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Designing and Implementing Science-Infused Reading Material (SIRM) for Improving Learners' Conceptual Understanding on Work

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ABSTRACT

This study highlights the need to improve students' conceptual understanding in physics through contextualized instructional materials. Despite the implementation of existing instructional material, there was a lack of localized materials aligned with the newly implemented MATATAG Curriculum. To address this gap, the researcher designed and implemented a Science-Infused Reading Material (SIRM) to enhance Grade 8 learners' conceptual understanding. The study aimed to identify the least-mastered topic, develop and validate the SIRM, and determine its effectiveness using formative assessment and pre- and post-test measures. The study employed a Research and Development (R&D) design guided by the ADDIE model. Findings revealed that Work and Energy was among the least mastered topics (MPS = 27.27%). The developed SIRM obtained an "Excellent" rating in content validation (M = 4.873) and full compliance in language validation. Learners achieved an average formative assessment score of 83% (Satisfactory). Pretest and posttest results showed a significant improvement (M = 6.69 to 12.28), with a normalized gain of 0.67 (average gain). The findings of this study imply that integrating reading strategies with visual elements into science instruction was an effective instructional material that enhanced learners' conceptual understanding and supported improved academic performance in physics education.

Keywords: Work, Physics Education, Conceptual Understanding, Science-Infused Reading Material (SIRM), Grade 8 Learners, MATATAG Curriculum.

INTRODUCTION

In science education, particularly in physics, improving learners' conceptual understanding remains a critical concern. Conceptual understanding plays a vital role in helping students interpret difficult ideas and apply them in problem-solving contexts (Nadelson et al., 2018; Taqwa et al., 2019). However, even with the growing emphasis on innovative instructional strategies, many learners still struggled to grasp complex physics concepts, highlighting gaps in both instructional resources and pedagogy. This concern is further reflected in large-scale assessments, where Filipino learners have performed significantly below standard in science, indicating the need for contextually relevant and more effective learning materials (OECD, 2023; Bernardo et al., 2023).

Existing literature suggests that the use of interactive and concept-focused approaches in science instruction can enhance learners' conceptual understanding by promoting deeper cognitive engagement and meaningful learning experiences (Elleman et al., 2019; Esparza et al., 2023). Approaches such as inquiry-based learning, semantic mapping, and contextualized instruction have shown promise in improving science learning outcomes (Abaniel, 2021; Dinsever et al., 2023). Additionally, printed instructional materials remain pedagogically valuable, as they support focus, retention, and comprehension more effectively than some digital formats (Furenes et al., 2021; Halamish & Elbaz, 2019). Despite these advancements, there remains a lack of localized, curriculum-aligned instructional resources—particularly printed Science-Infused Reading Materials (SIRM)—designed to address specific conceptual difficulties in physics, such as Work, within the local context and the newly implemented MATATAG Curriculum.

Addressing this gap, the present study focuses on the development and evaluation of printed Science-Infused Reading Materials (SIRM) to enhance Grade 8 learners' conceptual understanding of Work. Specifically, this study aims to: (1) Conduct a needs assessment among Grade 8 learners on the topic of Force, Motion, and Energy; (2) Develop SIRM focused on Work; (3) Evaluate the developed material in terms of content, language, and grade-level appropriateness; (4) Determine learners' outcomes after using the SIRM in terms of performance (Learning Activity) and normalized gain (pre- and post-test). Through these objectives, the study seeks to contribute to the growing body of research on interactive and concept-focused approaches and provide evidence-based instructional materials that address both conceptual and contextual learning needs.

METHODS

Research Design

This study employed a Research and Development (R&D) design guided by the ADDIE Model: Analysis, Design, Development, Implementation, and Evaluation, to systematically develop and evaluate Science-Infused Reading Materials (SIRM) aimed at improving learners' conceptual understanding in physics.

Respondents

The respondents consisted of Grade 8 learners from two (2) public secondary schools in Iligan City. A voluntary response sampling technique was employed, ensuring that only students with signed assent and parental consent participated. In the first school, pilot testing of the achievement test involved approximately one hundred-twenty-two (122) learners, while in the second school, final implementation of the SIRM included sixty-five (65) learners from two selected sections to ensure diversity in ability levels. Additionally, the content validator comprised four (4) content validators; three (3) science validators, and one (1) ICT validator. For the language, there was only one (1) language validator. These validators evaluated the developed SIRM for content and language quality.

Instrument

A 30-item needs-assessment questionnaire, based on Bloom's Taxonomy, was administered to identify learners' prior knowledge and least mastered topics in Force, Motion, and Energy. The developed SIRM, consisting of reading passages and formative assessments, served as the primary intervention material. Evaluation tools included content and language rating sheets adopted from LRMDS Guidelines. To measure learning outcomes, a 15-item multiple-choice achievement test was administered as both a pre-test and a post-test.

Procedure

The following stages outline the process for gathering data for the study. The process follows the Analysis, Design, Development, Implementation, and Evaluation stages, as illustrated in the diagram below.

A. Analysis Stage

In the analysis phase, the researcher conducted a needs analysis to identify the learners' academic requirements. This was carried out through a 30-item multiple-choice test aligned with the MATATAG Curriculum, administered at a private secondary school in Iligan City.

