all people at all ages by developing and implementing local contextualized SIMs (Strategic Intervention Materials) based on the least learned competencies, which enables improvement in the science learning outcomes, delivery of quality instruction, and provides local access to supportive materials for learning. This study also meets Goal number 9 of the UN Sustainable Development Goals by developing and implementing Local/Evidence-Based Educational Innovations to meet the needs of their communities.

This study, titled Development of Strategic Intervention Materials (SIMs) for Grade 7 Science in Kitcharao District, was conducted for the same reasons. It involved the development and validation of SIMs, using district-level assessment data from Kitcharao District, intended to remediate or provide additional support to learners who demonstrated significant difficulties in learning the four most problematic areas of science. The intent behind developing SIMs is to help learners improve their understanding of key scientific concepts and to assist teachers in developing and using remediation strategies based on objective data from the MATATAG Curriculum.

As a result of the recently updated Philippine Basic Education System's new three-term school calendar and scheduling policy (DepEd Order No. 009, s. 2026), the issue of localized instructional materials remains an important concern in the Philippine Basic Education System (DepEd).

However, it should also be noted that the competencies that the SIMs are designed to help students achieve remain unchanged; therefore, the SIMs will continue to be invaluable assistance for those with learning difficulties. The fact that they are created to support curriculum standards indicates that the SIMs will remain useful and necessary regardless of the length of the student's calendar year.

Related Studies

Through DepEd Order No. 39, series 2012, the Department of Education (DepEd) has established a formal basis for the use of Strategic Intervention Materials (SIMs). The policy acknowledges a critical need for targeted remediation to address students' least-mastered competencies. It emphasizes the use of SIMs as supportive instructional tools that fill gaps in student learning. SIMs provide learners with simplified definitions of concepts, examples of guided activities, and additional practice (reinforcement exercises) aligned with the curriculum, so that they can address their individual needs and master critical competencies before advancing to advanced levels of content/learning. In addition, SIMs are an effective and appropriate scaffolded instructional strategy that helps students understand complex concepts and improve their academic performance.

Research evidence from the Philippines indicates that SIMs affect learner achievement across disciplines and educational levels. Borabo and Dio's (2025) systematic review of Filipino students' work suggests that SIMs not only improve learning outcomes at each grade level but also do so consistently across levels. Many of the studies that contributed to their analysis possessed positive results and confirmed that SIMs are effective classroom interventions. Collectively, these findings indicate the importance of providing learners with structured, focused, and contextually relevant resources to reduce learning gaps.

In studies involving students in the Philippines, the use of SIMs produced measurable improvements in student performance. For example, students who received instruction from their teachers using SIMs showed rapid increases in mastery of targeted learning outcomes compared with their prior performance. Students also scored higher on standardized assessments than on their pre-SIM assessments (Sinco, 2020; Flores & Cacho, 2020). This data supports the assertion that SIMs provide students with focused, structured instructional support and help students who struggle with particular concepts achieve mastery through scaffolded, activity-based learning experiences.

When examining learner performance in science education, learners who received instruction using teacher-created SIMs achieved substantial learning outcomes on content-related assessments. Results from a quasi-experimental study of Grade 9 students enrolled in a science curriculum on global warming found that when learners were taught to use SIMs rather than classroom instruction, they achieved higher post-test scores than their pre-test scores (Gabucan & Sanchez, 2025). In addition, a study involving Grade V students in Zambales Province found that learners who used Science SIMs improved their performance, moving from the lowest level on their pretests to the highest on their posttests, providing statistically significant evidence of learning gains from the use of SIMs. Teachers involved in the research identified Strategic Instructional Materials (SIMs) as appropriate for classroom instruction because of their simplicity, structure, and guidance, which made them effective instructional tools for engaging and supporting learners.

While the majority of studies demonstrate increased student performance in language instruction (Duran & Eliaga, 2024) and in fifth-grade students' multiplication of fractions in math (Mangisel, 2024), the research supports the use of SIMs across both language and mathematics, including in elementary and secondary science.

According to Estipona (2024), students' performance in Technical-Vocational-Livelihood programs in the Beauty Nail Care Services course, taught using SIMs, has improved. This supports the idea that SIMs benefit all disciplines and improve learning outcomes.

Zabala (2023) described improved performance from using SIMs through instructional strategies designed to teach financial literacy skills (e.g., teaching students to differentiate between stocks and bonds).

Finally, additional research examined the effects of SIMs on the instructional performance of Grade VI students using a mixed-methods, sequential, explanatory research design that investigated the least-learned content areas with teacher-created SIMs (Sinco, 2020). Research results demonstrated that statistically significant differences existed between pre-test and post-test scores. Qualitative data that complemented the results showed that providing structured activities and simplified explanations helped learners understand complex science topics more easily. In a report by Limbago-Bastida and Bastida (2022), the researchers examined the effect of using SIMs in teaching Grade 11 Physical Science learners. They reported that learners exposed to SIMs showed statistically significant gains compared to learners who received conventional instruction. Similar findings were reported by Suarez and Casinillo (2020) for Grade VI pupils in science topics, including homogeneous and heterogeneous mixtures. These studies collectively demonstrated how targeted intervention materials effectively remediated difficult concepts.

Not only are SIMs effective in science, but they also produce positive effects in Social Studies, particularly during distance learning. Lazo and de Guzman (2021) investigated the use of SIMs in teaching Grade 9 Economics to students during the COVID-19 pandemic. The report indicated that learners exposed to SIM-based instruction improved their performance from "Did Not Meet Expectation/Fair" to "Satisfactory". Similarly, Dumdumaya et al. (2024) found that elementary students exposed to SIMs showed significant

improvements in their learning competencies. They emphasized that well-structured intervention materials build learners' understanding and confidence, leading to improved overall academic performance.

Furthermore, SIMs created positive perceptions of learning for many learners. According to Bacatan et al. (2022), both students and teachers have endorsed SIMs as an effective approach for supporting students who struggle to master competencies, increasing engagement in lessons, and improving classroom performance. In Mathematics, SIMs have been particularly effective at the secondary level. Arpilleda (2021) reported positive posttest gains in Integrated Mathematics 9 for students who were exposed to SIMs and had incorporated them into their lessons. In teaching secondary mathematics, integrated exponents were reported as one of the competencies in which students made posttest gains. In addition to benefiting these students, Contextualized SIMs also increased understanding and improved engagement. Ten SIMs were developed by Adonis (2020) for Grade 9 students, aligned with students' least-mastered competencies, and yielded increased assessment performance, increased student interest in learning, and the development of independent learning skills. Additionally, teacher-made SIMs were beneficial for underperforming science students. As reported by Jamandron (2020), Grade V students provided with SIMs for the Human Reproductive System and Classifying Vertebrates scored a mean percentage that was greater than a peer within a class not using SIMs (traditional) and demonstrated that SIMs can provide structured and targeted remediation that may be more effective than even direct one-on-one instruction.

SIMs can also be used in modular and remote learning situations. Acera (2022) found that teacher-made SIMs improved Science performance during the COVID-19 modular learning period and highlighted the need for responsive, tailored interventions to meet individual learners' specific needs. Gregorio (2024) reported that SIMs yielded similar academic performance among secondary Science students, and Arevalo, Janer, and Ricafort (2023) found that SIMs in Physics promoted both understanding and engagement among students engaged in distance learning. The research findings collectively support that SIMs provide students who have limited access to direct instruction with a measure of continuity in learning, while enabling instructional quality to be maintained across multiple forms of instructional delivery, including in-class instruction, thus allowing students to achieve high levels of performance with respect to their knowledge of essential competencies.

The current literature provides consistent evidence for the efficacy of SIMs in promoting academic achievement, deepening conceptual understanding, and increasing student motivation and interest across subject areas, instructional levels, and learning environments. SIMs provide a scaffolded resource by breaking complex concepts into smaller, more manageable, structured tasks that encourage mastery and internalization of new material (Borabo & Dio, 2025). The research findings provide valuable empirical and theoretical support for including SIMs as evidence-based interventions within the instructional practice framework to address the long-standing challenges students face in learning.

Although the literature provides strong support, a knowledge gap remains in the development and implementation of context-specific SIMs using local-level assessments, particularly in Grade 7 Science education. Many previous studies have examined general results/effectiveness, or only short-term outcomes, based on a small number of data sources. There is almost no research available on effective SIM implementation or within specific geographic areas (e.g., Kitcharao District), and on identified gaps in Grade 7 Science relating to local performance data (e.g., MPS on the least learned competencies). Due to identified gaps in SIM use, further studies are needed to develop materials that specifically and directly address the challenges students in that geographic area face.

This study will address the lack of knowledge in the area of developing and validating SIMs that will meet the needs of learners engaged in the Grade 7 Science curriculum in Kitcharao District; develop and validate materials based on the MATATAG Curriculum Framework and provide evidence-based recommendations for improving instruction and remediating non-mastered competencies as related to the teaching profession within the local area.

