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Developing short stories in teaching both physics content and reading skills

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ABSTRACT

The Philippine basic education continually languishes at the bottom in programme for international student assessment (PISA) and low achievement in national achievement test (NAT) thus the need for creative learning supplementation is a must. This study attempted to use reading as platform to engender science learning thereby hitting two goals in one intervention. Six contextualized science-infused reading materials were developed corresponding to the six topics in grade 7 science and utilizing the analysis, design, development, implementation, and evaluation (ADDIE) model as the developmental framework. The material passed the department of education criteria in terms of language evaluation and format while the content was evaluated by field experts. The material has an average lexical density of 51.45 and Flesch-Kincaid grade level of 7.80. The pandemic limited the target respondents to 54. Initial results showed that the material can possibly contribute to science learning based on the medium normalized gain. In terms of intrinsic motivation, all areas were rated high indicating that the users are well-motivated in using the reading material. The material also points to its potential to positively impact reading fluency. It is recommended that similar material be developed for all physics content in all levels from grade 3 to grade 10 and possibly be replicated in other science area.

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1. INTRODUCTION

The Philippine department of education embarked on a transformative journey with the implementation of the K to 12 curriculum program in 2012, aimed at fostering holistic development and global competitiveness among Filipino learners [1]. Despite these ambitious goals, recent assessments, including the national achievement test (NAT), the trends in international mathematics science study (TIMSS) in 2019, and the programme for international student assessment (PISA) in 2018, have revealed persistently subpar learning outcomes among students [2]. In particular, the Philippines lags significantly behind global reading proficiency standards, with a formidable financial challenge ahead to bridge this gap [2].

The already intricate landscape of education in the Philippines faced an unprecedented disruption with the onset of the COVID-19 pandemic in early 2020. In response to the health crisis, President Rodrigo

Roa Duterte ordered the closure of schools, affecting 27 million learners, teachers, and staff. Dayagbil *et al.* [3], mentioned in her study that the teaching and learning process takes on a different shape in times of crisis. When disasters and crises-whether man-made or natural-occur, schools and colleges must demonstrate resilience and adopt innovative strategies to ensure the continuity of education [3]. Thus, the need arose for a shift from traditional face-to-face instruction to various adaptable learning modalities tailored to students' needs.

Tugano *et al.* [4] highlighted the diverse learning modalities adopted globally in response to the abrupt shift in education delivery. While many institutions transitioned to online platforms such as Google Classroom, which students found engaging, others opted for remote or modular learning. This transition revealed various issues on accessibility, technological limitations, socioeconomic challenges, motivation and willingness of teachers, best practices, and opportunities, prompting educational institutions to adapt accordingly [4], [5].

Concurrently, the pandemic dealt a severe blow to the reading skills of students worldwide. In the Philippine context, the department of education recognized that low achievement levels in English, math, and science could be attributed to gaps in learners' reading comprehension skills [6]. To address this challenge, the department issued a memorandum emphasizing the importance of reading proficiency [6]. Furthermore, it underscored the collaborative role of parents, teachers, and other stakeholders in enhancing language proficiency through reading activities [7]–[9].

Building on this, research by Kanamitie *et al*. [10] revealed a positive and strong correlation between English language proficiency and academic performance in science (biology). This called for the incorporation of teaching language across disciplines [10]. As a response to these challenges, this study was conducted to develop science-infused reading materials, utilizing expository texts in developing contextualized stories as supplementary resources to enhance the reading proficiency, fluency, and comprehension of grade 7 learners in both science and English. Ensuring comprehension of academic content, which is primarily presented through challenging expository text, is essential for students, as evidenced by the common core state standards for English language arts, and researchers recommend teaching expository text structures to improve reading comprehension, especially among younger readers facing difficulties [11]–[13]. Also, a blend of various studies suggests that significant improvements in learning performance result from the localization and contextualization of teaching and learning processes, emphasizing the importance of personalized and engaging learning activities [14]–[16].