Initially, the researcher developed a 40-item multiple-choice needs assessment using a Table of Specifications (TOS) grounded in Bloom's Taxonomy to ensure balanced coverage across cognitive domains. Next, the assessment underwent face validation by five (5) validators, who evaluated the material on Clarity and Balance, Wordiness, Appropriateness of Response Listed, Application to Praxis, and Relationship to the Problem. Following validation, the instrument was pilot tested with one hundred twenty (120) students. Then, an item analysis was conducted to determine difficulty and discrimination indices. Based on the results, a Cronbach's Alpha of 0.723 for the 40-item test indicated that the instrument was reliable. Based on the Difficulty Index, 38 (95%) of the items fall under Average Items, 2 (5%) are Hard, and none (0%) are Easy. This distribution implies that the test items were well-designed to challenge learners without being overly straightforward or overly difficult. On the other hand, in the discrimination index, 15 (37.5%) fall under the discriminating item; the majority fall under the average item (23, 57.5%); and 2 (5%) fall under the non-discriminating item.

Furthermore, the researcher removed "rejected" items and retained those deemed valid or in need of revision. Subsequently, a refined 30-item test was finalized and administered to forty (40) Grade 8 students. The researcher then identified and ranked the least mastered topics in Force, Motion, and Energy based on the number of correct responses from students in each topic. Moreover, the results guided the selection of an appropriate MATATAG learning competency for the study's methodology.

B. Design Stage

Second, the researcher carefully selected specific learning competencies from the MATATAG curriculum, focusing on one of the top three least mastered topics within the domain of Force, Motion, and Energy. These topics were identified based on prior needs assessment results, ensuring that the material directly addressed areas where students struggled the most. The researcher also explored and incorporated localized, real-life scenarios related to Work and Energy, which served as meaningful contexts that helped students relate scientific concepts to everyday experiences.

Following this, the researcher proceeded to concept development, which included reviewing relevant literature, drafting reading selections, and organizing content based on the selected competencies. During this stage, the researcher crafted specific objectives for each lesson, conceptualized story titles, and wrote brief introductions for each story. To support clarity and structure, definitions of key science terms were placed in sidebars for easy reference, and the lessons were strengthened by integrating science and problem-solving content. The researcher also developed post-reading activities after each lesson to reinforce comprehension and application. Throughout this process, the material followed a consistent font style aligned with DepEd guidelines.

C. Development Stage

At this stage, layout design and visual elements were created in Canva Pro, and a Document Readability Application (Flesch-Kincaid) was used to ensure the write-up was at an appropriate level. Once the first version of the SIRM was completed, it was then submitted to the research panel for review. Feedback regarding the material's coherence, accuracy, and appropriateness was gathered, and revisions were made accordingly. This iterative process was continued until the panel provided final approval with no further recommendations. Afterward, the researcher developed the second version of the reading material, which was assessed by language and content validators. The researcher, together with the thesis adviser, reviewed and validated the experts' feedback to ensure alignment with the study's objectives. Based on the recommendations, revisions were made to improve the material. The final version was then submitted to the research adviser for final evaluation. Upon approval, the researcher was given the signal to proceed with the implementation phase.

Additionally, at this stage, the researcher developed a 25-item multiple-choice achievement test on Work and Energy for Grade 8 students to measure their incremental conceptual gains using the SIRM. Validators then evaluated the achievement test for clarity and balance, wordiness, appropriateness of response options, application to praxis, and relationship to the problem. After validation, the test underwent a pilot test at the first public secondary school in Iligan City, where it had three sections with a total of one hundred twenty-two (122) students. The researcher then performed an item analysis to determine validity and reliability, using the difficulty and discrimination indices as correlates of the final decision. This process helped identify questions that should be discarded or rejected, revised, or retained. Ultimately, the researcher selected fifteen items from the retained and needs-revision items for the final implementation.

D. Implementation Stage

In this phase, ethical issues and concerns were identified and addressed prior to the study's implementation. The researcher upheld the principle that ethical considerations were an essential part of the research process. Since the study employed voluntary response sampling, the researcher ensured that all respondents voluntarily signed the assent form together with their parents. The scope and content of the assent form were discussed with the learners during the orientation session preceding the distribution of the Science-Infused Reading Material (SIRM). This orientation covered the researcher's personal background, the study's purpose and objectives, the target participants, the study's duration, the potential risks and benefits of participation, the right to withdraw at any time, the privacy and confidentiality of their responses, and other essential matters.

Additionally, the researcher secured an approved ethical application form from the MSU-IIT Ethics Committee before obtaining formal approval to conduct the study from the DepEd Schools Division Superintendent and the School Head of the participating school. The SIRM was administered in a public secondary school in Iligan City that lacked science reading resources aligned with the newly implemented Grade 8 MATATAG Curriculum. This setting provided an ideal environment to assess the effectiveness of the SIRM in enhancing students' understanding of science concepts, particularly in areas where instructional materials were limited. At a time and place convenient for the participants, the respondents engaged with the Science-Infused Reading Material (SIRM) on the dates scheduled by the researcher.

Prior to the final implementation, the researcher conducted a 45–60-minute pilot test of the initial 25-item multiple-choice achievement test to evaluate item difficulty and discrimination. Item analysis was then performed to determine which items to retain, revise, or discard, resulting in a finalized 15-item test for the final implementation.

Hence, the final implementation was estimated to run for five consecutive school days (approximately one week) from March 2 to 6, 2025. Each reading session of the SIRM took up to 15– 20 minutes of silent reading (15 minutes each for Lessons 1 & 2, while 20 minutes for Lesson 3; because it was more calculation-based content), followed by another 5 – 10 minutes (5 minutes each for Lessons 1 & 2, while 10 minutes for Lesson 3), depending on the time needed to complete the corresponding formative assessment after each reading selection.

