

# Development and Evaluation of Interactive Contextualized E-Learning Resource for Grade 6 Mathematics

<sup>1</sup>Roxanne May B. Aranda, <sup>2</sup>Arnel A. Agustin

<sup>1</sup>Abinganan Elementary School, <sup>2</sup>Nueva Vizcaya State University

[roxannemay.aranda@deped.gov.ph](mailto:roxannemay.aranda@deped.gov.ph)

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Corresponding Email:

[roxannemay.aranda@deped.gov.ph](mailto:roxannemay.aranda@deped.gov.ph)

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## Index Terms:

ASSURE, contextualization, development, e-learning, GEMDAS, interactive, validation

**Abstract.** This study aimed to develop and evaluate an interactive, contextualized e-learning resource in Mathematics 6, specifically designed to address the least mastered competency: perform two or more various operations on whole numbers with or without exponents and grouping symbols, as identified by the learners of Abinganan Elementary School in the Bambang II District. Guided by the ASSURE Instructional Model, the researcher developed interactive digital elements, including localized video lectures and immediate feedback exercises, to bridge abstract mathematical concepts with the learners' daily experiences. Using a descriptive-comparative and developmental research design, the resource was evaluated by 21 respondents, including Grade 6 Mathematics teachers and instructional materials experts, through the DepEd LRMS Evaluation Rating Sheet for Non-Print Materials. The findings revealed that the developed interactive resource earned an overall mean of 3.87, corresponding to a Very Satisfactory descriptive rating, with high scores across Content Quality (M=3.88), Instructional Quality (M=3.85), Technical Quality (M=3.83), and Accuracy (M=3.90). Statistical analysis through a t-test for independent samples yielded a p-value of 0.427, indicating no significant difference between the evaluations of the two groups and confirming a strong professional consensus on the material's quality. The study concludes that the interactive e-learning resource is a valid and pedagogically sound intervention, leading to recommendations for further tests.

## Introduction

The mastery of basic mathematical operation is the crucial foundation of academic achievement and functional literacy in the modern, technology-centered world. Specifically, the Order of Operations (GEMDAS) is a critical gateway competency that determines the preparedness of a student to engage in higher-level algebra and problem-solving. However, international assessments such as TIMSS (2019) and PISA (2022) indicate a continuing learning gap among Filipino learners, who invariably perform below world averages in the numeracy domain. Previous research conducted by Ali Rahman et al. (2017) and Albento (2023) indicate that procedural errors may be related to surface-level learning and the lack of contextualized, technology-enhanced resources. Although the studies have confirmed that engagement can be enhanced with the help of interactive tools and localized content, there is still a gap. Most local research concentrates on generalized performance, often neglecting the specific and data-driven Least Mastered Competencies (LMCs) identified by classroom teachers.

This study will close this gap by developing an interactive and contextualized e-learning resource that is specifically aimed at addressing the competency: performing two or more various operations on whole numbers with or without exponents and grouping symbols. This ability, commonly known as the GEMDAS rule, was revealed as the least mastered competency of Grade 6 pupils at Abinganan Elementary School during the Second Quarter Examination.

By placing the intervention in this confirmed weakness area and using the ASSURE Model, the study transforms learners from passive recipients into active participants. The primary goal is to develop and evaluate this e-learning resource for Grade 6 Mathematics, and to compare the results of the evaluation of instructional material experts and teachers to ascertain classroom practicability.

### *Research Questions*

This study sought to answer the following questions:

1. What interactive, contextualized e-learning resource in Mathematics 6 was developed using the ASSURE Instructional Model to address the identified least mastered competency?
2. What is the evaluation of the Grade 6 teachers and instructional materials experts of Bambang II District on the developed learning intervention in terms of content quality, instructional quality, technical quality, and accuracy?
3. Is there a significant difference in the evaluation of the two groups of respondents on the developed learning material in terms of content quality, instructional quality, technical quality, and accuracy?

### *Null Hypothesis*

There is no significant difference in the evaluation of the developed interactive contextualized e-learning resource in Mathematics 6, in terms of content quality, instructional quality, technical quality, and accuracy, as perceived by the two groups of respondents.