In general, the researcher had emphasize promoting science, information and communication technologies (ICT), and English language development simultaneously. As a teacher and a researcher, it is vital to look for opportunities to develop a deep and complex understanding of science and to learn pedagogical strategies using ICT in promoting English language and literacy as part of science instruction. Meanwhile, the objective of this study is to develop a science-infused reading material that will serve the following purposes: i) to stimulate learner's interest, motivation, and critical thinking in reading, ii) to serve as a supplementary learning resource in teaching science focuses on force, motion and energy, iii) to promote science literacy and strengthen the reading proficiency of every learner and nurture a culture of reading through an online platform, and iv) appreciate science concepts through localized stories and natural phenomena. Specifically, this study aims to:

- Describe the profile of respondents in terms of: i) academic performance in science and ii) reading level (PHIL-IRI pre-test results school year 2021-2022);
- Describe the process involved in the development of a science-infused reading material as supplementary reading material for grade 7 science and English;
- Evaluate the developed reading material by experts in terms of: i) language; ii) lay-out and format; iii) content standards; and iv) lexical density and Flesch-Kincaid grade level;
- Determine the fluency and comprehension skills of the learner-respondents;
- Assess the effectiveness of the reading material in terms of normalized gain score; and
- Evaluate the reading intervention (content and processes) as perceived by the study participants.

2. METHOD

2.1. Research design

The study uses one group pretest-posttest quasi-experimental design with both qualitative and quantitative support. The researcher is executing the analysis, design, development, implementation, and evaluation (ADDIE) process in this study. A preliminary survey (profiling of learners) was employed in the study as part of the analysis stage. The design, development, trial implementation of science-infused reading material in measuring the fluency, comprehension and increment of conceptual gain of learners and evaluation of the material and reading activity follows.

Repetitive oral reading using the Microsoft teams reading progress tool assesses the fluency of the learners. Further, focused silent reading with a 30-item multiple-choice was administered to assess the

students' comprehension skills. Another set of achievement pre and post-test were also conducted after the final reading to measure the increment of conceptual gain.

2.2. Procedure

To come up with the science-infused reading material, the researchers followed the procedure below with the ADDIE model as its developmental framework:

- A needs analysis was conducted through profiling of the grade 7 respondents. It includes gathering their Philippines-individual reading inventory (PHIL-IRI) results and the average grade in science for the first and second quarter. The data gathered in this stage supported the idea of the researcher that there is a need of designing supplementary reading material for the scientific and language literacy development of learners. Also, it would help the researcher to choose and decide relevant instructional format as part of the methodology in conducting the study. According to a study by Boakye [17], the importance of need analysis which includes the profiling of learners was stressed during the first stage of reading intervention.
- Designing the science-infused reading material was the second stage of the study. Based on the needs defined in the analysis stage, the first step employed by the researcher in this stage is conducting research which involves collecting data such as deciding on the pair of appropriate most essential learning competencies (MELCs) in science and English as the reference point for writing the selections of the reading material. Identifying and searching localized stories and real-world experiences and phenomena in science, the length and text structures that would fit the content of the material were also considered by the researcher at this stage. The researcher also considered the best layout and format that would adequately support the concept presented by searching related literature and established guidelines in developing learning resource material. Concept development is the next step, which is related to research extractions, in this phase, the researcher writes the selection, did the lay-out and formatting, create list of reference materials, illustrations used, and their respective sources. Then, the first version which is the Alpha version of the reading material was presented to the research advisers. The comments and suggestions with regards to coherence, accuracy, and appropriateness of the material by the research advisers were taken and the cycle repeats until no further improvements given by the research adviser/members. After that, the researcher proceeded to produce the second version, the gamma version of the reading material. This version underwent evaluation from experts in the field of language, content, and layout and format for copyright checking as well. The summary of findings from the experts were reviewed and validated by the researcher with his research advisor for conformance review. After that, the comments, and suggestions in revising the second version were incorporated in the reading material. The researcher then came up with the final version named by the researcher as gamma version. The final version was presented to the research advisor for final verdict and was given the signal to move forward for implementation.
- The development of the reading material covered the whole duration of writing the selections by the researcher which includes the formulation of an assessment test for comprehension following the style of PHIL-IRI. The material underwent a partial face and content validation by the researcher adviser and his panel of evaluators. Then, the material underwent full validation through evaluation of experts in language, layout and format, and science content experts for any corrections and suggestions that the researcher used in revising the material and the test. After incorporating the suggested changes, the developed material was now deemed valid and ready for try-out implementation. Further, a document readability application was used to ensure the write-up was at the appropriate level. Also, at this stage, the researcher developed a 24-item multiple-choice achievement test about force, motion, and energy in grade 7 that was used to measure the increment of conceptual gain in the respondents using the developed science-infused reading material. This achievement test underwent face validation by the adviser and evaluators who were teaching physics. Then, the achievement test underwent an item analysis.
- Ethical issues and concerns were identified and resolved before the implementation of the study. The researcher believed in the idea of seeing ethical considerations as one of the most important parts of the research. Since the researcher employed a voluntary response sampling, before the conduct of the study, the researcher ascertained that all respondents have voluntary signed the assent form together with their parents. During the implementation, the researcher conducted an orientation for parents and learners about the distribution and activation of Microsoft Office 365 accounts for learners. The learners were taught how to use their Microsoft Account in Microsoft Teams App to enroll in the virtual classroom created by the researcher for oral reading fluency assessment. At their convenient time and place, the respondents performed the reading assignment within the scheduled date set by the researcher. Then, a pre-achievement test assessment was given in a face-to-face setting to two classes of grade 7 learners. On the following day, a silent focused reading was administered to the respondents for comprehension assessment. The day after next, the researcher gave final instruction on how to use the reading material by