The process began on Day 1 with ethical groundwork, including distributing assent and consent forms and briefing participants about their rights. On Day 2, the consent and assent forms were collected, and a pre-test was administered to establish a performance baseline. The main intervention took place on Days 3 and 4, during which students participated in silent reading sessions of three different selections. On Day 3, students read the first two selections with five-minute formative assessments, while on Day 4, they focused on a more intensive third selection, with a 20-minute reading period and a 10-minute assessment. The study concluded on Day 5 with a 25-minute post-test to measure knowledge gained and perception questionnaires for both students and teachers to assess the SIRM's effectiveness. The implementation ended with the distribution of tokens as a token of appreciation for the participants.

Evaluation Stage

In the evaluation phase, the validation process began with the needs assessment, which was validated by five (5) validators. It was followed by the validation of the first version of the SIRM by the thesis advisers and panel members. Next, the validation of the second version of the SIRM, which was conducted by two (2) sets of validators, one (1) English Language validator, and four (4) Content Validators; three (3) Science and one (1) ICT content validators. After all revisions with no further comments, the final version was created, which was implemented together with the pre- and post-tests to measure learners' conceptual gains, which were administered to sixty-seven (67) grade 8 learners.

Data Analysis

(1) The Department of Education grading system was used to classify learners' performance, where scores ranged from 75 to 100, with 75 as the passing mark. Scores of 75% and above indicated passing performance, while scores below 75% were considered failed. (2) For content validation, a rating scale adapted from the

Learning Resource Management of Development System (LRMDS) guidelines was utilized. Rating ranged from "Poor" (1.00-1.79) to "Excellent" (4.20 – 5.00). (3) Language validation was assessed using a checklist from the same LRMDS guidelines. The validator responded with "YES" (Complied) or "NO" (Not Complied), and the results determined whether the SIRM required revisions or was ready for final implementation. (4) The researcher utilized the Flesch Kincaid Grade Level to evaluate the readability of the SIRM, which measures the number of grade levels needed to understand the SIRM.

Statistical Tools

Data were analyzed using both descriptive and inferential statistical tools. (1) Mean and (2) Average mean were used to evaluate validators' ratings, while (3) percentage distribution summarized response patterns. Learners' performance was interpreted using the Department of Education grading scale. To determine the effectiveness of the SIRM, (4) normalized gain (<g>) was computed to measure improvement between pre-test and post-test scores.

RESULTS AND DISCUSSION

The study presents clear findings based on the development and evaluation of a Science-Infused Reading Material (SIRM) for Grade 8 learners on the topic of Work.

A. The Least Mastered Topic of Grade 8 Learners in Physics

This section shows the Physics subjects in which Grade 8 students scored lowest (according to the MPS of correct responses). Determining the least-mastered topics can help identify areas requiring learner support and instructional intervention.

