Perceptions of Pre-Service Teachers on Digitized Collaborative Strategic Reading (CSR) Material: A Basis for Enhancing Reading and Arithmetic Skills in Project LETRA

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ABSTRACT

Digital technology is increasingly used to widen access to quality education, yet printed instructional materials remain common in community-based programs. This study examined the perceptions of pre-service teachers on digitizing the Collaborative Strategic Reading (CSR) materials of Project LETRA, a Polytechnic University of the Philippines (PUP) Taguig extension program, as a basis for enhancing reading and arithmetic skills. Using a quantitative, non-experimental descriptive-correlational design, data were gathered through a researcher-developed questionnaire administered via Google Forms to 114 third- and fourth-year Bachelor of Secondary Education students majoring in English and Mathematics, selected through purposive sampling. Data were analyzed by frequency, percentage, median, interquartile range, net agreement rating, and Spearman's rho. Respondents reported an Advanced level of technological proficiency in basic digital literacy, instructional technology skills and digital facilitation (Grand Median = 4.00 for each). They agreed that paper-based materials present pedagogical challenges, particularly in monitoring student understanding of unfamiliar words and identifying numerical information in lengthy word problems. Highly Necessary features included interactive “Preview” checklists, collaborative digital whiteboards, text-to-speech support, and automated “Check” functions. Respondents also perceived that digitization can improve students’ reading comprehension and arithmetic skills. Technological proficiency was moderately and positively correlated with perceived necessity of digitized materials ($\rho = 0.414$, $p < .001$), and perceived necessity was moderately and positively correlated with perceived impact on reading comprehension ($\rho = 0.462$, $p < .001$) and arithmetic accuracy ($\rho = 0.486$, $p < .001$). The findings provide a diagnostic basis for prioritizing features in a digitized CSR-Arithmetic template. Because the results reflect perceptions rather than measured learner outcomes, future studies should test the material's effectiveness with the intended learners.

Keywords: Collaborative Strategic Reading; digitized instructional materials; pre-service teachers; reading comprehension; arithmetic skills.

INTRODUCTION

Background and Literature

Education nowadays often involves digital technology. Digitized learning is meant to expand access, especially for students from low-income households, who face the biggest barriers to quality education (UNESCO, 2021). One of the concerns addressed by Sustainable Development Goal 4 is to promote equal access to quality education (United Nations, 2023).Locally, the pandemic showed how wide the gaps were. Many Filipino teachers had to improvise with whatever digital tools they had, and their approaches differed from one school to another (Caratiquit & Caratiquit, 2022; Javier, 2022). National policy points the same

way. The Commission on Higher Education's (CHED) 2016 order on research, innovation, and extension (CHED Memorandum Order No. 52) wants universities to put these three functions to work for equity and relevance (Commission on Higher Education [CHED], 2016).

The Lifelong Learning Development Framework Act or the Republic Act No. 12313, is the promotion of lifelong learning. It also encourages the use of modern learning technologies and provides for the training of teachers utilization (Republic Act No. 12313). Both of these fit within AmBisyon Natin 2040, the national vision for a better quality of life for Filipinos (National Economic and Development Authority, 2016).

At the Polytechnic University of the Philippines (PUP) Taguig Campus, one example of extension work is Project LETRA (Learning Engagement Through Reskilling and Assessment), run by the Mentors' Society. The project supports young learners in the communities with basic literacy skills. The project also gives real teaching experience to the facilitators, the Bachelor of Secondary Education (BSEd) pre-service teachers. (Latoja et al, 2025) researched on project LETRA and found out that students of grade 8 progressed in their learning using the instructional resources based on the Collaborative Strategic Reading (CSR) approach.

Growth areas were sequencing, identifying main ideas, drawing conclusions and making inferences. CSR runs on group roles and a few simple routines. In "Click or Clunk," learners flag words or ideas they don't understand, and in "Get the Gist," they sum up what they have read. These routines help them check their own understanding and build meaning together.