discussing the different parts of the selection. Activity sheets were given to the respondents for their final output in the activity.
- A post-achievement test was given to the respondents after all the reading activities were done. Right after, the respondents evaluated the study through the intrinsic motivation questionnaire.

2.3. Data analysis

Statistical analyses were carried out to interpret the data gathered. These were the frequency and percentage distribution, mean, document readability application, mean percentage score (MPS), standard deviation, Microsoft Teams Reading Progress Tool, and normalized gain score.

2.3.1. Frequency and percentage distribution

Frequency and percentage distribution were used to present the data gathered in the PHIL-IRI pretest results of the grade 7 learners of the respondent schools. The PHIL-IRI pretest results indicated the reading level of the learners. The same statistical tool was used to present the data gathered in the preliminary survey of the respondents about their academic performance (grades in science).

2.3.2. Mean

The developed reading material underwent face and content validations from experts. First, the developed reading material was evaluated using the language evaluation tool. Next, it was reviewed by five content experts using the evaluation rating sheet for general reference material. Finally, it underwent evaluation by a layout and format experts using the evaluation tool for layout and format. These evaluation tools were adapted and slightly modified from the department of education guidelines and processes for learning resources management and development system (LRMDS) assessment and evaluation of localized materials [18]. To come up with the results of these evaluations, their comments and suggestions, and the sum and mean of the different criteria were gathered and presented in a tabular form. Mean was also used in the analysis of data in measuring the learner's intrinsic motivation in the following areas: i) interest/enjoyment, ii) effort, iii) pressure/tension, iv) choice, and v) value/usefulness. This questionnaire was adapted from Choi *et al.* [19] in their study about the intrinsic motivation inventory.

2.3.3. Document readability application

The researcher's intent was simply to test the readability of the developed reading material and its appropriateness to the grade level of the respondents. This is an online tool that can be accessed at https://www.online-utility.org/english/readability_test_and_improve.jsp. The researcher focused on the Flesch-Kincaid grade level and lexical density results for this study. Lexical density estimates the linguistic complexity in composition from the functional words (grammatical units) and content words (lexical units). Moreover, Flesch-Kincaid grade level indicates the number of years of education a person needs to understand the text easily on the first reading.

2.3.4. MPS and standard deviation

The responses from the comprehension test were analyzed using MPS and standard deviation. MPS indicates the ratio between the number of correctly answered items and the total number of test questions or the percentage of correctly responded to items in a test, the NAT [20]. To compute for the MPS, this equation was used by the researcher, MPS=(No. of learners who got the correct answer/total no. of students)×100%. Based on the standard norm, a 50% score is considered a mean score, while a score of 75% or above is within the highest quartile and a percentage score between 0% and 49% was considered as low [21]. Further, a standard deviation was used to measure how disperse the responses are in relation to the mean.