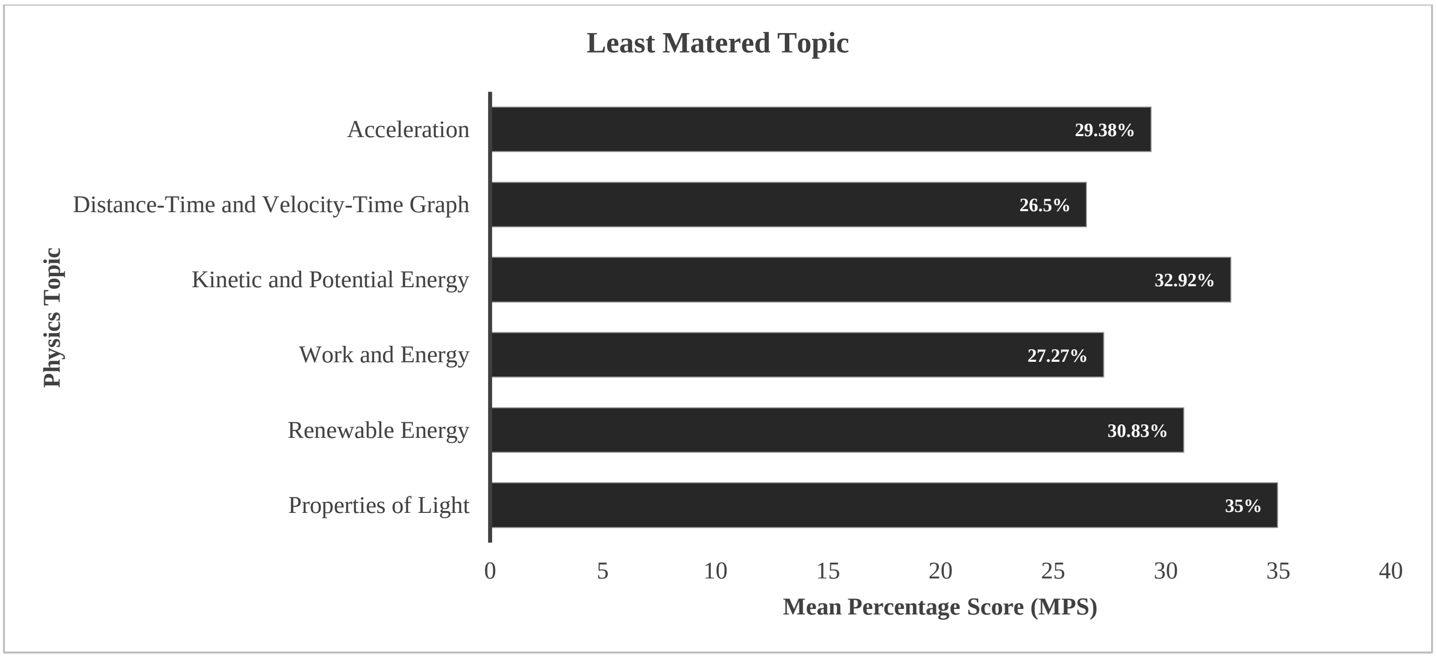

Figure 1: Least Mastered Topic in Grade 8 Physics

As shown in Figure 1, the Mean Percentage Score (MPS) for learners across the selected Physics topics indicated low mastery in several concepts. As the main topic of the study, Work and Energy received an MPS of 27.27%, indicating learners' difficulty in understanding the concepts and underscoring the need for targeted instructional support. This finding is supported by studies showing that students commonly struggle with work-energy concepts, particularly in understanding the work-energy theorem, kinetic energy, and potential energy (Rivaldo et al. 2020). The topic Distance-Time and Velocity-Time Graph recorded the lowest MPS at 26.5%, suggesting that learners also experience challenges in interpreting motion graphs and relating graphical representations to physical concepts. Acceleration (29.38%), Renewable Energy (30.83%), and Kinetic and Potential Energy (32.92%) showed only moderate performance, while Properties of Light obtained the highest MPS at 35%,

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reflecting a relatively better understanding compared to the other topics. Overall, these results indicate that learners experience considerable difficulty in abstract and mathematically oriented Physics concepts, highlighting the need for contextualized and targeted instructional interventions (Rivaldo et al. 2020).

B. Unpacking the Learning Competency

This section describes the approach to designing the SIRM with the thesis adviser and panel members. Harjanta and Herlambang (2018) confirm that this phase plays a crucial role in the product development process, and it precedes actual product development. The design of the Science-Infused Reading Material (SIRM) was based on the Grade 8 Science curriculum and the Department of Education's MATATAG Curriculum.

Table 1. MATATAG Competency Utilized in SIRM

Content	**Learning Competency**	**Specific Objectives**	**Title of the Story**
Work and Energy	Recognize that work is done when force causes the displacement of an object	1. Define work and displacement;	Forces at Work
		2. Explain the relationship between force, displacement, and the work done on an object.	Let's Do Work
		3. Calculate the work done on an object given value fort he force applied and the resulting displacement.	From Push to Joules

Table 1 presents the content and learning competencies under the topic "Work and Energy" from the MATATAG Curriculum Guide. The learning competency was unpacked into three (3) specific objectives, namely: (1) define work and displacement, (2) explain the relationship between force, displacement, and the work done on an object, and (3) calculate the work done on an object given the value for the force applied and the resulting displacement. This illustrates the principle that measurable, clear learning outcomes align with instruction and ensure coherence among content, activities, and learning outcomes (Yassin, 2026). According to Penuel et al. (2022), unpacking competencies into specific objectives fosters a deeper understanding, especially of what learners need to do and know for the topic, thereby strengthening curriculum implementation. The table also linked each specific objective to the titles of the stories: "Forces at Work", "Let's Do Work", and "From Push to Joules". As Barrun & Cajurao (2025) stated, the use of contextualized reading material supports learning by connecting difficult science concepts to real-life situations, thereby improving learners' conceptual understanding and engagement.

C. Comparison of the First and Second Versions of the SIRM

This part of the study compared the two versions of the Science-Infused Reading Material (SIRM): the First and Second versions.

Table 2. Changes in the SIRM (First Version and Second Version)

First Version	**Comments and Suggestions**	**Second Version**
	Change "Story 1, 2, & 3" to "Lesson 1, 2, & 3." The background is so pale, make it livelier.	

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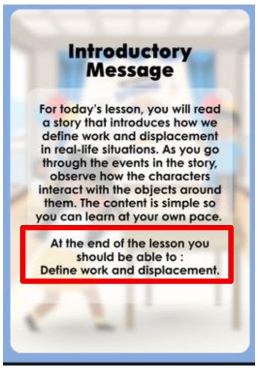
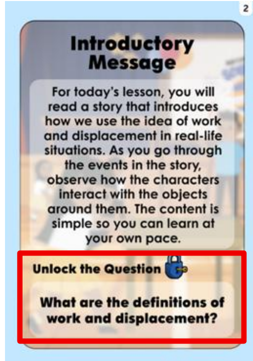
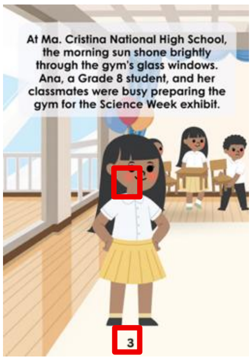
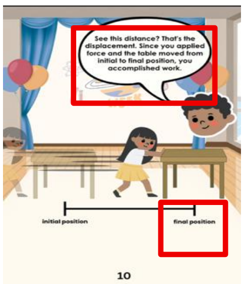
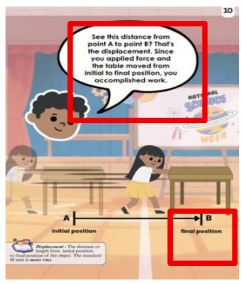
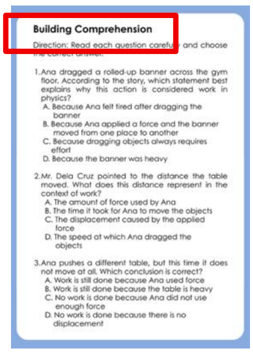
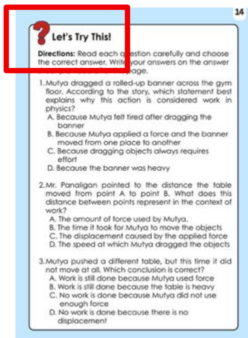
	Add icons for each part of the SIRM. Add the phrase "Unlock this question" at the beginning of each reading selection to inform readers of the content before reading.	
First Version	**Comments and Suggestions**	**Second Version**
	Move the page number from the middle bottom to the upper corner of the SIRM. Why are there cheeks are so pink? Better if you remove the blush. Add catchy phrase before the reading selection started like "Let's Read!"	
	Include science trivia or key terminologies in the sidebar for easy reference. Change the names of the characters to more unique Filipino name.	
	Add the phrase "from point A to point B" for clarity. Replace the line with an arrow to indicate that the table is moving from point A to point B.	
	Add catchy phrase like "Let's Try This!" in formative test.	