Project LETRA currently uses paper-based materials to implement CSR. This format may make it harder to monitor learners' understanding, give immediate feedback, and provide varied instructional support. Digitizing the materials may allow features that support learners and make the activities easier to facilitate. Extending the digitized materials to arithmetic is also a natural next step since reading comprehension is closely tied to arithmetic, particularly when learners have to understand word problems, interpret information, and pick out the details needed to solve them (Akın, 2022; Alghazo et al., 2022; Valenzuela et al., 2024). (Latoja et al, 2025) focused on reading only, and no CSR material that integrates arithmetic has been developed or implemented for Project LETRA.

Based on the literature reviewed, limited research has examined pre-service teachers' perceptions of digitized CSR materials, particularly those integrating CSR and arithmetic. It is therefore important to determine whether pre-service teachers consider the proposed features necessary. Their technological proficiency and perceptions may provide useful guidance for developing the materials.

THEORETICAL AND CONCEPTUAL FRAMEWORK

Three theories guide this study. The Technological Pedagogical Content Knowledge (TPACK) framework explains the importance of integrating technological, pedagogical, and content knowledge in teaching (Mishra & Koehler, 2006). Here, content knowledge relates to reading comprehension and arithmetic, pedagogical knowledge to the CSR approach, and technological knowledge to the digital platform that would host the material. Social constructivism means children learn from other people, whether by talking, working together or being guided by someone who knows more capable.

Vygotsky called the gap such help can close the Zone of Proximal Development (Wibowo et al., 2025). In this context, the proposed digitized CSR material may serve as a tool for supporting collaboration and scaffolding. The Technology Acceptance Model (TAM) explains how perceived usefulness and perceived ease of use relate to technology acceptance (Davis, 1989). It provides a basis for examining pre-service teachers' perceptions of the proposed material and its possible use in Project LETRA.