2.3.5. Microsoft teams reading progress tool

A reading progress tool in a Microsoft Teams App was used to measure the learners' fluency. The average words per minute and average accuracy rate, including correct words, mispronunciations, omissions, insertions, self-corrections, and repetitions from the responses, were presented in tabular form. These results were taken from the automated calculations of the tool as soon as students turned in their recorded readings in the virtual classroom of the Microsoft Teams App.

2.3.6. Normalized gain

The utilization of the formula <g>=(posttest score-pretest score)/(maximum possible score-pretest score) enables the assessment of the effectiveness of the developed reading material, with the results categorized as low, medium, or high gains, as per the framework adapted from a study mentioned by Liwanag *et al.* [22]. This decision was based on the suggestion in a research study, emphasizing the continued relevance of normalized gain in evaluating the educational effectiveness of pedagogy within the domain of physics education [23].

3. RESULTS AND DISCUSSION

3.1. Analysis stage

3.1.1. Grade 7 PHIL-IRI group screening test (pre-test) school year 2021-2022

The PHIL-IRI was developed to give teachers a tool for assessing and summarizing students' reading abilities. It is a method for determining a student's reading level that consists of graded passages. It is necessary to remember that the PHIL-IRI is simply a fair approximation of a learner's abilities and should be used in conjunction with other credible evaluation methods [24].

Data from PHIL-IRI group screening test (PHIL-IRI GST) pre-test of grade 7 learners of the respondent school was retrieved by the researcher to analyze the ongoing instructional need of learners for any possible reading intervention. Teachers should have information about their students' reading levels and abilities before they can create and give appropriate reading instruction [24]. The data presented in Table 1 shows the reading level of grade 7 learners of the respondent school based on the results of the PHIL-IRI GST pre-test.

The data shows that 37 or 35.23% of 105 learners were under the frustration level. This means that 37 learners scored seven and below out of a 20-item multiple-choice test administered. Further, there were 56 or 53.33% of instructional learners. This means they scored eight to fourteen out on a 20-item multiple-choice test. Students who received a raw score of less than 14 (74%) should be evaluated further since this could indicate that the student was having difficulty reading at-level text [24]. As a result, an individualized examination was required to explain the child's reading abilities better. On the other hand, a student who garnered a raw score equal to or greater than 14 (75%) at independent level need not undergo further testing.

3.1.2. Grade 7 grades in science during the 1st and 2nd quarter

Presented in Table 2, shows the grades of grade 7 learners in science of the learners-respondents in Ditucalan National High School. The data revealed that most learners were under satisfactory performance during the first grading (59 out of 102 or 57.8%). There were 21 students, or 20.6%, who were relatively satisfactory. Further, no students got an outstanding grade for the first grading. In the second grading, there was a slight increase in the number of students that were fairly satisfactory, very satisfactory, and outstanding performance. Although, most of the students were still under satisfactory performance (40 out of 102 or 39.2%). Taking the average of their grades for the two quarters, the data shows that most students fell under the satisfactory and very satisfactory performance, which were 45.1% and 40.2%, respectively. This means that most of the learners had adequate score, though not outstanding performance, in science in this printed modular distance learning modality (PMDLM) in the respondent school. To address these learning gaps of learners in the respondent schools both in terms of reading skills and satisfactory achievements in science, the researcher hoped that developing a contextualized supplementary science-infused reading material could help address both issues of the learners.

Table 1. PHIL-IRI GST pretest of Grade 7 learners-respondents

Grade 7 learners of the respondent school	
Reading level	No. of learners
Frustration	37 or 35.23%
Instructional	56 or 53.33%
Independent	12 or 11.42%
Total	105

Table 2. Learner's grade in science

Grading scale	Grades in science		
	1st quarter	2nd quarter	Average
Outstanding (90-100)	0	26	0
Very satisfactory (85-89)	22	30	41
Satisfactory (80-84)	59	40	46
Fairly satisfactory	21	6	15
Does not meet expectations (60-74)	0	0	0
Total	102	102	102

3.2. Designing stage

The researcher designed the reading material with the help of the research adviser. It was about force, motion, and energy in grade 7 science third quarter topics. Before the development stage, alignment to the Department of Education (DepEd) K to 12 most essential learning competencies (MELCS) [25] and science curriculum guide 2016 [26], which targeted competencies essential for learners to learn in grade 7 science, was made sure.