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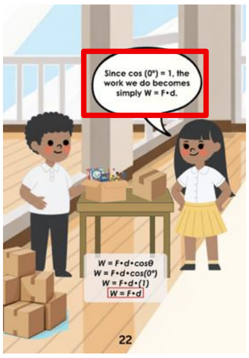
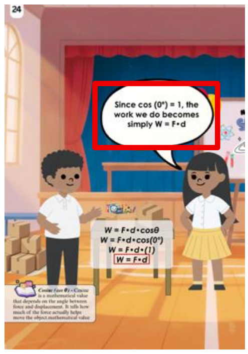
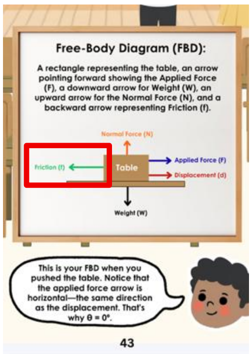
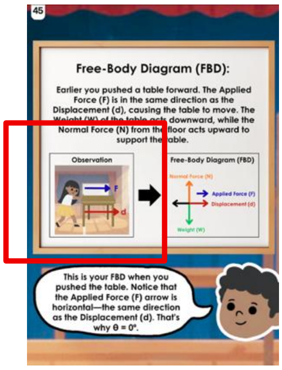
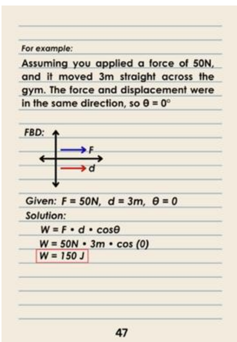
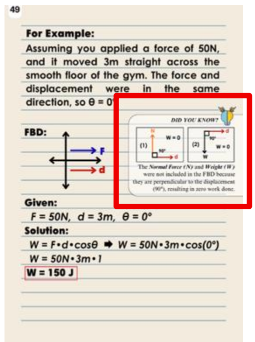
	Ensure that the emotions of the characters are consistent with the dialogue (e.g., avoid portraying a character as happy when the dialogue expresses discomfort such as “my arms already hurt”).	

First Version	Comments and Suggestions	Second Version
	Remove the period “dot” after equations only, as this may confuse learners into thinking it is part of the equation.	
	In the free-body diagram (FBD), remove the term “fiction” since it’s a smooth floor. Focus only on Normal Force, Weight, Applied Force, and Displacement. Add an image of Mutya pushing a table, including arrows representing the forces for visual representation.	
	Include an illustration showing the normal force and weight as equal to zero, so that learners can easily understand that these forces are not included in the FBD.	

A comparison between the two versions of the SIRM is presented in Table 2, showing that validators’ comments indicate that the revisions helped the SIRM enhance both instructional clarity and visual design, which are essential factors in effective instructional material. From "Story" into "Lesson," adding guiding phrases such as "Let's Read!" and "Let's Try This!" and including prompts like "Unlock this Question," strengthens the structure and orientation of the material. According to Garay Abad & Hattie (2025), well-structured instructional materials should clearly emphasize learning intentions and help students focus during the intervention. Adding key terminology, science trivia, and detailed phrases like "from point A to point B" also improved conceptual understanding by providing references and minimizing cognitive load. Halawa et al., (2024) study showed that high-quality, contextualized materials support better engagement and comprehension in science learning.

Meanwhile, for visual and layout improvements, such as enhancing background color, maintaining consistent character emotions, adding icons, repositioning page numbers, and emphasizing the usability and content quality of the SIRM. The design features and visual feedback help students improve their performance and engagement when the content and learning goals are aligned with them. Validator's suggestion towards adding illustrations, like Mutya was pushing the table with force arrows, and refining the free-body diagram (FBD) by focusing on the essential forces only, supports the need for simplified and accurate visual representation. Therefore, this reflects findings that enhanced, interactive science instructional materials would improve learners' academic performance when refined based on the validators' feedback (Ortega, 2025).