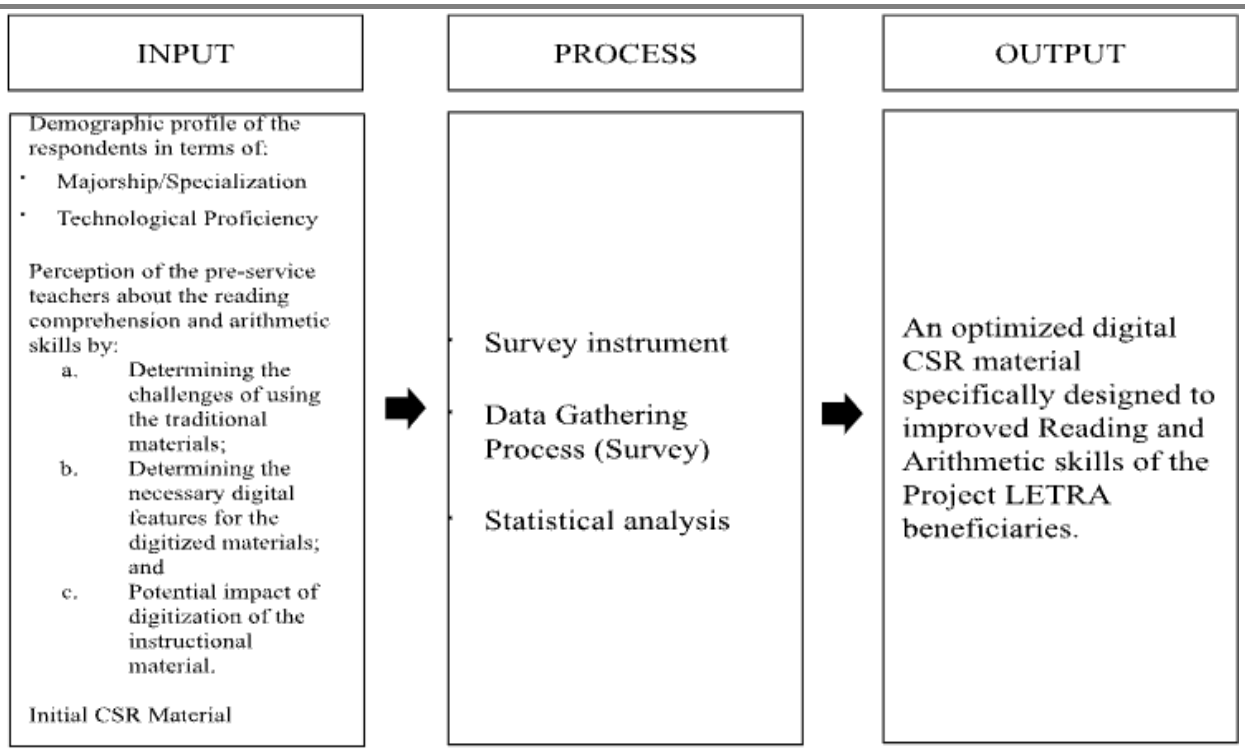


Figure no 1. Conceptual Framework of the Study (input-process-output model)

The conceptual framework of this study was based on the Input-Process-Output (IPO) model. Inputs were essential materials, data, resources, or information that was utilized during the process stage of the study. The inputs were processed through the distribution of the survey instrument to the respondents conducted during the data gathering, ensuring all the information is accurately obtained. Finally, the output of this study was an optimized digital Collaborative Strategic Reading (CSR) material using the analyzed data as the fundamental basis during its development.

Research Gap and Objectives

The study of Latoja et al. (2025) focused on reading only, and no CSR material that integrates arithmetic has been developed or implemented for Project LETRA. Based on the literature reviewed, limited research has examined pre-service teachers' perceptions of digitized CSR materials, particularly those integrating CSR and arithmetic. It is therefore important to determine whether pre-service teachers consider the proposed features necessary. Their technological proficiency and perceptions may provide useful guidance for developing the materials.

This study examined how 114 third- and fourth-year BSEd pre-service teachers (English and Mathematics majors) of PUP Taguig Campus perceive the digitization of the CSR materials used in Project LETRA. The general objective of this study was to determine the perceptions of pre-service teachers on the digitization of CSR materials in Project LETRA as a basis for enhancing students' reading comprehension and arithmetic skills.

1.4 Statement of the Problem and Hypothesis

The researchers would like to seek answers to the following specific questions:

1. What is the demographic profile of the pre-service teachers in terms of:

a. Sex

b. Age

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c. Year level

d. Majorship / Specialization

e. Course Taken

2. What is the respondents level of Technological Proficiency?

3. What is the level of perceived pedagogical challenge encountered by the pre-service teachers in using current paper-based materials for:

a. Reading comprehension strategies

b. Arithmetic skill integration?

4. What is the level of perceived necessity for the following digital features in the proposed CSR-Arithmetic template:

a. Reading Scaffolds;

b. Arithmetic Scaffolds?

5. To what extent do the pre-service teachers perceive the potential impact of digitization on the enhancement of students' skills in:

a. Reading comprehension; and

b. Arithmetic accuracy

6. Is there a significant relationship between the pre-service teachers's technological proficiency and their perceived necessity for digitized instructional materials?

7. Is there a significant relationship between the perceived necessity for digitized instructional materials and the perceived potential impact of digitization on the enhancement of student skills in:

a. Reading comprehension; and

b. Arithmetic accuracy?

8. Based on the findings, what prioritized set of digital features and functionalities can be proposed for the enhancement of Project LETRA instructional materials?

Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

H01:There is no significant relationship between the pre-service teachers's technological proficiency and their perceived necessity for digitized instructional materials.

H02: There is no significant relationship between the perceived necessity for digitized instructional materials and the perceived potential impact of digitization on the enhancement of student skills in reading comprehension.