Table 3 shows the competencies in reading skills and science in grade 7 with the corresponding title of the selection in the material. The researcher made use of three localized stories about the procession of St. Michael Archangel to discuss the motion, the artificial wave pool in Maze Park and Resort to discuss waves characteristics, and the participation of Mr. Neil Ray Llanes in Asia's Got Talent, a Filipino beatboxer to discuss how sounds are produced by humans. Further, the researcher used another three selections about natural phenomena in which the students can directly observe their surroundings, such as the colors of the sky, the sun's energy, and lightning, to discuss light, heat, and electricity. Through the use of contextualized teaching instruction and materials, particularly by integrating Philippine short stories in English, a research study demonstrated that students showed increased engagement and improvement in reading comprehension, highlighting the importance of familiar and relevant content in enhancing learners' interest and understanding [27]. This approach aligns with the theory of contextualized learning, which suggests that effective learning happens when learners process new information in a manner that aligns with their frame of reference, encompassing their personal inner world of memory, experience, and response [28].

Further, each selection in the reading material was composed of different parts anchored on the disciplinary literacy approach. Disciplinary literacy, as a means to integrate science and literacy, not only fosters deeper learning within specific content areas by depicting the social practices and cognitive procedures employed by experts in a discipline [29] but also serves as an influential method for equipping students to become both well-informed citizens and as the next generation of scientists [30].

The reading material began with a thought-provoking question, designed to encourage students to recognize the necessity of engaging with the text in order to find the answers. Consequently, this approach was aimed at instilling motivation for reading among the students. The text body included text structures (expository text), text features (boldface headings and vocabulary, diagrams, photographs, captions), specialized vocabulary, and sources of information within and across disciplines which will help the learners understand the content. Also, it would help enhance the fluency skills of learners in reading. Lastly, the selection had a comprehension assessment to measure how far they read and understand the text. The questions adopted the style of assessment used by the PHIL-IRI which uses a standardized multiple-choice test following the barrett taxonomy of cognitive and affective dimensions of reading comprehension in formulating the questions.

Table 3. Aligning the reading article to DepEd K to 12 MELCS and science curriculum guide 2016

Topic	Reading skill (English C.G./MELCs)	Learning competencies (science C.G. 2016/MELC's)	Reading article
Motion	Use the passive and active voice meaningfully in varied contexts (EN7G-III-c-2)	Describe the motion of an object in terms of distance or displacement, speed or velocity, and acceleration; (S7FE-IIIa-1)	Procession of St. Michael Archangel!
Waves	Use the past and past perfect tenses correctly in varied contexts (EN7G-III-h-3)	Infer that wave carry energy; (S7LT-IIIc-4) and relate the characteristics of waves.	Maze Park and Resort
Sound	Use phrases, clauses, and sentences appropriately and meaningfully (EN7G-II-a-1)	Explain sound production in the human voice box and how pitch, loudness, and quality of sound vary from one person to another:	Filipino beatboxer Has got a talent
Light	React to what is asserted or expressed in a text (EN8RC-IIIe-2.1.7)	Relate characteristics of light such as color and intensity to frequency and wavelength;	Colors of the Sky
Heat	Determine the worth of ideas mentioned in the text listened to (EN7LC-IV-g-8.2)	Infer the conditions necessary for heat transfer to occur (S7LT-IIIh-i-12)	Solar energy
Electricity	Determine the truthfulness and accuracy of the material viewed (EN7VC-I-h-10)	Describe the different types of charging processes (S7LT-IIIj-13)	Lightning

3.3. Development stage

The developed reading material was evaluated in terms of language, layout, format, and content according to the DepEd standards adapting their evaluation rating sheets. The comments of the evaluators are considered by the researcher in the revisions of the reading material before its implementation. The following are the results of the evaluation rating by the experts.

The researcher consulted the expertise of a Bachelor of Elementary Education (BEED) Program Head of the University of Southeastern Philippines, Tagum-Mabini Campus. Table 4 shows the results of his evaluation in terms of language. He rated the reading material as compliant with all criteria as his suggestions were provided. This means that the material satisfies all the indicators needed in the language evaluation tool needed in developing the reading materials.