Theoretical/Conceptual Framework

Instructional material development in the basic education system of the Philippines follows national education policies focused on learner-centered, inclusive, and localized instruction. Republic Act 10533, or the Enhanced Basic Education Act of 2013, requires a curriculum that is developmentally appropriate, responsive to learners' needs, learner-centered, and inclusive. Locally produced instructional materials will be developed and used as established by law and approved by regional- and division-level authorities (Republic Act No. 10533, 2013).

To further address the learning gap, the Department of Education has developed intervention strategies through DepEd Order No. 39 s. 2012. With this order, policy directives have been issued to implement remediation and intervention programs to improve learners' least mastered competencies. Policies outlining teachers' responsibilities for designing and using appropriate instructional interventions to improve learners' academic performance and ensure that each learner masters essential competencies are also described (DepEd, 2012).

According to these policies, Strategic Intervention Material (SIM) is a concept developed as a supplemental instructional tool to provide additional instruction for re-teaching concepts and skills that a learner has failed to master through regular classroom instruction. Specifically, SIM focuses on the least-mastered competencies and, through simplified explanations, guided activities, and reinforcement tasks, scaffolds the learner's performance to promote mastery of the target competencies. Research findings have shown that the use of SIM improves learner performance by providing targeted and structured instructional support (Leopardas, Clet, & Ensomo, 2020). The study is based on Jean Piaget's Cognitive Development Theory. Piaget argues that students learn through interaction with their surroundings (McLeod, 2026). Additionally, Piaget believes that cognitive development occurs in stages and that students learn best through experiential, hands-on learning (manipulating, exploring, and reflecting on concepts). Therefore, as part of this learning theory, Strategic Intervention Materials (SIMs) have been created to help learners build their understanding as independent learners by providing structured tasks/activities, problem-solving opportunities, and opportunities to explore beyond the lesson. Students will be able to connect with the content at their own pace, reinforce what they know, and reach the level of mastery required for each least-learned competency through their engagement with the learning material.

Another constructivist perspective that supports students through SIMs is Cognitive Load Theory (CLT). The CLT states that instructional materials must provide information in bite-sized, manageable units to avoid overloading working memory and to set students up for success in schema development (Enhancing Teaching Strategies through Cognitive Load Theory, 2024). In creating the SIMs, the principles of the constructivist perspective and CLT have been combined by breaking tasks down into scaffolded, simplified steps and guided examples that reduce cognitive load while facilitating active exploration. By providing learners with the ability to interact with structured content, practice problem-solving, and develop understanding over time, SIMs align with Piaget's principle of constructing knowledge through active engagement with the learning material.

Furthermore, the constructivist approaches of Discovery Learning and Constructivism align with Piaget's idea that knowledge is constructed through active participation in the learning process. According to constructivist theory, learners gain insight through working with resources, making connections back to what they already know, and reflecting on their experiences as they interact with the world around them (Constructivism as a Theory for Teaching and Learning, no date). Learners learn better when they engage in discovery learning rather than receiving information handed down through the teaching process (Guided Discovery Learning Model). Also, via the Social Constructivist Theory of Vygotsky, it is stressed that social interactions and the provision of suitable support within the zone of proximal development (ZPD) can help the learner develop their thinking abilities (Vygotsky's Sociocultural Theory of Cognitive Development, no date; Vygotsky's Social Constructivist Theory 101, 2025).

The development of SIMs draws on these theories to create learner-centered, scaffolded, and structured learning materials that enable learners to actively explore and acquire concepts through inquiry, practice, and proficiency in their least-learned areas. The use of Piaget's theories will contribute to the learner's experience of meaningful, experiential, and cognitively achievable learning, providing a foundation for long-term retention of skills and knowledge.

The foundation for developing SIMs is Jean Piaget's Cognitive Development Theory, which posits that learners actively construct knowledge as they interact with their environment and draw on prior learning experiences (McLeod, 2026). To illustrate this idea of stepwise cognitive development, the ADDIE model can be used to develop SIMs because its systematic phases align with Piaget's cognitive stages, facilitating the alignment of instructional materials. Thus, the ADDIE model provides an organized framework for operationalizing Piaget's principles by structuring learning experiences that are developmentally appropriate and grounded in learner participation in knowledge construction. The five phases of the ADDIE model - Analyze, Design, Develop, Implement, and Evaluate - provide the framework to develop SIMs iteratively. All five phases apply concepts from cognitive development, constructivism, and cognitive load theory to increase learner engagement, provide scaffolding, and help learners master the least-learned competencies.

The conceptual framework for this study is based on the ADDIE model and defines the process for researching, creating, validating, and piloting SIMs for Grade 7 Science. The ADDIE phases are used to clearly identify the roles of each participant (Researcher, Expert, Science teacher, and learner) so that each participant understands their role in the ADDIE Process in creating quality, student-focused instructional materials.

Using the ADDIE process, this study will identify the independent variable: developing SIMs through the ADDIE model. The SIMs will be built upon the framework of Piaget’s Cognitive Development, Cognitive Load Theory, Constructivism, Discovery Learning, and Sociocultural Theory. The independent variable includes analyzing the least-learned competencies, designing activities for students, developing instructional materials, implementing SIMs, and evaluating the developed SIMs. The study's dependent variables include SIMs’ acceptability, usability, and effectiveness, as evaluated by Experts, Science Teachers, and learners, based on quality, format, presentation, and organization; accuracy and up-to-dateness; learner engagement; and mastery of the least-learned competencies. The way each participant interacts with the SIMs will be influenced by cognitive ability, prior knowledge, and learning needs, as outlined in the MATATAG Curriculum. In the Analysis phase of developing instructional materials, the objective is to identify the areas in which Grade 7 students perform the worst in science, using district assessment data and other relevant academic records. The SIMs will be developed to address students' actual learning gaps and Instructional needs, in accordance with the MATATAG Curriculum. The researcher is responsible for collecting and analyzing data and will, as such, gather information from experts, science teachers, and learners. This phase will address the variable of

identifying the least-learned competencies in the subject area, which will then provide the rationale for developing Intervention materials.

During the Design phase, the researcher will determine the structure, format, activities, assessments, and instructional flow of the SIMs. The design of the SIMs should also align with the various curriculum standards and support learners' needs. Principles from Piaget's Theory of Cognitive Development, Constructivist Principles, and Cognitive Load Theory will be incorporated into the design to ensure that the activities are developmentally appropriate, engaging, well-scaffolded, and easy for learners to comprehend. In addition to the above variables, the materials will include guides, activities, assessments, enrichment, and reference cards to encourage learner participation and promote independent learning. Variables that will be addressed in this phase include the Quality of Instructional Design, learner-centered design, the use of scaffolding strategies, and the Cognitive Manageability of the materials.

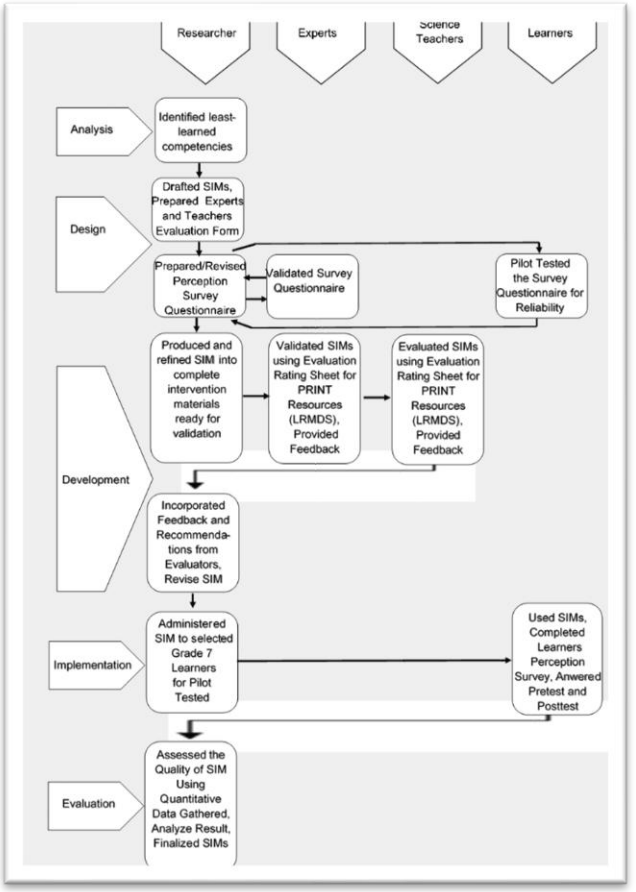
In the Development phase of the SIMs, the researcher will create and refine them. The researcher will create the content for the SIMs, including Illustrations, Learning Activities, and Assessment Components for each SIM. Expert validators and Science teachers assess print resources using the DepEd-LRMDS evaluation tool. The evaluators' ratings are the basis for improving and revising the instructional materials to ensure quality, accuracy, clarity, organization, and appropriateness. Some of the variables of emphasis during this phase are content validity, instructional quality, format, presentation, organization, and accuracy and up-to-dateness of the developed SIMs.