H03: There is no significant relationship between the perceived necessity for digitized instructional materials and the perceived potential impact of digitization on the enhancement of student skills in arithmetic accuracy

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METHODOLOGY

Research Design

The study used a quantitative, non-experimental descriptive-correlational design. The descriptive component characterized the respondents' technological proficiency and their perceptions of paper-based materials, necessary digital features, and the potential impact of digitization. The correlational component tested whether technological proficiency was related to perceived necessity of digitized materials, and whether perceived necessity was related to perceived impact on students' reading comprehension and arithmetic accuracy. No experimental condition was introduced.

Respondents and Sampling

The respondents were third- and fourth-year BSEd pre-service teachers majoring in English or Mathematics at PUP Taguig Campus. Purposive sampling was used. To qualify, a student had to have completed or been taking at least one relevant course: Language Learning Materials Development, Teaching and Assessment in Macroskills, Technology for Teaching and Learning 1 or 2, or Assessment in Learning 1 or 2. These courses give students experience in developing instructional materials and using educational technology. The campus registrar listed 161 eligible students. A Raosoft calculator (95% confidence level, 5% margin of error, 50% response distribution) gave a required sample of 114, which was the number of respondents obtained.

Research Instrument

Data were gathered with a researcher-developed structured questionnaire in three parts. Part 1 collected demographic information (sex, age, year level, specialization, and relevant courses taken). Part 2 measured technology proficiency on a five-point scale (5 = Expert, 4 = Advanced, 3 = Intermediate, 2 = Beginner, 1 = No Experience) with three areas: Basic Digital Literacy, Instructional Technology Skills, and Digital Facilitation. Part 3 measured perceptions of digitized CSR material on a four-point scale, with no neutral option, across three areas: Pedagogical Challenges in Paper-based Approaches, Necessary Features of Digitized Materials, and Potential Impact on Student Enhancement. Challenge and impact items ranged from 4 (Strongly Agree) to 1 (Strongly Disagree). Necessity items ranged from 4 (Highly Necessary) to 1 (Not Necessary), with Highly Necessary interpreted as a mean of 3.26 to 4.00. The instrument was tested for reliability using Cronbach's alpha and certified by the PUP Taguig statistician. The overall coefficient was 0.803 (Good), and the coefficients of the scored parts ranged from 0.700 to 0.890 (Acceptable to Good).

Data Gathering Procedure

The researchers obtained institutional clearance and sent request letters to the Registrar's Office and the PUP Taguig Campus Director. The questionnaire was then distributed through Google forms with clear instructions and the researchers were available to clarify questions. Responses were reviewed for completeness and accuracy prior to encoding.

Statistical Treatment

Data were analyzed with Statistical Package for Social Sciences (SPSS) version 26. Frequency and percentage distributions described the demographic profile. Because responses were ordinal, the median and interquartile range (IQR) were used as measures of central tendency and variability. The net agreement rating (NAR), the percentage of respondents giving a positive answer minus the percentage giving a negative answer, supported the median-based interpretation. Because the data were not normally distributed, Spearman's rank-order correlation (rho) tested the relationships among variables at the 0.05 level of significance.

RESULTS

Demographic Profile of the Respondents

Among the 114 respondents, most were female (75.44%), aged 20–21 (50.87%), in their fourth year (52.6%), and majoring in English (63.16%). English majors outnumbered Mathematics majors in the campus population as well (94 of 161 eligible students). Technology for Teaching and Learning 1 and 2 were the most commonly taken relevant courses (94.74% each).