Regarding lay-out and format, the researcher consulted the expertise of a creative arts specialist II from the DepEd central office-bureau of learning resources (BLR) production division. Initially, he provided comments and made recommendations that the material needs major revision following his summary of findings. After the researcher incorporated his suggestions, the revised work was presented to him, and he

rated the material. Table 5 shows the results of his evaluation in terms of layout and format. It means that the material is now compliant with all criteria the department of education set in developing localized learning materials in terms of layout and format.

Table 4. Results of the evaluation by language expert

Criteria	Description
Coherence and clarity of thought	Complied
Grammar and syntax	Complied
Spelling and punctuation	Complied
Consistency in style	Complied
Translation	Complied

Table 5. Results of the evaluation by lay-out and format expert

Criteria	Description
Physical attributes	Complied
Back matter pages	Complied
Layout and design	Complied
Typographical organization	Complied
Visuals	Complied

Lastly, the researcher consulted science experts to evaluate the material in terms of content standards. Table 6 presents the rating of content expert evaluators on the developed reading material. The total rating is 33.2 out of 40, which means it passes the content standards set by the department of education, which is 30 points for any printed localized learning materials. Based on the mean rating of 4.08, the evaluation result points to a high level of satisfaction, suggesting that the reading material was well-crafted. This also means that the developed reading material can be considered a supplementary learning resource for grade 7 science and reading intervention material.

Table 6. Mean rating of the evaluation of content experts

Criteria	Rating	Description
Content reinforces, enriches, and leads to the mastery of specific learning competencies for the level and subject it was intended for.	4.2	Very satisfactory
İnformatıon provided is up-to-date.	4	Very satisfactory
The facts are accurate.	4.8	Excellent
Language is appropriate for the level of the target user.	4	Very satisfactory
Visuals are relevant to the text and suitable to the age level and interests of the target user.	4.2	Very satisfactory
Visuals are clear in content and detail.	4.2	Very satisfactory
Typographic layout/design adequately supports the concepts presented.	4	Very satisfactory
The size of the letters is appropriate for the target user.	3.8	Very satisfactory
Total rating	33.2	Passed
Average mean rating	4.08	Very satisfactory

After incorporating all the comments and suggestions of the evaluators in the material, the researcher tested the reading material using the document readability application to ensure the write-up was at the appropriate level. Presented in Tables 7 and 8, the final version of the reading material has a mean value of lexical density 51.45 and a mean value of Flesch-Kincaid grade level 7.8. Non-fictional literature should have a lexical density ranging between 40% and 64%. This means that the developed reading material is appropriate to target users in terms of the structure and complexity of the texts. Further, the material is also fitted to grade 7 learners by approximating the results in Flesch-Kincaid grade level, which is 7.8.

Table 7. Lexical density of the reading material

Version	Lexical density						
	R.S. 1	R.S. 2	R.S. 3	R.S. 4	R.S. 5	R.S. 6	Mean
Alpha	57.37	51.16	48.27	49.75	50.99	53.87	51.90
Beta	56.49	50.16	48.88	50.93	45.10	56.89	51.40
Gamma	56.43	50.16	49.29	50.38	47.69	54.79	51.45

R.S.=reading selection

Table 8. Flesch-Kincaid grade level of the reading material

Version	Flesch-Kincaid grade level						
	R.S. 1	R.S. 2	R.S. 3	R.S. 4	R.S. 5	R.S. 6	Mean
Alpha	7.90	8.52	6.63	7.65	8.56	8.35	7.9
Beta	7.64	8.24	6.48	8.26	9.41	10.34	8.4
Gamma	7.94	8.24	6.61	7.65	7.46	9.01	7.8

R.S.=reading selection

3.4. Implementation stage

3.4.1. Fluency insights

The researcher used the reading progress tool of the Microsoft Teams App to conduct the respondents' oral reading. Of the 54 respondents, only 30 students responded to the oral reading activity. These students had gadgets and internet connections in their homes to use in the activity.