The validated SIM materials are pilot-tested during the implementation phase with selected Grade 7 learners from Kitcharao District. The learners are provided with SIMs during intervention sessions designed to reteach learners who have not yet mastered the subject area (Science). The learners, through a variety of guided and independent activities, will actively use the materials, apply the concepts learned, complete exercises, and develop a deeper understanding of science concepts. This phase reflects the learner-centered, experiential nature of the study. The variables of emphasis during this phase include engagement, participation, comprehension, and mastery of the least learned competencies.

The evaluation phase is when experts, science teachers, and learners evaluate the SIMs for acceptability and usability. Information will be gathered from evaluation forms and surveys to assess learners' perceptions and analyze the strengths, effectiveness, and potential areas for improvement of the SIMs. The evaluation findings will serve as the basis to recommend to the school, district, or division the use of the developed SIMs. The variables measured in this phase include acceptability, usability, effectiveness, learner satisfaction, and instructional relevance.

In summary, the conceptual framework illustrates how the ADDIE Model, grounded in Piaget's Cognitive Development Theory, Cognitive Load Theory, Constructivism, Discovery Learning, and the Sociocultural Theory, supports the systematic development of Strategic Intervention Materials (SIMs). The framework illustrates the relationship between the identified least-learned competencies and the instructional design process, as well as the intended outcome of producing learner-centered, validated, and effective materials to help Grade 7 Science students master concepts.

Figure 1. Research Flow



Objectives of the Study

This study sought to: (1) identify the least learned competencies in Grade 7 Science across the four quarters in Kitcharao District based on district assessment data; (2) design and develop Strategic Intervention Materials (SIMs) for Grade 7 Science based on the identified least mastered competencies; (3) determine the validity of the developed SIMs as evaluated by expert validators and Science teachers in terms of content, format, presentation and organization, and accuracy and up-to-datedness; (4) assess the level of learners' perception of the developed Strategic Intervention Materials in terms of clarity, usability, engagement, design, organization, appropriateness, and impact; (5) determine whether a significant difference exists in the learners' mean scores before and after the implementation of the Strategic Intervention Materials; and (6) identify the pathways for the utilization of the developed SIMs at the school, district, and division levels.

Methodology

This study employed a research and development (R&D) or developmental research design, combined with a descriptive-evaluative and quasi-experimental approach, to develop and validate Strategic Intervention Materials (SIMs) for Grade 7 Science in Kitcharao District. Guided by the ADDIE Model (Analysis, Design, Development, Implementation, and Evaluation), the study identified least mastered competencies using district assessment data across four science domains. It developed four competency-based SIMs aligned with the MATATAG Curriculum. The research was conducted in two public secondary schools in Kitcharao District, Agusan del Norte, involving five expert validators, thirteen Science teachers, and thirty purposively selected Grade 7 learners. The developed SIMs were evaluated using the Department of Education Learning Resource Management and Development System (DepEd LRMDS) Evaluation Tool for Print Resources in terms of content, format, presentation and organization, and accuracy and up-to-dateness. Learners' perceptions were measured through a validated perception survey focusing on clarity, usability, engagement, design, organization, appropriateness, and impact. To determine the effectiveness of the intervention materials, a one-group pretest-posttest quasi-experimental design was employed, and learners' performance before and after SIM implementation was analyzed using a paired-samples t-test at a 0.05 level of significance. Descriptive statistics, including the weighted mean and standard deviation, were likewise used to analyze evaluative and perceptual data.

Results and Discussion

Problem 1. What are the least-learned competencies in Grade 7 Science across the four domains in Kitcharao District, based on district assessment data?

Table 1 shows the least-learned competencies in Grade 7 Science, as indicated by relatively low MPS scores.

Table 1 . ***Identified Least Learned Competencies Based on the Kitcharao District Report***

Domain (D)	Identified Competencies	MPS	Remarks
D1	Explain the changes of state in terms of particle arrangement and energy changes (solid → liquid → vapor; vapor → liquid → solid).	31%	Not Mastered
	Express the amount of solute present in a given volume of solvent quantitatively.	33%	Not Mastered
	Demonstrate how different factors, such as heat, affect the solubility of a solute in a given solvent.	36%	Approaching Mastery
	Follow the appropriate steps of a scientific investigation, including the aim/problem, materials, method, results, and conclusion.	40%	Approaching Mastery
D2	Differentiate plant and animal cells based on their organelles.	32%	Not Mastered
	Explain that genetic information is passed on to offspring from both parents through meiosis and fertilization.	30%	Not Mastered
	Use examples of food pyramids to describe the transfer of energy between organisms across trophic levels.	34%	Approaching Mastery
D3	Draw a free-body diagram to represent the relative magnitudes and directions of the forces in balanced and unbalanced situations.	29%	Not Mastered
	Distinguish between speed and velocity using vector concepts.	32%	Not Mastered
	Explain, in terms of the particle model, the processes underlying heat convection and conduction.	35%	Approaching Mastery
D4	Use the PHIVOLCS Fault Finder or another reliable information source to identify the nearest fault system relative to their community and assess the risk of earthquakes to their local community.	31%	Not Mastered
	Explain how energy from the Sun interacts with the atmosphere.	33%	Not Mastered
	Make a physical model or use drawings to demonstrate how the tilt of the Earth relative to its orbit around the Sun affects the intensity of sunlight absorbed by different areas of the Earth over the course of a year.	35%	Approaching Mastery

(68%-100%-Mastered, 67%--34%-Approaching Mastery, 33% and less-Not Mastered)

In the first domain, 4 competencies were identified as least learned. These are the following: (1) Explain the changes of state in terms of particle arrangement and energy changes (solid → liquid → vapor; vapor → liquid → solid) (31%), (2) Express quantitatively the amount of solute present in a given volume of solvent (33%), (3) Demonstrate how different factors affect the solubility of a solute in a given solvent, such as heat. (36%), and (4) Follow appropriate steps of a scientific investigation, including aim/problem, materials, method, results, and conclusion (40%).

In the second-domain analysis of the table results, three skills are identified as the greatest difficulties for learners. The lowest-performing ability is explaining how genetic information is transmitted to offspring via meiosis and fertilization, with an MPS of 30%. The next-lowest-performing skill, with an MPS of 32%, is the ability to differentiate between plant and animal cells based on the organization of their organelles; both of these skills are qualitatively categorized as Not Mastered. The one with the higher MPS uses the food pyramid to describe how energy moves from one trophic level to another; with an MPS of 34%, this skill falls into the Approaching Mastery category. Current research in science education supports the argument that students find abstract concepts in Genetics and Cell Biology difficult to learn. Due to the abstract nature of genetic concepts, the complexity of the processes involved, and the introduction of scientific vocabulary, students often have difficulty forming appropriate mental models of inheritance or of how cells work (M. Machová & E. Ehler, 2021). Studies suggest that many students also misinterpret conjugate verbs, leading them to repeat and further misunderstand biological processes (Benjamin M. Donovan, 2021).

Additionally, various studies on biology education continue to emphasize that challenges arise when students attempt to visualize microscopic structures and connect cellular functions to their real-world experiences. Meaningful learning and conceptual understanding of Life Science topics have been significantly limited (Gurmeet Singh & Radhika Khunyakari, 2023).

In domain 3, the lowest overall results for the three learning outcomes were in each of the following areas: (1) drawing free-body diagrams (29% mastery of free-body diagrams); (2) differentiating between speed and velocity while using vector image (32% mastery); and (3) explaining the process of conduction/convection based on particle theory (35% mastery). All three were designated as "Not Mastered." However, in contrast, the explanation of how to create convection/conduction based on particle theory supported approximately 35% of participants in providing conceptual explanations. Research in physics education supports these findings, showing that learners tend to have difficulty with the concepts of Force, Motion, and Energy due to their abstract nature and the high demands on spatial and representational reasoning. Studies have shown that students often do not draw and interpret free-body diagrams accurately and do not know how to identify and express the forces acting on objects. As a result, they hold onto misconceptions about Newtonian mechanics (Pratiwi et al., 2021; Sirait et al., 2021). Also, learners have significant difficulty distinguishing between speed and velocity and often confuse scalar and vector quantities. Therefore, when learners apply motion concepts to real-world situations, they often misunderstand them. Findings from Madina et al. (2022) indicate that learners hold many misconceptions about straight-line motion, particularly regarding velocity and its relationship to motion, and often offer incorrect reasons for their misunderstandings of displacement, speed, and direction.