Overall, the validators' feedback and revisions to the first version of the SIRM were improved by revising the content, visuals, and structure of the material. This shows the importance of validation in strengthening the design of the instructional material. Ortiz-López et al. (2024) stated that feedback-based revision would help learners better align with their needs and lead to higher-quality teaching and student outcomes.

D. Content Validators' Rating on the Second Version of the SIRM

This section presents the evaluation results of the content and language validators on the final version of the Science-Infused Reading Material (SIRM) and also the content of the achievement test. The ratings determine the material's overall quality, validity, and suitability for implementation.

Table 3. Results of the Evaluation by Content Validators (N=4)

Criteria	**Rating**	**Description**
Content reinforces, enriches, and leads to the mastery of specific learning competencies for the level and subject it was intended for.	5.00	Excellent
Information provided is up-to-date.	4.75	Excellent
The facts are accurate.	5.00	Excellent
Language is appropriate for the level of the target user.	5.00	Excellent
Visuals are relevant to the text and suitable to the age level and interests of the target user.	4.75	Excellent
Visuals are clear in content and detail.	4.75	Excellent
Typographic layout/design adequately supports the concepts presented.	4.75	Excellent
The size of the letters is appropriate for the target user.	5.00	Excellent
Average Mean Rating	4.87	Excellent

Note: 1.00 – 1.79; Poor, 1.80 – 2.59; Fair, 2.60 – 3.39; Satisfactory, 3.40 – 4.19; Very Satisfactory, 4.20 – 5.00; Excellent

As shown in Table 3, the evaluation of the content validators for the SIRM received ratings between 4.75 and 5, described as "Excellent," indicating that the instructional material was accurate, up to date, and suitable for Grade 8 learners. The average rating of 4.873 indicates a high level of quality. This supports the claim of Esparza

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et al. (2023) that well-designed instructional material can improve understanding through appropriate presentation and clear content. The consistent high ratings from the validators show that the SIRM met the expected standard and was ready for classroom use. According to Ruel et al. (2021), proper validation of instructional materials ensures their quality and effectiveness.

E. Language Validators' Rating (Second Version of the SIRM)

This section presents the evaluation of the SIRM by language validators. Their ratings assess the material's coherence and clarity of thoughts, grammar and syntax, spelling and punctuation, and consistency in style to ensure the tool meets academic standards.

Table 4. Results of the Evaluation by Language Validator

Criteria	Description
Coherence and Clarity of Thought	Complied
Grammar and Syntax	Complied
Spelling and Punctuation	Complied
Consistency in Style	Complied

Table 4 presents the language validation results, showing that all criteria, including clarity, grammar, spelling, and consistency, were marked as "Complied." This indicates that the SIRM is clear, well-organized, and easy to understand. The material follows correct language rules and maintains a consistent style, which supports effective learning. As noted by Minerales et al. (2025), clear and accurate language helps prevent confusion among learners. Overall, the results confirm that the SIRM is linguistically sound and ready for use, consistent with the importance of language validation.

Table 5. Content and Language Validator's Comments and Suggestions on the Second Version of the SIRM.

Area	Validator	Comments and Suggestions
Language	LV1	Put period (.) after Mutya "Yes, Mutya." Add "s" in "direction". We use the term "directions" for tasks or how to do it, same with instructions. For question number 3 "Mutya pushes… and it does not…" use past form for consistency because in the story, you started your narrative in the past tense. "Mutya pushed…and is did not…" Put period "." After the word "work" Add "s" in "direction". We use the term "directions" for tasks or how to do it, same with instructions. For question number 3 "Bayani pushes… but the wall does not…" Use past form for consistency because in the story, you started your narrative in the past tense. "Bayani pushed… but the wall did not…" For question #2 "Mutya pulls…" use past form for consistency because in the story, you started your narrative in the past tense. "Mutya Pulled…" Delete "s" from the word "letters". Do not add "s" because you are asking the student to provide a single letter for each item. Change the description in the paragraph to match the illustration in the story. In physics, if you say they are lifting a "stack," it sounds like they are working together on one big pile. By saying they "individually lifted one box," you make it clear that: Mutya does work and Bayani does work too.

Content	CV1 (SCIENCE)	Check whether it is appropriate to use the dot product symbol ("•") in the formula W = F•d•cosθ. It may be better to remove the dot symbol. The content is accurate; however, the visuals are monotonous. Use brighter colors and characters that Grade 8 learners can relate to. (Applies to all lessons.)
	CV2 (SCIENCE)	In Free-Body Diagram (FBD), the Applied Force (F) and Displacement (d) arrow should overlap each other.
	CV3 (SCIENCE)	Since the terms push, pull, and others are collectively referred to as **force**, consider using **"Force"** directly in the title or replacing it with a more appropriate term.
	CV4 (ICT)	Adding **Answer Sheet numbers** (e.g., Answer Sheet #1, #2, and #3) will improve organization and ease of use. (Applies to all lessons.) Change the expression/emotion of Mutya "remember the table is heavy!". In Let's Try This! Provide "direction/Instruction" that they need to answer it in the next activity sheet/answer sheet. Including an answer key at the end of the SIRM is recommended to support teachers in checking learners' responses and to facilitate independent learning. (Applies to all lessons.) Including an answer key at the end of the SIRM is recommended to support teachers in checking learners' responses and to facilitate independent learning. (Applies to all lessons.) Add "face" (image) of James Prescott Joule.