Table 9 shows the calculated average number of words per minute of the respondents, using the reading progress tool of the Microsoft Teams App, which is 64 wpm with an accuracy rate of 62%. The average oral reading rate based on 77 studies and 5965 participants is 183 wpm. However, reading rates are lower for children, old adults, and readers with English as a second language [31]. This implies that the respondents' reading fluency is still underdeveloped and needs further practice in oral reading.

Table 9. Respondents' reading fluency insights

No. of students participated	Average word per minute	Average accuracy rate
30	63	60%

3.4.2. Comprehension results

MPS indicates the ratio between the number of correctly answered items and the total number of test questions or the percentage of correctly responded to items in a test, the NAT [20]. Table 10 shows that the respondents' comprehension tests were generally lower, 36.67%, with a standard deviation of 2.8616. This implies that the respondents reading comprehension still needs to be evaluated further. With this, the researcher suggested that the respondents must undergo further focused reading activities and interventions to improve academic performace. Recent research supports this view by demonstrating that strong reading proficiency is positively associated with higher overall academic achievement. A systematic literature review involving 27 peer-reviewed studies highlighted that cognitive and linguistic factor, such as vocabulary knowledge and executive function, along with effective instructional support and teacher-student interactions, significantly influence both reading development and academic success. The findings further emphasize the importance of holistic, evidence-based interventions to bridge literacy gaps and enhance learning outcomes across disciplines [32].

Table 10. Respondent's comprehension test results

N	Highest possible score	Total score	Mean	MPS	Standard deviation
54	30	594	11	36.67%	2.8616

3.4.3. Conceptual understanding of the respondents

During this stage, the pretest and posttest results were further analyzed to better understand the developed reading material's influence on the student respondents' achievement on force, motion, and energy in grade 7 under the PMDLM. A total of 54 data sets were included in the analysis. Table 11 showed that the class obtained an average gain score of 39.34% from 5.87 in the pretest to 13.00 in the posttest. Interestingly, this medium normalized gain in an achievement test of the respondents on force, motion, and energy was considered a significant improvement. The present study yielded a medium normalized gain, even though the study was conducted on a group of learners whose majority were average-performing students under the PMDLM in a basic education curriculum. The study of Rusilowatil *et al.* [33] supported this result since its implementation of the developed integrated teaching materials optimizes students' scientific literacy with a normalized gains of 0.74 of high rating. This means that contextualizing learning materials can effectively increase student's scientific literacy than other teaching materials. Additionally, a study revealed that the use of contextualized learning materials in reading instruction significantly improved students' reading comprehension performance, demonstrating the effectiveness of aligning educational content with learners' real-life contexts and interests [34].

Table 11. Average normalized gain of the class (N=54)

Achievement test	Mean average	Average class gain	Interpretation
Pretest	5.87	0.393358	Medium
Posttest	13.00		

Table 12 shows the average learning gain of the respondents classified according to their academic performance as fairly satisfactory (N=1), satisfactory (N=34), very satisfactory (N=18), and outstanding (N=1). Only one stayed in fairly satisfactory with a medium gain of 0.526316. This is followed by 34 respondents obtaining satisfactory results with a medium gain of 0.305425. There were 18 respondents in the satisfactory level with an average medium gain of 0.377976. Lastly, only 1 respondent in the category of outstanding with a medium gain of 0.352941.

Table 12. Average learning gain of the class (N=54)

Achievement test	Outstanding (N=1)	Very satisfactory (N=18)	Satisfactory (N=34)	Fairly satisfactory (N=1)
Mean pretest score	7	5.33	6.15	5
Mean posttest score	13	12.39	11.62	15
Class gain	0.352941	0.377976	0.306425	0.526316
Interpretation	Medium	Medium	Medium	Medium

Utilization of expository texts using contextualized supplementary reading materials has proven to be an effective strategy in enhancing the academic performance of students through reading across various performance levels. As mentioned in the study of Herdiawan [35], in the realm of reading instruction, various media and strategies have been identified as effective tools in improving student's comprehension such as the implementation of the picture strip story strategy rooted in the principles of contextual teaching and learning (CTL). Thus, this study reinforces the importance of using contextualized reading materials to address the diverse needs of learners. The findings provide valuable insights for educators and curriculum designers aiming to improve students' academic performance through reading.