In addition to previous studies, other studies indicate that students tend to have difficulty connecting macroscopic observations with conceptual models in physics, which leads to difficulties in explaining thermal processes such as conduction and convection using particle-level reasoning (Soeharto & Csapó, 2021). By interpreting this data, one can see that students still tend to have difficulties making an accurate connection to an abstract concept in physics.

The domain 4 results indicate that three competencies were particularly challenging for students in reaching the mastery level. Of these three competencies, the greatest difficulty was encountered when using the PHIVOLCS Fault Finder to assess local earthquake risk, with students achieving a Mastery Proficiency Score (MPS) of 31%. In the second MPS, the explanation of how solar energy interacts with the atmosphere received a score of 33%, placing this competency in the Not Mastered category. Finally, students demonstrated 35% mastery when creating physical models or drawings to illustrate the impact of Earth's tilt on the intensity of sunlight, indicating a student level of Approaching Mastery.

According to recent studies examining common ways of learning in Earth and space science education, geoscience concepts are abstract, large-scale, and spatial, so learners often struggle to interpret geospatial data and Earth system models and representations, such as maps. This is important because understanding how geospatial data and Earth system models work is critical to understanding various Earth hazards, such as earthquakes and faults (Ribeiro & Orion, 2021). In addition, students often hold misconceptions about solar radiation and atmospheric processes, particularly regarding how solar energy is absorbed and distributed throughout the Earth's system (da Rosa, 2021). Consistent with research on astronomy education, studies indicate that learners have difficulty understanding seasons and axial tilt. Often, students mistakenly attribute seasonal changes to the distance between the Sun and Earth rather than to the tilt of the Earth's axis (Bykerk-Kauffman, 2021; NOAA Climate Education Resources, 2021-2023).

These studies show how learners continue to experience difficulty integrating spatial reasoning and Earth and space system models into their scientifically accurate understanding.

Problem 2. Based on the identified least-learned competencies, what Strategic Intervention Materials (SIMs) can be designed and developed for Grade 7 Science?

Based on the identified least-learned competencies across the four domains, four (4) Strategic Intervention Materials (SIMs) were designed and developed. The development process followed a structured instructional design to simplify complex scientific concepts into student-friendly tasks.

The researcher developed one SIM for each domain of the Grade 7 Science curriculum. Each material was designed with a specific theme and a set of "Cards" to guide the learner through the intervention process.

Table 2 summarizes the alignment between the learning competencies and the developed interventions.

Table 2. ***Alignment of Least-Learned Competencies and Developed SIMs***

Domain	Least-Learned Competency (LLC)	SIM Title	Key Strategy/Theme
D1	Expressing the amount of solute quantitatively in a given volume of solvent.	**The Great Science Mix-Up**	Quantitative calculation of solutions using household examples.
D2	Differentiating plant and animal cells based on their organelles.	**Cell-O Quest**	Microscopic adventure focusing on structural comparison.
D3	Drawing free-body diagrams (FBD) to represent relative magnitude and direction of forces.	**Arrow Power**	Visualizing abstract forces using arrow-based diagrams.
D4	Explaining how solar energy interacts with the atmosphere.	**Sun-Kissed**	Atmospheric "Space Suit" analogy (Bounce, Soak, and Spread).

All of these developed SIMs used a standardized five-card structure to maintain consistency and support effective pedagogy. This design allows all students to progress from the simplest concept to its most complex application in a scaffolded way.

Below are figures of the Guide Card, which serves as an overall overview of the topic and outlines the learning targets using characters to engage students, Activity Cards that have three to four tasks that students can complete to practice the competency, Assessment Card which consists of a five-item test that can be used to measure the immediate mastery of the goals of the SIM, Enrichment Cards that contain additional activities

that will allow your students to gain a deeper understanding of the material, Reference Cards containing links to resources where students can read more about the topic, and Answer Key Cards that give instant feedback on self-correction. The visual engagement and the simplicity of the language guiding the design of the SIMs were paramount in creating these learning materials. For example, the conceptual understanding of force from Domain SIM Arrow Power has been simplified and translated into the task of determining the direction of force and the magnitude of force, supporting the principles of Scaffolding (the provision of temporary assistance to support students in the achievement of tasks that they would otherwise be unable to complete independently).

Similarly, Domain 4 SIM Sun-Kissed uses the analogy of a Space Suit to help learners understand how atmospheric interactions (Reflection, Absorption, Scattering) occur and to compare scientific concepts with familiar objects such as sponges and blankets, thereby reducing learners' cognitive load.

The addition of an AI Declaration and Disclosure in each SIM highlights the collaborative nature of the development process. The researcher utilized AI tools to create high-quality, customized diagrams specifically designed to align with and support the competencies identified for Grade 7 Science, thereby providing content-accurate and visually engaging instructional materials for students who are predominantly visual learners.

The selection of the least-learned competencies for each domain was based on their relevance to the anticipated learning gaps identified for the Grade 7 learner and their potential to be developed into hard-copy Strategic Intervention Materials (SIMs). The chosen competencies were deemed appropriate for the development of SIMs, as they can be structured and documented through clear, step-by-step learning tasks supported by simple explanations, illustrations, diagrams, and guided activities, suitable for hard-copy delivery. Therefore, SIMs have been developed to be practical for classroom implementation, easy to utilize during Remediation sessions, and aligned with the instructional needs of learners engaged with the MATATAG Curriculum.

The findings of the 2021 study conducted by Arpilleda support these conclusions, as he contended that Strategic Intervention Materials are effective tools for improving learners' mastery of Least Learned Competencies in Mathematics. His research showed that SIMs improve learners' academic performance by providing clearly structured, guided activities that are tailored to address specific learning difficulties.

Similarly, in 2021, Lazo and De Guzman pointed out in their successful study of distance education in Economics that SIMs provide an effective means of remediating competency gaps by enhancing students' understanding through simplified lesson delivery and targeted remediation supports for students having difficulty with complex subject matter.

Gabucan and Sanchez (2021) also found that instruction delivered using SIMs resulted in substantial improvements in learners' understanding of the scientific concepts of Global Warming and their implementation of a study of how utilizing structured intervention materials, supported through the use of guiding activities and contextualized examples, enhances learners' comprehension and level of learner engagement with challenging Science subject matter.

Lastly, the 2024 study by Lituañas and De la Cruz demonstrates that contextualized SIMs are effective supplemental resources when developed to meet learners' individual needs and the competencies outlined in the curriculum. Their research focused on the value of clear delivery methods, visual presentations, and organized instructional tasks in improving learners' understanding of science.

In summary, by developing the competencies selected for each SIM, SIMs have been shown to address each domain’s critical learning gaps, thus providing a targeted, structured, and competency-based support

system for each learner aligned with the MATATAG Curriculum. Copies of these research documents and the SIMs were provided in separate attachments for reference and review.

Problem 3. How do expert validators and science teachers evaluate the developed SIMs in terms of content, format, presentation and organization, and accuracy and up-to-dateness?

Table 7 summarizes expert and teacher validation across all factors.

Table 7. ***Summary of experts and teachers' validation across all factors***

Factors	Experts	Remarks	Teachers	Remarks
Content	27.30	Passed	26.37	Passed
Format	69.85	Passed	68.81	Passed
Presentation and Organization	20.00	Passed	18.48	Passed
Accuracy and Up-to-datedness of Information	24.00	Passed	24.00	Passed

The Comprehensive Validation Process Overview has been summarized in Table 7 as the Summary of Expert and Teacher Validation Across All Factors, as this is the last table displaying the results of the four Evaluation Categories of Expert Validators and Teacher Validators to show that the Strategic Intervention Materials (SIM's) have consistently met or exceeded the minimum quality level expectations for Instructional Materials.

From the summary table, it can be seen that both experts and teacher validators provided a "Passed" for all factors. The Experts' Validation Scores ranged from a perfect score to high scores in Format (69.85) and Content (27.30). Similarly, the Teacher Validation Scores were fairly robust, with only very slight variations compared to the Experts' Validation Scores, because the teacher validators had a more practical perspective grounded in their actual teaching experience.

The most significant finding was in the Accuracy and Up-to-datedness category, where both groups provided the maximum score of 24.00. This indicates that both groups have determined that the materials are scientifically accurate for student use.

Overall, the results indicate a high level of inter-rater reliability, suggesting that although the Experts and Teachers Validation Scores represent two distinct professional roles, there is agreement on the SIMS's overall effectiveness. This agreement demonstrates that the materials are not only pedagogically sound (Content) and technically accurate (Accuracy), but also visually and ergonomically appropriate for Grade 7 learners (Format and Presentation). The successful validation of the resulting SIMs ("The Great Science Mix-Up," "Cell-O Quest," "Arrow Power," and "Sun-Kissed") based on all of the above factors shows that they are valid instructional materials. The SIMs can be effective tools for closing learning gaps across the least-mastered competencies in what students have studied, providing students with an organized, engaging, and error-free means of achieving mastery in science.