Note: LV = Language Validator, CV = Content Validator

The validators' feedback on the second version of the SIRM is shown in Table 5, specifically regarding language clarity, scientific accuracy, and usability. The language validator (LV1) focused on proper grammar, consistent verb tenses, and clearer wording to make it easier to read and understand. The conceptual accuracy was further refined by science content validators (CV1, CV2, and CV3), who simplified formulas, corrected diagrams, used the term "force" more precisely, and proposed more engaging visuals for Grade 8 students. The ICT content validator (CV4) enhanced the organization by including clear instructions, labeled answer sheets, and an answer key to facilitate independent use. Such changes made the content more coherent and efficient, since clear, well-organized content and visuals promote better understanding and learning (Fiorella & Mayer, 2022; Mayer, 2023).

F. Flesch Kincaid Readability Test Result

This section of the study demonstrates the SIRM's reliability using the Flesch-Kincaid readability calculator. It will identify the suitability of the text for the target group level.

Table 6. Readability Test of the Final Version of the three (3) Stories.

Title of the Story	Reading Ease Score	Grade Level	Interpretation
Force at Work	62.3	8^{th} & 9^{th} Grade	Standard
Let's Do Work	70	8^{th} & 9^{th} Grade	Standard
From Push to Joules	63.9	8^{th} & 9^{th} Grade	Standard
Mean	65.4	8^{th} & 9^{th} Grade	Standard

Table 6 presents the readability of the final version of the SIRM stories, as measured by the Flesch-Kincaid calculator. The reading ease scores were between 62.3 and 70, while the grade levels were between 8th and 9th grade, which match the target learners. This means the texts use appropriate, clear language with moderate difficulty. In this regard, Antonio et al. (2026) stated that readability tests are used to align materials with learners' reading levels to improve understanding (Antonio et al., 2026; Sá, 2023). Overall, the stories in the SIRM are readable and suitable for classroom use.

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G. Performance Outcome (Learning Activity)

This section presents learners' performance on the learning activity after each content story/lesson in the SIRM.

Table 7. Performance Outcomes of the Students in Formative Assessment (N = 65)

Lesson	Mean Score (%)	Interpretation	Remark
1	84	Satisfactory	Passed
2	86	Very Satisfactory	Passed
3	78	Fairly Satisfactory	Passed
Average Mean	**83**	**Satisfactory**	**Passed**

Note: Below 75; Did Not Meet Expectations (Failed), 75 – 79; Fairly Satisfactory (Passed), 80 – 84; Satisfactory (Passed), 85 – 89; Very Satisfactory (Passed), 90 – 100; Outstanding (Passed)

Table 7 shows the students' performance in the formative assessments for the three lessons. Kokkiz et al. (2024) note that formative assessments enable teachers to recognize students' strengths and weaknesses, allowing them to provide timely support. Therefore, the outcomes indicate that the 65 learners garnered the following mean percentages: Lesson 1, 84%; Lesson 2, 86%; and Lesson 3, 78%, with an overall mean of 83%. This shows that students did not perform poorly during the lessons, with most scores ranging from satisfactory to very good. It also indicates that the learners could comprehend and apply what they learned in the SIRM. Based on Ramdhani et al. (2024), formative assessment enhances learners' understanding, engagement, and overall learning when used consistently and effectively during lessons. Furthermore, large-scale studies confirm that formative assessment positively impacts learners' achievement, supporting the observed performance results (Yao et al., 2024). Overall, the findings indicate that the learning material, SIRM, promotes and supports learning outcomes.

H. Final Version of the Science-Infused Reading Material (SIRM)

This section of the study presents the final version of the SIRM for Grade 8 learners. It shows sample images of SIRM integrating reading skills with science content, focusing on the topic of Work.

Figure 2. Final Version of the SIRM

The final version of the SIRM was carefully revised based on the validator feedback, as shown in Figure 2. The text is also more accurate in its language use, with consistent verb tenses, proper punctuation, and correct word choice, thus creating clearer, easier-to-read material. Scientific material was also streamlined by simplifying formulas, using proper free-body diagrams, and improving illustrations and design to enable Grade 8 students to comprehend concepts. It has been shown that clear explanations and powerful visuals aid learning and memory (Schneider et al., 2022). In general, the SIRM is better structured and student-centered, with more explicit guidelines, marked answer sheets, and an answer key that supports the teaching process and independent learning, aligning with best practices in instructional design (OECD, 2023).

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I. Scores of the Learners on Pre-Test and Post-Test

This section presents the students' distribution of scores on the pre- and post-tests. The table shows the frequency of scores under the DepEd grading system, along with their interpretations and remarks. This section provides a clear basis for students' performance before and after the intervention.

Table 8. Summary of Score Distribution in the Pre-Test and Post-Test Scores (N = 65)

Grading Scale (%)	Interpretation	Pre-Test		Post-Test		Remarks
		n	%	n	%	
90-100	Outstanding	–	–	13	20	Passed
85-89	Very Satisfactory	–	–	18	28	Passed
80-84	Satisfactory	–	–	20	31	Passed
75-79	Fairly Satisfactory	2	3	5	7	Passed
Below 75	Did not meet expectations	63	97	9	14	Failed

Note: Below 75; Did Not Meet Expectations (Failed), 75 – 79; Fairly Satisfactory (Passed), 80 – 84; Satisfactory (Passed), 85 – 89; Very Satisfactory (Passed), 90 – 100; Outstanding (Passed)