Table 1. Demographic profile of the respondents (N = 114)

Variable	Category	f	Percentage
Sex	Female	86	75.44%
	Male	23	20.18%
	Prefer not to say	5	4.38%
Age	20–21 years	58	50.87%
	22–23 years	52	45.61%
	24–25 years	3	2.63%
	28–29 years	1	0.88%
Year level	Fourth year	60	52.60%
	Third year	54	47.40%
Specialization	English	72	63.16%
	Mathematics	42	36.84%

Technological Proficiency

The respondents rated themselves Advanced in all three areas of technological proficiency (Table 2). Their strongest skill was navigating cloud-based platforms (NAR = 89.47%), followed by converting static paper-based material into an electronic format (72.81%). Their weakest skills were troubleshooting hardware and software problems during a live session (40.35%) and integrating external arithmetic tools (52.63%). In digital facilitation, respondents were most proficient in monitoring multiple students' progress simultaneously on a digital dashboard (63.16%).

Table 2. Respondents' level of technological proficiency

Area / Indicator	Median	IQR	NAR (%)	Interpretation
Basic digital literacy (Grand Median)	4	1	70.76	Advanced
Navigating cloud-based platforms (e.g., Google Drive, Canva, MS Teams)	4	1	89.47	Advanced
Troubleshooting hardware/software problems during a live session	4	1	40.35	Advanced
Instructional technology skills (Grand Median)	4	1.67	63.45	Advanced
Converting static paper-based material into an electronic format	4	2	72.81	Advanced
Integrating external arithmetic tools into a lesson	4	1	52.63	Advanced
Digital facilitation (Grand Median)	4	1.5	60.09	Advanced
Monitoring multiple students' progress simultaneously on a digital dashboard	4	2	63.16	Advanced

Legend: 1.00-1.80 (No Experience), 1.81-2.60 (Beginner), 2.61-3.40 (Intermediate), 3.41-4.20 (Advanced), 4.21-5.00 (Expert).

Pedagogical Challenges of Paper-Based Materials

The participants indicated that printed documents present difficulties with regard to reading comprehension and arithmetic integration (Table 3). The main difficulty perceived in reading was ensuring students could identify and comprehend unfamiliar words, which had a NAR of 75.44%. Meanwhile, maintaining interest in the reading material had the lowest NAR of 33.33%. The primary obstacle in arithmetic was students' difficulties understanding numbers in lengthy word problems, which had an NAR of 91.23%, followed by a risk of overwhelming students with wordy problems (84.21%). Having limited room to present the solution step by step was found to be least challenging with an NAR of 56.14%.

Table 3. Perceived pedagogical challenges of paper-based materials

Area	Grand Median	IQR	Interpretation	Variables	NAR(%)
Reading comprehension	3	1	Agree	Ensuring students can identify and comprehend unfamiliar words	75.44
				Maintaining interest in the reading material	33.33
				Students' difficulty understanding numbers in lengthy word problems	91.23
Arithmetic skill integration	3	1	Agree	Risk of overwhelming students with wordy problems	84.21
				Limited room to present the solution step by step	56.14

Legend: "1.00-1.75 (Strongly Disagree), 1.76-2.50 (Disagree), 2.51 – 3.25 (Agree) and 3.26 -4.00 (Strongly Agree)"

Necessary Features of Digitized Materials

The respondents rated the proposed digital features Highly Necessary for both reading and arithmetic scaffolds (Table 4). For reading, collaborative digital whiteboards for group wrap-up questions ranked highest (NAR = 92.98%), followed by text-to-speech or audio support and interactive "Preview" checklists (91.23% each). Digital "Gist" text boxes ranked lowest (77.19%) and were interpreted as Moderately Necessary. The interactive "Preview" checklist obtained the highest rating (91.23%) for the arithmetic, followed by the automated "Check" button and the collaborative digital whiteboards (89.47% each), virtual manipulatives (80.70%), and the digital scratchpad (78.95%).