Branch (2009) states that, through the ADDIE process, instructional materials must be designed using a carefully considered, systematic approach. The satisfactory results of the SIMs' validated evaluations demonstrate that a systematic process was followed in developing these materials.

Instructional design is an evidence-based, systematic process and a clearly defined means of developing and evaluating instructional materials against their intended learning outcomes and learner needs (Reiser & Dempsey, 2023). High ratings for the content and format of the SIMs indicate that they have been

developed in accordance with sound instructional design principles and can support the targeted Science competencies, particularly the least-mastered skills.

Overall, the presentation and organization of the SIMs received perfect or near-perfect ratings, supporting the notion that the SIMs provide highly logical structures and clear sequences for learners to follow as they progress through lessons and activities.

Mayer (2024) asserts that well-organized multimedia and instructional materials enhance meaningful learning by reducing cognitive overload. Clear, well-organized materials help students process and retain knowledge.

Additionally, according to the DepEd Learning Resource Management and Development System (LRMDS, 2022) guidelines, learning materials must ensure usability in both classroom and self-learning environments by providing a cohesive, logically organized, and developmentally appropriate structure. The high evaluation ratings for the presentation and organization aspects of both SIMs demonstrate their adherence to these standards.

The consistent, perfect ratings for both the accuracy and currency of the information within the SIMs correlate positively, demonstrating that the SIMs are consistent in overall accuracy and current with acceptable scientific knowledge. This is paramount, as accuracy in scientific education directly impacts a learner's ability to conceptualize a scientific concept correctly.

Educational resources must be accurate, up to date, and aligned with current knowledge systems to provide a high-quality learning experience for learners (UNESCO, 2023). The evidence supporting the claim that the instructional materials are relevant and accurate to current knowledge is reiterated by OECD (2023), which states that the educational system must provide reliable and relevant instructional materials to produce effective teaching and learning outcomes.

This analysis concludes that the SIMs are reliable and instructional resources aligned with current international standards for teaching and for providing effective Instructional Materials (IM).

Problem 4. What is the level of learners' perception of the developed Strategic Intervention Material (SIM) in terms of clarity, usability, engagement, design, organization, appropriateness, and impact?

Table 15 presents a summary of learners' perceptions of the developed Strategic Intervention Materials (SIMs).

Table 15. Level Of Learners' Perception Of The Developed Strategic Intervention Materials (SIMs).

Criteria	Mean	Standard Deviation	Perceived Level
Clarity	3.79	0.41	Very High
Usability	3.76	0.43	Very High
Design	3.83	0.37	Very High
Organization	3.77	0.42	Very High
Appropriateness	3.82	0.42	Very High
Impact	3.79	0.42	Very High

Note: Mean scores falling within 1.00-1.74: Very Low, 1.75-2.49: Low, 2.50-3.24: High, 3.25-4.00: Very High

The highest mean, 3.83, indicates a very high level of learners' perception of Design. Similarly, the lowest mean of 3.76 indicates a very high level of perception regarding Usability. In effect, the consistently high ratings across all criteria indicate a very high level of learners' perception of the developed Strategic Intervention Materials (SIMs). This summary highlights that while all aspects of the materials are exceptionally well received, the visual and structural design stands out as a particular strength, and usability remains a highly effective component of the instructional package.

The calculated standard deviations for the four SIMs ranged from 0.37 to 0.43, suggesting that learners' responses were consistently highly correlated. The design's standard deviation of 0.37 indicates that learners were most consistent in their perceptions of the instructional content's visual appeal. The standard deviation of 0.43 for usability indicates that learners showed greater variability in how easily the materials are to use compared to the other three SIMs. This indicates that learners' overall perceptions of the instructional materials' effectiveness across all four SIMs are homogeneous, rather than limited to small groups.

This finding also supports Reiser and Dempsey's (2023) assertion that effective instructional materials must be well-organized and usable. If an instructional resource is clearly organized, it is easier for a learner to process and remember information, and therefore, they exhibit greater success in their learning.

Furthermore, as indicated by the DepEd Learning Resource Management and Development System (2022), all learning materials must be organized logically, suitable for development, and usable. This is especially true for modular and intervention-based instruction. High scores in organization across all SIMs demonstrate that these requirements were met. The high mean scores for the design and engagement of the SIMs, as evidenced by the consistently high means throughout the quarters, demonstrate that the learners found the SIMs to be visually appealing and engaging, thus suggesting that the materials were able to engage learners' attention and encourage learners to engage with the content actively.

According to Mayer (2024), effective multimedia and instructional design should employ both visual clarity and engagement strategies to facilitate meaningful learning. Well-designed instructional materials help reduce extraneous cognitive load for learners and increase their motivation to learn, particularly in science, where many concepts are abstract.

Additionally, according to UNESCO (2023), visually well-designed instructional materials significantly contribute to learners' motivation and engagement, thereby increasing participation in basic education. Learners' perceptions of the SIMs support this global finding, as they illustrate that the design of the instructional materials has played a major role in enhancing learners' learning experience.

High mean ratings for the appropriateness and impact of the SIMs suggest that learners found them appropriate for their level and that they effectively enhanced their understanding of science concepts. This finding also supports the principle of instructional alignment, as stated by Branch (2009), that instructional materials are effective when developed relative to the needs, abilities, and learning context of the learner(s). The high mean rating in the appropriateness area indicates that the instructional materials for the SIMs have addressed learners' learning gaps.

OECD (2023) stated that, in addition to the need for accessibility, effective educational resources should also be impactful in terms of improving the outcomes of the learner(s). Therefore, the strong impact in the impact area indicates that learners experienced meaningful learning gains from using the SIMs.

The low-to-moderate standard deviation across all quarters indicates a high degree of consistency in learners' responses. This finding indicates broad agreement among respondents regarding their positive perceptions of the SIMs.

Reiser and Dempsey (2023) asserted that instructional design is an empirical, iterative process in which evaluation data are collected and analyzed to determine the design's effectiveness and to support changes to it. Therefore, consistent performance data across groups might indicate that the SIM instructional materials are reliably supporting learners' intended engagement.

The study's overall findings indicate overwhelming agreement among learners that the SIMs are effective, exciting, well-designed, and helpful in improving their comprehension of science concepts. The basic principles of instructional design and the body of educational research in this area strongly support these findings.

Problem 5. Is there a significant difference in the mean scores of the learners before and after the implementation of SIM?

Table 16 shows the paired t-test results for the difference between the learners' pre-test and post-test scores.

Table 16.*Paired t-test results on the difference between the pre-test and post-test scores of the learners*

Domain	Pre-test	Post-test	Mean Difference	P-value	Remarks
D1	4.83	8.57	3.74	<0.001	Significant
D2	6.07	7.01	0.94	0.032	Significant
D3	4.50	7.73	3.23	<0.001	Significant
D4	4.90	7.57	2.67	<0.001	Significant

Level of significance: 0.05

The results of the paired t-test comparing pre-test and post-test data for learners across the four domains are displayed in Table 16. All four quarters showed statistically significant improvements in learners' performance ($p < 0.05$). Therefore, the instructional approach used throughout the study appears to be an effective means of improving students' academic performance over time. As indicated by the increase in post-test scores from the pre-test, the instructional process provided learners with additional knowledge and skills. i.e., formative activities that positively affect achievement (Creswell & Guetterman, 2021; Hattie, 2023).

In Domain 1 of the analysis, the pre-test and post-test mean scores were statistically significant, with a meaningful increase of 3.74 from 4.83 (pre) to 8.57 (post), yielding $p < 0.001$. This large increase in mean score indicates significant improvement in learners' mastery of the competencies taught during the quarter. It suggests that learners had very little prior knowledge of these competencies and made progress after receiving instruction. This finding supports the notion that providing targeted, engaging instruction, along with structured learning activities, positively affects learners' cognitive development and academic success (Vygotsky, 1978).

The evidence indicating that the instructional methods used during the first quarter promote learning closure and increase students' understanding is also evident in the results in Domain 2. When computing post-test scores for Domain 2 ($M = 7.01$) relative to pre-test scores ($M = 6.07$), we observe a difference of 0.94 ($p = 0.032$). Although lower than the increase observed in the previous quarter, it remains statistically significant and supports the conclusion that learners have continued their growth through intervention-based instruction, even with greater baseline knowledge than at the previous administration of the assessments.

Furthermore, the smaller mean difference in Domain 2 may indicate that the competencies taught in Quarter 2 were either less challenging or that students had prior knowledge of the content. The evidence nonetheless continues to demonstrate that effective and continuous instruction, along with reinforcement activities, are critical elements for continual academic growth and academic success among all learners (Agarwal et al., 2021).