As shown in Table 8, most learners' pre-test performance was below the expected level. 63 of 65 (97%) learners fell into the "Below 75" category, meaning they "Did Not Meet Expectation" or "Failed." Only 2 (3%) of the learners reached the "Fairly Satisfactory" level, while no students attained the "Satisfactory," "Very Satisfactory," or "Outstanding" levels. These results suggested low conceptual knowledge before instruction, a condition typically observed in pre-test assessments before targeted learning interventions begin, in which learners show limited mastery of the scientific concepts (Sirianansopa, 2024). The data highlights the need for intervention and instructional support to improve learners' conceptual understanding. Meanwhile, the post-test score distribution showed a clear improvement in learners' performance after exposure to the SIRM. Most of the learners reached the higher performance level, where 13 (20%) learners were in the "Outstanding" range, 18 (28%) in the "Very Satisfactory " range, 20 (31%) learners fell under the "Satisfactory" range, and 5 (7%) of the learners reached the "Fairly Satisfactory" range. In comparison, 9 (14%) remained in the "Below 75" category. The shift in the distribution indicated that most learners met or exceeded the expected level of competence after exposure to the SIRM (Lichtenberger et al., 2025). This means the results indicated that the intervention improved students' conceptual understanding and led to better learning outcomes (Korur et al., 2025).

J. Normalized Gain and Paired Sample Test (Pre-Test and Post-Test)

Table 9. Normal Gain Score (N = 65)

	Mean	Normalized Gain	Interpretation
Pre-Test	6.6923	0.67	Average
Post-Test	12.2769		

Table 9 shows that the overall mean score was 6.6923 on the pre-test and 12.2769 on the post-test, with a normalized mean gain of 0.67, which is considered an average level of gain. It signified a large amount of learning in the group. This shows that the SIRM enhanced students' understanding, as evidenced by improved post-test performance. The results indicate that the SIRM is effective, as it improves learners' conceptual understanding and overall performance (Colleta & Steinert, 2020; Christman et al., 2024).

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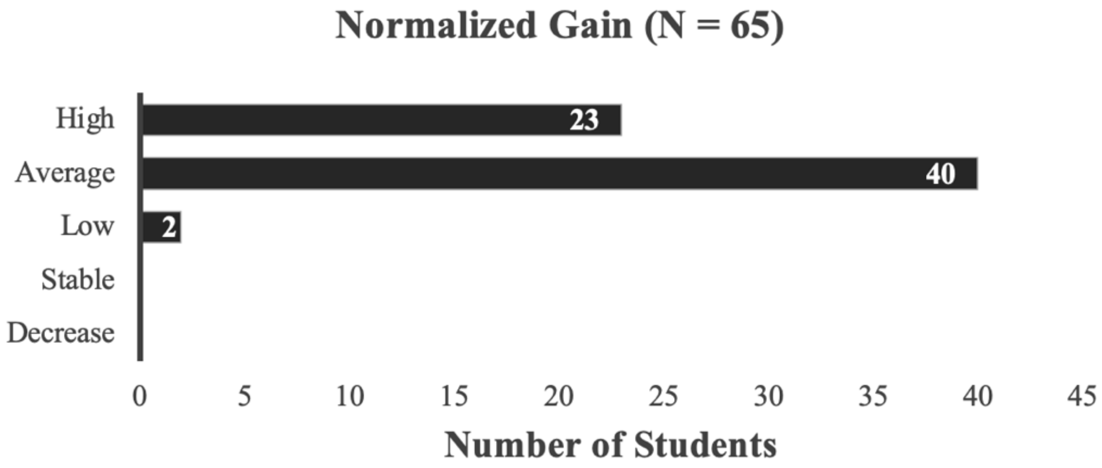

Figure 3. Distribution of Students' Normalized Gain Level

As shown in Figure 3, 23 of 65 learners achieved a high normalized gain score, suggesting that the SIRM was highly effective for a significant portion of learners. Meanwhile, most learners (40 of 65) achieved an average normalized gain, indicating moderate improvement in their learning after using the SIRM. On the other hand, only 2 learners fell into the low-gain category, while no students were classified as stable or decreased. This distribution indicates that the SIRM generally contributed positively to students' academic performance, with most learners demonstrating measurable progress and none regressing.

CONCLUSION

This study addressed the difficulty Grade 8 learners have in understanding the concept of Work and the lack of instructional materials that integrate interactive and concept-focused approaches in science. Findings revealed that learners initially had low mastery, justifying the development of the Science-Infused Reading Material (SIRM). The material was found to be valid, appropriate, and of high quality based on content, language, and readability evaluations. Its implementation significantly improved learners' performance, leading to better conceptual understanding, support for meaningful learning, and the promotion of interactive and concept-focused approaches in science education.

RECOMMENDATION

Future researchers may expand the scope of the study by including multiple schools, larger sample sizes, and different grade levels to enhance the generalizability of the findings. Further studies may explore the effectiveness of Science-Infused Reading Materials (SIRM) in other science topics beyond Work to determine its applicability across the broader science curriculum. Researchers are encouraged to conduct longer-term SIRM implementations to examine their impact on learners' retention and sustained conceptual understanding. It is recommended to refine and standardize the assessment instruments used in the study to ensure alignment with national or standardized testing frameworks. Future studies may investigate integrating SIRM with other instructional approaches or digital formats to enhance its adaptability and effectiveness across diverse learning environments. Future studies may use learners' own dialects (e.g., Cebuano, Maranao, etc.) so that learners can engage with the material more easily.

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