Table 4. Perceived Necessity of Digital Features in the Proposed CSR-Arithmetic Template

Scaffold	Grand Median	IQR	Interpretation	Digital feature	NAR (%)
Reading scaffolds	3.6	1	Highly Necessary	Collaborative digital whiteboards for group wrap-up questions	92.98
				Text-to-speech or audio support	91.23
				Interactive "Preview" checklists	91.23
				Digital "Gist" text boxes (interpreted as Moderately Necessary)	77.19
Arithmetic scaffolds	4	1	Highly Necessary	Interactive "Preview" checklist	91.23
				Automated "Check" button	89.47
				Collaborative digital whiteboards	89.47
				Virtual manipulatives	80.7
				Digital scratchpad	78.95

Legend: "1.00-1.75 (Not Necessary), 1.76-2.50 (Slightly Necessary), 2.51 – 3.25 (Moderately Necessary), and 3.26 -4.00 (Highly Necessary)"

Potential Impact of Digitization on Student Skills

The respondents strongly agreed that digitization can enhance reading comprehension and agreed that it can enhance arithmetic accuracy (Table 5). Digital scaffolding tools for summarizing and interactive platforms that raise engagement drew particularly high agreement for reading, while immediate digital feedback and digital worksheets for organizing solution steps did so for arithmetic.

Table 5. Perceived potential impact of digitization

Area / Indicator	Median	IQR	NAR (%)	Interpretation
Reading comprehension (Grand Median)	4	1	94.04	Strongly Agree
Learners demonstrate an improved ability to summarize texts with the support of digital scaffolding tools	4	1	96.49	Strongly Agree
Student engagement is increased due to the interactive nature of digital learning platforms	4	1	96.49	Strongly Agree
Arithmetic accuracy (Grand Median)	3.2	1	90.18	Agree
Immediate digital feedback enhances the accuracy of students' computations	3	1	94.74	Agree
Digital worksheets support improved sequencing and organization of problem-solving steps	3	1	94.74	Agree

Legend: "1.00-1.75 (Strongly Disagree), 1.76-2.50 (Disagree), 2.51 – 3.25 (Agree), and 3.26 -4.00 (Strongly Agree)"

Relationships Among the Variables

Spearman's rho indicated that there were notable, moderate, and positive correlations in all three tests (Table

6). Since all p-values were less than 0.05, the null hypotheses H01, H02, and H03 were not accepted. Individuals with advanced technical expertise believed that digital materials are more important, and those who believed that digital text is more important recognized the capabilities of technology in their skill set.

Table 6. Spearman's rho correlations

Variables	Null hypothesis	ρ	p-value	Verbal interpretation	Decision on H0
Technological proficiency and perceived necessity	H01	0.414	< .001	Moderate positive correlation	Not accepted (rejected)
Perceived necessity and impact on reading comprehension	H02	0.462	< .001	Moderate positive correlation	Not accepted (rejected)
Perceived necessity and impact on arithmetic accuracy	H03	0.486	< .001	Moderate positive correlation	Not accepted (rejected)

Note: "If the p-value is less than or equal to the level of significance (0.05), reject H0; otherwise, fail to reject H_0."

DISCUSSIONS

Technological Proficiency and the Case for Digitization

The 'Advanced' proficiency of the respondents suggests pre-service teachers possess the digital skills to

work with digitized CSR materials. The respondents' lower ratings for troubleshooting during live sessions and for using external arithmetic tools highlight areas where practical preparation is needed. This aligns with the broader literature, which describes teachers' technology integration as shaped by their perceptions, skills, and support (Akram et al., 2022) and notes both opportunities and challenges in integrating digital education in higher education (Alenezi et al., 2023).

The respondents identified challenges with paper materials that were specific. In reading, challenges involved keeping track of students' unfamiliar words and providing immediate feedback. While in arithmetic, extracting numbers from lengthy word problems and handling text-heavy problems. The arithmetic findings are consistent with evidence linking reading comprehension to performance on mathematical word problems (Valenzuela et al., 2024). The feedback challenge confirms the result, showing that English teachers struggle to provide feedback on time, largely due to time constraints and heavy workloads (Dabuco and Ibojo, 2025), which digital tools such as the automated "Check" function can help solve.