The results for Domain 3 of the study mirrored those for Domains 1 and 2; that is, the pre-test and post-test scores were also statistically significant, as evidenced by similarly large increases. In Domain 3, pre-test scores had a mean of 4.50, while post-test scores had a mean of 7.73; thus, the mean difference of 3.23 and $p < 0.001$ confirms interest in making limited improvement relative to pre and post-test assessments, which were achieved at the same time as comparable levels of student improvement between the preceding two quarters. In Domain 4, there was a similar trend: the pre-test mean was 4.90, followed by a post-test mean of 7.57, yielding a statistically significant difference of 2.67 ($p < 0.001$).

These results indicate that learners made significant progress across all domains during the final quarter of the study, with increases in mean scores attributed to cumulative learning, increased learner confidence, and access to efficient instructional practices. As supported by research, continued practice and timely feedback, delivered through actively engaged learning environments, develop a deeper understanding of concepts and promote retention in learners (OECD, 2023). Overall, the paired t-test analysis confirms a significant difference between pre- and post-test scores for learners across all four quarters, leading to the rejection of the null hypothesis. The findings imply that the educational intervention or instructional approach used throughout the study had a positive, meaningful effect on learners' academic performance.

Problem 6. Based on the developed SIMs, what are the pathways for their utilization in the following levels? School level; District level; and Division level?

The final phase of this study focused on identifying the structured pathways for the utilization of the developed Strategic Intervention Materials (SIMs). This process ensures that the validated materials, "The Great Science Mix-Up," "Cell-O Quest," "Arrow Power," and "Sun-Kissed," reach the target learners effectively and sustainably.

Table 17 shows the summary of Expert and Teacher Recommendations for Utilization.

Table 17. ***Expert and Teacher Recommendations for Utilization***

Category	Recommended for Approval	Recommended for Revision	Non-Approval	Total Approval Rating
Expert Validators (5)	**3**	**2**	**0**	**100%**
Science Teachers (13)	**13**	**0**	**0**	**100%**
Overall	**18**	**2**	**0**	**100%**

As shown in Table 17, the pathways for using the developed SIMs were established based on recommendations from five (5) expert validators and thirteen (13) science teachers from Kitcharao District. Table 17 also shows the results obtained from the DepEd Learning Resource Management and Development System (LRMDS) Evaluation Tool, indicating that 100% of the total SIMs received approval ratings from the

thirteen (13) science teachers. Additionally, three (3) of the five (5) expert validators recommended that the SIMs be approved immediately, and two (2) of the five (5) expert validators recommended that the SIMs be approved with minor modifications. None of the five (5) experts recommended denying approval for any of the SIMs. The recommendations from expert validators for modifications address the development and evaluation phases of the ADDIE model and serve as quality control for the materials. Although the teachers' approval of the SIMs indicates they are ready for classroom use from the practitioner's perspective, the expert validators assure that the materials comply with the LRMDS quality standards. The level of support given to SIMs in this work by Picardal and Sanchez (2022) aligns with the provision of contextualized resources when they can bridge the identified learning gaps. The structured review process followed provides the evidence needed to meet the quality assurance requirements cited by Khutwane and Mahlangu (2025), ensuring that only refined and validated materials are used for implementation. The unanimous agreement among all parties involved in supporting the proposed SIM utilization pathways in DepEd reflects a collective view of the significance of validation processes in ensuring the quality and relevance of instructional materials. This view is supported by research studies (Picardal & Sanchez, 2022; Limbago-Bastida & Bastida, 2022; Danes et al., 2026), which indicate that teaching resources evaluated and contextualized to curriculum standards and learner needs are more acceptable than those not aligned with them. Furthermore, numerous examples demonstrate the effectiveness of SIMs in improving student learning outcomes in Science when they are developed and validated correctly before use (Limbago-Bastida & Bastida, 2022; Danes et al., 2026).

In addition, quality assurance processes in schools ensure the effectiveness of instruction and guarantee that only validated materials are used in the teaching and learning process (Khutwane & Mahlangu, 2025).

The strong endorsement from all parties involved provides the basis for establishing the utilization paths of the SIMs at the school, district, and division levels, in accordance with the DepEd LRMDS guidelines (Department of Education, 2021). Quality assurance processes for instructional resources should include multiple validation and approval levels to provide accountability and ensure that instructional resources are appropriate for classroom use (Khutwane & Mahlangu, 2025; Philippine Journal of Education Studies, 2023). This validated process also underscores the importance of good governance in retaining high-quality learning materials within the educational system.

At the school level, SIMs will be endorsed and used by Grade 7 Science teachers for remediation and intervention activities to address the least mastered competencies. Evidence indicates that when teachers use SIMs as targeted instructional support materials, they can improve student performance (Limbago-Bastida & Bastida, 2022; Danes et al., 2026).

At the district level, SIMs will be reviewed and disseminated through LAC sessions and instructional supervision conducted by PSDS. LACs have been shown to enhance teacher professional development and improve teacher instructional practices through collaborative professional development (Detuya & Tudlasan, 2026).

At the division level, SIMs will be submitted to the LRMDS office for possible recognition for use across all schools, and the systematic use and dissemination of validated instructional materials will improve instruction quality and support the scalability of effective practices (Mendiola & Estonanto, 2022). In addition, the systematic implementation and monitoring of SIMs will provide opportunities to sustain instructional innovations throughout the educational system.

In summary, the findings show that the developed SIMs are highly acceptable and have strong potential for a structured School–District–Division approval pathway. The SIMs developed will support

systematic implementation, facilitate monitoring, and ensure sustainability. Recent research studies demonstrate the need for structured quality assurance systems and collaborative professional development mechanisms to ensure the effective and lasting impact of instructional materials on student achievement (Khutwane & Mahlangu, 2025; Detuya & Tudlasan, 2026).

Conclusions

The empirical findings from the data analysis provide substantial evidence to support conclusions about the development, evaluation, and effectiveness of the Strategic Intervention Materials (SIMS) in Grade 7 Science.

1. The identification of the least learned competencies in Grade 7 Science revealed that learners had difficulty understanding essential concepts across all four domains. This implies the need for appropriate intervention materials to address persistent learning gaps.
2. The ability to devise and implement specific SIMs designed to address the specific learning needs indicates that the most effective manner of executing instructional design is by tailoring it in a systematic process to address the precise local needs of students who struggle academically.
3. The "Very Satisfactory" ratings from expert validators as well as classroom science teachers indicate that the developed SIMs successfully possess the four essential factors of instructional quality: content quality, format, presentation and organization, and accuracy and up-to-dateness of information. This comprehensive validation confirms that the materials meet or exceed national DepEd criteria, establishing them as highly credible, peer-validated, and pedagogically sound instruments for Science instruction.
4. The strongly positive feedback from the students indicates that the developed materials successfully satisfy the seven core dimensions of a learner-centered intervention: clarity, usability, engagement, design, organization, appropriateness, and impact. This comprehensive student approval demonstrates that these structured, user-friendly layouts and design choices successfully minimized learning anxieties, built confidence in self-paced learning, and lowered the cognitive barriers associated with decoding complex scientific concepts.
5. The statistically significant increase in scores from the post-tests demonstrates that systematically developed, self-paced strategic intervention materials have strong potential to serve as effective instructional tools for increasing baseline academic achievement levels and facilitating immediate concept mastery among students.
6. The unanimous support and recommendation for LRMDS integration establishes the SIMs developed within the current study as completely viable, scalable assets to be adopted to support the academic intervention programs of the schools, districts, and divisions.

Recommendations

Education department officials may leverage this study to develop a general, overarching policy for macro-level governance, to be used in conjunction with improved curriculum implementation. Senior administrators should institutionalize the strategic use of Strategic Intervention Materials (SIMs) as a key part of the development of national and regional remedial programs (to provide support for children who are struggling in school). Officials should also create support systems to assist educational institutions with funding, technical support, and standard pedagogical training, enabling teachers to develop and distribute instructional materials contextualized to their regions, ultimately aligning with Sustainable Development Goals 4 and 9.

School administrators may use the results of this study to create, implement, and evaluate science-based intervention and support programs in their schools. It is recommended that school administrators create repositories of validated SIMs and facilitate their replication and widespread adoption across their district to help identify and address academic deficits among their students. Furthermore, school leaders should use these results to prioritize their staff's professional development, allocate resources to innovative instructional materials, and establish strategies to measure the impact of instructional efforts on student academic achievement.

Teachers and instructional designers may consciously incorporate research-based SIMs into their lesson plans to diversify how they facilitate students' learning and support the delivery of a variety of learning styles. Teachers should develop and use innovative, localized, and highly interactive instructional tools to help students deepen their understanding of abstract scientific concepts and foster student-centered learning. By using research-based SIMs, teachers will increase students' ability to close immediate learning gaps, improve conceptual retention, and create a positive learning environment for all students.