Furthermore, the findings of this study resonate with the seminal work of Wheeler and Wheeler [36] as encapsulated in their influential publication, "selecting appropriate reading materials." Wheeler and Wheeler [36] astutely contended that while vocabulary proficiency remains a significant contributor to the complexity of reading, it is pivotal to recognize the intricate interplay of other critical factors. These factors encompass adaptability, organizational structure, illustrative elements, sentence composition, and the overall format of reading materials [36]. Furthermore, the results of this research are congruent with the PISA 2018 reading literacy framework. The framework's recent updates emphasize the exploration of innovative technological tools and the incorporation of scenarios that encompass both print and digital text [37]. This entire viewpoint confirms the varied nature of effective reading materials selection and design by highlighting the thorough procedure employed in the development of the supplemental material used in this study.

3.5. Evaluation stage

After taking the posttest, the 54 student-respondents answered the intrinsic motivation questionnaire that disclosed their interest, effort, pressure, choice, and usefulness of the developed reading material during the implementation stage. Generally, the respondents perceived the developed reading material and the reading activity as enjoyable, engaging, and valuable in the same 54 student-respondents who took the achievement test in both pre-and post-reading instructions. Table 13 indicates a predominant agreement among respondents that the developed reading material on contextual basis significantly contributes to their enhanced understanding of science concepts. Also, they decided that the reading activity was exciting because it is a new educational tool to practice reading. Further, this implies that the respondents were intrinsically motivated to perform the different activities in the study without any obvious external rewards from the researcher. Similarly, Fahmi *et al.* [38] research indicates that creating contextual teaching materials leveraging local advantages significantly enhances student interest, engagement, and cognitive abilities, leading to improved learning outcomes, with participants expressing high satisfaction in addressing learning gaps through independent learning modules [39]. Additionally, several research [40], [41] suggest that the CTL approach makes the students obtain better learning achievement and enhances both student motivation and reading comprehension, while Valerio [42] underscores the significance of pre-service teachers fostering intrinsic motivation through innovative teaching pedagogies.

Table 13. Consolidated mean rating of intrinsic motivation of respondents using the developed reading material and reading activity

Respondents	Overall mean	Interpretation
Students (N=54)	3.25	Mostly agree

4. CONCLUSION

As elucidated by the findings, there is enough evidence for the researchers to conclude that there is a need for a new localized supplementary reading material capable of enhancing the scientific literacy, oral reading fluency, and comprehension of students within the respondent school. Furthermore, the developed reading material was identified as a potential supplementary learning tool for grade 7 science and a reading intervention resource, as confirmed by the evaluation of experts. Notably, the pilot testing of the material, integrated into a blended learning approach, resulted in remarkable improvements in students' conceptual understanding, evident from the normalized gain, thereby solidifying its effectiveness as a supplementary resource.

Additionally, the respondents expressed a positive perception of the reading material and the associated activities, deeming them engaging, and stimulating. This response led to the intrinsic motivation of the respondents to actively participate in the various exercises facilitated by the reading material. Their feedback underscored the material's role in enhancing their grasp of scientific concepts, while the reading activities contributed significantly to their ongoing reading practice. Based on these compelling results, it is strongly recommended that similar materials be developed to cover all physics content across various grade levels, from grade 3 to 10, with the potential for replication in other science domains.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
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R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The author declares no conflict of interest.

INFORMED CONSENT

The researcher ascertained that all respondents have voluntary signed the assent form together with their parents. The scope of the content of the assent form was clearly discussed to the parents and the learners during the orientation about the distribution and activation of Microsoft Account O365 for learners. These include the personal background of the researcher, the purpose and objectives of the study, the target participants, the duration of the conduct of the study, the risk and benefits they can get by participating, and the right to withdraw their participation at any time throughout the study, the privacy and confidentiality of their responses, and other important matters.

ETHICAL APPROVAL

The research involving human participants complied with all relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration. Ethical approval was obtained from the ethics committee of MSU-IIT. In addition, necessary permissions were secured from the Department of Education Schools Division Superintendent of Iligan City and the School Head of the participating school in Ditucalan, Iligan City.

DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author, [MAAM]. The data which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

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