Prioritized Digital Features

The necessity ratings indicate the prioritization of the digital CSR-Arithmetic template. Respondents valued features that support collaboration, feedback, and access, such as collaborative digital whiteboards, text-to-speech support, interactive "Preview" checklists, and the automated "Check" button. This corresponds to the social-constructivist idea that cooperativeness and scaffolding are key elements in the learning process, which is supported by previous studies that endorse CSR and digital collaborative learning to enhance reading comprehension (Aldossary & Abdelshasheed, 2024). Digital "Gist" text boxes and the digital scratchpad rated lowest, though still favorably, so they may be built after the higher-ranked features.

Interpreting the Correlations

The moderate positive correlations are consistent with the Technology Acceptance Model, where more skilled respondents found the use of digitized materials more necessary, and those who regarded them as more necessary expected greater advantages in reading and arithmetic. The correlations do not imply causation, and therefore these findings could not demonstrate that proficiency leads to acceptance or actual perceived necessity leads to learning outcomes.

Limitations

The study was based on self-reported perceptions from one campus through purposive sampling, which means that the findings cannot be generalized to other institutions. The study did not evaluate the actual performance of the learners in reading or math and also did not test a prototype that has been developed. Thus, the assessments regarding necessity and impact are merely opinions and do not provide evidence of effectiveness.

CONCLUSION AND RECOMMENDATIONS

Conclusions

Pre-service teachers from PUP Taguig exhibited Advanced technological proficiency, recognized the pedagogical limitations of paper-based CSR materials, identified scaffolding, collaboration, and feedback features as Highly Necessary, and anticipated digitization to support reading comprehension and arithmetic accuracy. Perceived impact was positively related to perceived necessity and proficiency was positively related to perceived necessity. This gives a practical basis for Project LETRA to prioritize features for a digitized CSR-Arithmetic template.

Recommendations

The researchers recommend adapting existing CSR instructional materials used in Project LETRA into a

digitized CSR-Arithmetic template that incorporates highly necessary features, particularly interactive "Preview" checklists, collaborative digital whiteboards, audio support or text-to-speech, and automated "Check" functions. Virtual manipulatives and digital scratchpads may also be included to support arithmetic activities and step-by-step problem-solving. These features can help with reading comprehensions, arithmetic problem solving, and collaborations, and can be used as supplementary alternatives for existing printed materials.

It is also recommended that technology-related activities be implemented in the relevant courses in PUP Taguig to further enhance pre-service teachers' skills in using and evaluating digital instructional materials. Continued institutional backing and collaboration between faculty and Project LETRA implementers may also support implementations. Finally, future researchers are advised to evaluate the proposed materials with real learners to see if they are accessible for the learners and effective in improving reading comprehension and arithmetic skills.

Ethical Consideration

The study was reviewed and approved by the PUP Research Ethics Committee (REC) with the ethical approval code of Ethics Clearance Code No. 2026-0529, in accordance with the requirements of Philippine Health Research Ethics Board (PHREB). Institutional permission was also obtained from the Director of the Polytechnic University of the Philippines (PUP) Taguig Campus before the data were collected. Participation was voluntary, and respondents were informed that they could withdraw from the study at any time without penalty . Informed consent was obtained before the survey was administered. The researchers maintained the confidentiality and anonymity of the respondents in compliance with the Data Privacy Act of 2012 (Republic Act No. 10173). All the collected data were used only for academic and research purposes .

Conflict Interest

The authors declare no conflict of interest.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available in order to protect the privacy and confidentiality of the respondents.

Declaration Use of AI

AI tools were used as a supplementary aid for grammar checking, language clarity, and organization of selected text . The authors designed the study, collected and examined the data, interpreted the results, checked all the materials and are completely responsible for the manuscript.

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