Students are encouraged to actively engage in learner-centered activities (interactive activities within the SIMs) to help develop greater responsibility for their academic success. SIMs can help students master challenging science concepts, reduce their individual learning gaps, and enhance their long-term ability to recall information. Continued engagement in the SIMs will improve individual academic achievement in science and help increase individual student confidence.

The validated instruments and empirical evidence from this study may serve as a foundation for future research examining broader issues in remediation, SIMs, and curriculum implementation. Future researchers are encouraged to replicate or extend the framework established by this study's findings by investigating the impact of SIMs on curriculum implementation across a greater variety of grade levels, subject areas, and educational institutions. In addition, future researchers should conduct longitudinal studies to evaluate the impact of using SIMs on student achievement and global educational models.

Further research on this study is also recommended. The results of the current study offer an excellent starting point for developing future projects. In particular, future SIM administrations should be organized into a long-term, highly structured classroom or institution-wide remediation program rather than compressed into a single day with limited time to provide this service. Longitudinal research utilizing the most sophisticated inferential statistic (i.e., a paired t-test) with a larger group should be undertaken to validate the long-term academic efficacy and stability of SIMs and to evaluate the comparison of pre- and delayed post-tests. By using this structured mechanism, the observed academic growth will reflect true retention of knowledge and conceptual understanding over the long term, rather than a short-term measure of success. The proposed Strategic Intervention Material (SIM) Remediation Program is attached in Appendix V.

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References

Acera, F. S. (2022). The use of strategic intervention materials in science (SIM-S) to improve learners' academic performance. International Journal of Advanced Social Science, 5(4). https://ijassjournal.com/2022/V5I4/414665472.pdf

Adonis, A. B. (2020). Contextualized strategic intervention materials in Grade 9 mathematics. PEOPLE: International Journal of Social Sciences, 5(3), 850–868. https://doi.org/10.20319/pijss.2020.53.850868

Agarwal, P. K., Nunes, L. D., & Blunt, J. R. (2021). Retrieval practice consistently benefits student learning: A systematic review of applied research in schools and classrooms. Educational Psychology Review, 33(4), 1409–1453. https://doi.org/10.1007/s10648-021-09595-9

Aguanta, C. B., Augusto, M. A. T., Bajenting, J. V., Buayaban, K. C., Cruz, E. J. P., Fantonial, N. F., Kwan, J. A. M., & Acut, D. P. (2024). Factors affecting students' concept retention in learning science online using instructional videos. Journal of Education and Learning (EduLearn), 18(2), 499–511. https://doi.org/10.11591/edulearn.v18i2.21117

Arevalo, C. M. E., Janer, S. S., & Ricafort, J. D. (2023). Development of contextualized strategic intervention materials for Grade 8 physics. United International Journal for Research & Technology, 4(7), 114–118.

Arpilleda, A. J. (2021). Strategic intervention material: A tool in enhancing Grade Nine students' mathematical performance. International Journal of Research in Education and Science, 10(5), 61–72. https://doi.org/10.5861/ijrse.2021.5051Atkinson,

Croisant & Bretz (2021). – Students' challenges in linking chemical representations, https://pubs.rsc.org/en/content/articlehtml/ 2021/rp/d0rp00193g

Bacatan, J., Acedillo, R., Lagahit, J.-A., & Macusang, A. J. (2022). Students' and teachers' perceptions on the effectiveness of using strategic intervention material in science. International Journal of Research and Innovation in Social Science, 6(3), 60–68. https://doi.org/10.47772/IJRISS.2022.6304

Bajarias, N., Ramos, R., de Guzman, R., Largo, P., Galicia, D. B., & Cayogyog, A. O. (2024). Dynamics of curriculum alignment: Experiences of elementary school teachers in focus. International Journal of Research and Innovation in Social Science. https://doi.org/10.47772/IJRISS.2024.807145

Borabo, J. G., & Dio, R. V. (2025). Effectiveness of strategic intervention material (SIM) in improving Filipino students' performance in science and mathematics: A meta-analysis. Journal of Basic Education Research, 6(2), 79–89. https://doi.org/10.37251/jber.v6i2.1420

Branch, R. M. (2009). Instructional design: The ADDIE approach. Springer. https://doi.org/10.1007/978-0-387-09506-6.

Bykerk-Kauffman, A. (2021). Misconceptions about seasons and Earth–Sun relationships. Science Education Resource Center (SERC), Carleton College. https://serc.carleton.edu

Cayabas Jr., J. P., & Sumeg-ang, D. A. (2023). Challenges and interventions in developing instructional materials: Perspectives of public school teachers in basic education. International Journal of Innovative Research and Scientific Studies, 6(4), 849–855. https://doi.org/10.53894/ijirss.v6i4.2059

Creswell, J. W., & Guetterman, E. D. (2021). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (6th ed.). Pearson. https://api.pageplace.de/preview/DT0400.9781292337852_A39573381/preview-9781292337852_A39573381.pdf

da Rosa, J. A. (2021). Climate science misconceptions and reasoning difficulties among undergraduates. Journal of Geoscience Education, 70(4), 501–516. https://doi.org/10.1080/10899995.2021.2006549

Danes, J. D., Valera, J. S., & Galay-Limos, J. A. (2026). Effectiveness of strategic intervention materials (SIMs) in improving Grade 7 science learning outcomes. International Journal of Research Studies in Educational Technology, 10(1), 19–35. https://doi.org/10.5861/ijrset.2026.26002

Department of Education. (2009). Guidelines and processes for LRMDS assessment and evaluation (Version 1.0). https://lrmds.deped.gov.ph/docs/LRMDSGuidelines.pdf

Department of Education. (2012). DepEd Order No. 39, s. 2012: Policy guidelines on addressing learning gaps. https://www.deped.gov.ph/wp-content/uploads/2012/05/DO_s2012_39.pdf

Department of Education. (2024). DepEd Order No. 010, s. 2024: Policy guidelines on the implementation of the MATATAG curriculum. https://www.deped.gov.ph/wp-content/uploads/DO_s2024_010.pdf

DepEd Learning Resource Management and Development System. (2022). Guidelines on the development and evaluation of learning resources—Department of Education, Philippines.

Detuya, R. T., & Tudlasan, R. T. Jr. (2026). Learning action cell (LAC) sessions on professional development and their impact on quality instruction. Excellencia: International Multi-Disciplinary Journal of Education, 4(2), 89–132. https://multijournals.org/index.php/excellencia-imje/article/view/3756

Donovan, B. M. (2021). Ending genetic essentialism through genetics education. Human Genetics and Genomics Advances, 3(1), 100058. https://doi.org/10.1016/j.xhgg.2021.100058

Dumdumaya, C. C., Nahial, W. L., Sabacajan, B. T., & Morados, A. N. (2024). Effect of strategic intervention materials on learners' learning competencies. International Journal of Multidisciplinary: Applied Business and Education Research, 5(6). https://doi.org/10.11594/ijmaber.05.06.11

Duran, M. R. D., & Eliaga, C. T. (2024). Ang bisa ng Strategic Intervention Material (SIM) sa pagkatuto ng Filipino 9. International Journal of Research Studies in Education, 13(16), 161–173. https://doi.org/10.5861/ijrse.2024.24838

Enhancing teaching strategies through cognitive load theory: Process vs. product worked examples. (2024). Education Sciences, 14(8), 813. https://doi.org/10.3390/educsci14080813

Estipona, J. D. R. (2024). Strategic intervention material (SIM): Its effectiveness in teaching beauty nail care services. American Journal of Physical Education and Health Science, 2(1), 30–34. https://doi.org/10.54536/ajpehs.v2i1.2412

Fernandez, M. M. (2025). S.M.A.R.T.: Enhancing performance in identifying cell parts and functions among Grade 7 learners of Maddela Integrated School of Arts and Trades. Volume 1, Issue 8, 168–190. https://doi.org/10.5281/zenodo.16822961

Flores, M. A. Z., & Cacho, M. I. (2020). Strategic intervention material in English 6. Union Christian College Philippines Journal of Multidisciplinary Research.

Gabatino, J. (2025). Improving the experimentation skills in science of Grade 5 learners through electronic inquiry-based learning kit. International Journal of Research Studies in Education, 14(15), 59–68.

Gabucan, J. R., & Sanchez, J. M. P. (2021). Strategic intervention material (SIM)-based instruction for teaching global warming concepts in 9th-grade science. International Journal of Education and Research. https://www.researchgate.net/publication/350609489_Strategic_Intervention_Material_SIM-based_Instruction_in_Teaching_Global_Warming_in_9th_Grade_Science

Gregorio, F. H. S. (2024). Utilization of strategic intervention material (SIM) in teaching biology. Pedagogy Review: An International Journal of Educational Theories, Approaches and Strategies, 3(1), 1–8. https://doi.org/10.62718/vmca.pr-ijetas.3.1.SC-0724-008

Hattie, J. (2023). Visible learning: The sequel: A synthesis of over 2,100 meta-analyses relating to achievement. Routledge. https://doi.org/10.4324/9781003380542

Hendrycks, D., et al. (2021). Measuring Mathematical Problem Solving With the MATH Dataset. arXiv.https://arxiv.org/abs/2103.03874

Jamandron, H. E. (2020). Teacher-made science strategic intervention materials: A tool for remediation. IJRDO – Journal of Educational Research, 5(8).

Khutwane, T. M., & Mahlangu, V. P. (2025). The significance of implementing quality assurance in schools to enhance learner performance. International Journal of Learning, Teaching and Educational Research, 24(8), 671–687. https://doi.org/10.26803/ijlter.24.8.29

Lazo, D. D., & De Guzman, M. F. D. (2021). Strategic intervention material: A learning approach to teaching economics in distance education. International Journal of Computer Engineering in Research Trends, 8(5), 76–84. https://www.ijcert.org/index.php/ijcert/article/view/653

Limbago-Bastida, R. A. C., & Bastida, G. L. (2022). Effectiveness of strategic intervention materials on students' learning outcomes. European Journal of Social Sciences Studies, 7(4), 1–14. https://doi.org/10.46827/ejsss.v7i4.1249

Lituañas, A. B., & De la Cruz, F. M. (2024). Development and validation of contextualized strategic intervention materials in science for Grade 6 learners. Asian Journal of Science Education. https://www.researchgate.net/publication/387852042_Development_and_Validation_of_Contextualized_Strategic_Intervention_Materials_in_Science_for_Grade_6_Learners

Machová, M., & Ehler, E. (2021). Secondary school students' misconceptions in genetics: Origins and solutions. Journal of Biological Education, 57(3), 633–646. https://doi.org/10.1080/00219266.2021.1933136

Madina, I. S., Mayasari, T., Ratnawulan, S., Sari, S. Y., & Sundari, P. D. (2022). Identification of students' misconceptions in straight-motion materials using a four-tier diagnostic test and the certainty-of-response index (CRI). Pillar of Physics Education, 15(1), 21–30. https://www.researchgate.net/publication/362314261_IDENTIFICATION_OF_STUDENT'S_MISCONCEPTIONS_ON_STRAIGHT_MOTION_MATERIALS_USING_FOUR-TIER_DIAGNOSTIC_TEST_AND_CERTAINTY_OF_RESPONSE_INDEX_CRI

Mangisel, F. P. (2024). The efficacy of a validated strategic intervention material in multiplication of fractions. Randwick International of Education and Linguistics Science Journal, 6(2), 574–589. https://doi.org/10.47175/rielsj.v6i2.1164

Mayer, R. E. (2024). The Cambridge handbook of multimedia learning (3rd ed. update). Cambridge University Press. https://www.researchgate.net/publication/359588183_The_Cambridge_Handbook_of_Multimedia_Learning_3rd_ed

McLeod, S. (2026, January 23). Piaget's theory and stages of cognitive development. Simply Psychology. https://www.simplypsychology.org/piaget.html

Mekwong, S., & Chamrat, S. (2021). The development of learning activities using three levels of chemical representation to enhance upper secondary students' understanding of organic chemistry concepts. Journal of Physics: Conference Series, 1835(1), 012027. https://doi.org/10.1088/1742-6596/1835/1/012027

Mendiola, A. C., & Estonanto, A. J. J. (2022). Utilization of instructional materials developed by the mathematics teachers in the Province of Sorsogon, Philippines. Asian Journal of Education and e-Learning, 10(3), 30–39. https://doi.org/10.24203/ajeel.v10i3.7045

National Oceanic and Atmospheric Administration (NOAA). (2021–2023). Earth science education and climate literacy resources. https://oceanservice.noaa.gov

Niño, E. J. A., & Lomibao, L. S. (2026). A systematic review of the development and validation of instructional materials used in Philippine mathematics classrooms. Journal of Innovations in Teaching and Learning, 6(1), 1–8.

Organization for Economic Co-operation and Development. (2023). PISA 2022 results (Volumes I–II): Country notes – Philippines. OECD Publishing.

OECD. (2023). Education at a glance 2023: OECD indicators. Organization for Economic Co-operation and Development. https://www.oecd.org/education/education-at-a-glance/

Philippine Journal of Education Studies. (2023). Philippine Journal of Education Studies (PJES): Volume 2, Number 1. University of the Philippines College of Education. https://educ.upd.edu.ph/wp-content/uploads/2024/04/PJES-DOI-04162024.pdf

Picardal, M. T., & Sanchez, J. M. P. (2022). Effectiveness of contextualization in science instruction to enhance science literacy in the Philippines: A meta-analysis. International Journal of Learning, Teaching and Educational Research, 21(1), 140–156. https://www.researchgate.net/publication/358201544_Effectiveness_of_Contextualization_in_Science_Instruction_to_Enhance_Science_Literacy_in_the_Philippines_A_Meta-Analysis

Pratiwi, I. K., Kusairi, S., & Sunaryono, S. (2021). Analyzing students' skill in drawing a free-body diagram. AIP Conference Proceedings. https://doi.org/10.1063/5.0043440

Rahmawati et al. (2021). – Students' difficulties in understanding submicroscopic representations in chemistry https://www.mdpi.com/2227-7102/11/4/185

Reiser, R. A., & Dempsey, J. V. (2023). Trends and issues in instructional design and technology (5th ed.). https://dokumen.pub/trends-and-issues-in-instructional-design-and-technology-5nbsped-9781032819761-9781032819754.html

Republic Act No. 10533. (2013). Enhanced Basic Education Act of 2013. https://lawphil.net/statutes/repacts/ra2013/ra_10533_2013.html

Ribeiro, T., & Orion, N. (2021). Educating for a holistic view of the Earth system: A review. Geosciences, 11(12), 485. https://doi.org/10.3390/geosciences11120485

San Isidro, J. B., & Dio, R. V. (2025). Effectiveness of strategic intervention material (SIM) in improving Filipino students' performance in science and mathematics: A meta-analysis. Journal of Basic Education Research, 6(2), Article 1420. https://doi.org/10.37251/jber.v6i2.1420

Sanguenza, R. L. P., & Gamao, W. E. (2021). Utilization of strategic intervention materials (SIM): Accounts of public elementary teachers. Philippine Journal of Teacher Education. https://ejournals.ph/article.php?id=20183

Sinco, M. G. M. (2020). Strategic intervention materials: A tool in improving students' academic performance. Asian Journal of Pedagogical and Educational Studies, 6(5).

Singh, G., & Khunyakari, R. (2023). Analyzing scaffolds in learning systems concepts in school biology. Journal of Biological Education, 57(2), 432–451. https://doi.org/10.1080/00219266.2021.1924228

Sirait, J., Ainley, J., & Silitonga, H. T. M. (2021). The pattern of physics education students' diagrams and answers in solving force problems. Journal of Physics: Conference Series, 2145(1), 012067. https://doi.org/10.1088/1742-6596/2145/1/012067

Soeharto, S., & Csapó, B. (2021). Evaluating item-difficulty patterns to assess student misconceptions in science across physics, chemistry, and biology concepts. Heliyon, 7(11), e08352. https://doi.org/10.1016/j.heliyon.2021.e08352

Suarez, M., & Casinillo, L. (2020). Effect of strategic intervention material (SIM) on academic performance: Evidence from Science VI students. Review of Socio-Economic Research and Development Studies, 4(1), 20–32.

UNESCO. (2024). Rethinking learning: Educational systems as complex systems. UNESCO Mahatma Gandhi Institute of Education for Peace and Sustainable Development.

UNESCO. (2023). Global Education Monitoring Report 2023: Technology in Education. United Nations Educational, Scientific and Cultural Organization. https://www.unesco.org/gem-report/

Villar, A. S., Gabriel, E. R., & Farin, E. N. (2022). Academic performance of Grade V pupils using science strategic intervention material in Zambales, Philippines. Asian Journal of Education and Social Studies, 33(1), 27–35. https://doi.org/10.9734/ajess/2022/v33i130783

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press. https://doi.org/10.2307/j.ctvjf9vz4

Wabingga, A., & Tomakin, T. (2025). From challenges to solutions: How teachers in remote schools cope with the adaptation of the MATATAG curriculum. Psychology and Education: A Multidisciplinary Journal, 38(3), 232–238. https://doi.org/10.70838/pemj.380302

Zabala, O. II. (2023). Strategic intervention material (SIM) on senior high school student learning in stocks and bonds. American Journal of Education and Technology, 2(4).

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