### *Theoretical and Conceptual Framework*

This study was anchored on the ASSURE Instructional Model (Heinich et al., 1999), a systematic instructional model that has verified the successful incorporation of technology, pedagogy and learner-centered in the classroom instruction. To bridge the gap at the classroom level, the researcher operationalize the six stages of the ASSURE model (Analyze Learners, State Objectives, Select Methods, Media, and Materials, Utilize Media and Materials, Require Learner Participation and Evaluate and Revise).

The whole conceptual framework was further grounded on the Constructivist Approach accredited to Jean Piaget (1973) and Lev Vygotsky (1978) which holds that learners are capable of constructing their own knowledge not passively receiving information. It was also in line with the Zone of Proximal Development proposed by Vygotsky and implemented in the local study by Ramos (2021), according to which digital interventions are most effective when they can provide the required support to students to achieve higher levels of mathematical thinking.

The instructional material was developed in a systematic way based on an Input-Process-Output (IPO) framework to guarantee a sound pedagogical and technical quality. The Input phase focused on determining the least mastered competency in Mathematics. The process involved the development of the resource following the ASSURE Model followed by evaluation across four quality domains. Finally, the Output was a developed and evaluated interactive contextualized e-learning resource in Mathematics 6, that mathematics teachers and material experts confirmed to be a useful tool in enhancing learner mastery regarding the identified least mastered competency.

## **Methodology**

### *Research Design*

The research design was grounded in a developmental research design using the descriptive-comparative method to develop and evaluate an interactive, contextualized e-learning resource in Mathematics 6. The descriptive part identified the least mastered competencies in Mathematics 6 based on second quarter assessment results. The developmental part involved designing, developing, and evaluating an interactive, contextualized e-learning resource guided by the ASSURE Instructional Model. The collected data based on the evaluation tools will undergo comparative statistical treatment to determine whether there is a significant difference in the evaluation of the two groups of respondents on the developed learning material in terms of content quality, instructional quality, technical quality, and accuracy.

### *Research Environment*

The research was carried out in Abinganan Elementary School in the Bambang II District, an environment characterized by a supportive teaching staff yet stagnating performance indicators in Mathematics. Results from the National Achievement Test and District competitions reveal a persistent proficiency gap and a "middle-tier" status, indicating that traditional teaching methods have failed to move students beyond basic knowledge. To address this academic plateau, the school serves as an ideal research site for implementing a contextualized e-learning intervention aimed at transforming consistent mediocrity into high-level mathematical mastery.

### Respondents

Table 1 presents the frequency and percentage distribution of the study's 21 respondents, divided into two groups to allow a two-tier evaluation and validation process: 11 Grade 6 mathematics teachers (currently teaching Mathematics 6 with at least two years of teaching experience) and 10 instructional materials experts (Learning Resource Coordinators of Bambang II District of Nueva Vizcaya).

Group	No. of Respondents	Percentage
Grade 6 Mathematics Teachers	11	52.38%
Instructional Material Experts	10	47.62%
<b>Total</b>	<b>21</b>	<b>100%</b>

### Sampling Procedure

The study employed purposive sampling to select experienced Grade 6 mathematics teachers and instructional materials experts with the appropriate expertise and professional experience to offer a plausible and precise evaluation of the instructional material. The involvement of both group of respondents facilitated the study to the extent that the interactive e-learning resource was validated in a balanced and rigorous manner.

### Research Instrument

An evaluation checklist adopted from the Department of Education (DepEd) Learning Resource Management and Development System (LRMDS) evaluation tool for non-print materials was used. The checklist assessed the developed interactive contextualized e-learning resource in terms of Content Quality (alignment with DepEd learning competencies, relevance, accuracy, and appropriateness); Instructional Quality (effectiveness of teaching methods, learner engagement, and critical thinking promotion); Technical Quality (clarity of audio and visuals, synchronization, readability, and absence of technical faults); and Accuracy (correctness of information and absence of factual, grammatical, or typographical errors). The scale criterion comprises of the categories of Very Satisfactory (4), Satisfactory (3), Poor (2) and Very Poor (1).

### Data Gathering Procedure

Adheres to DepEd Order No. 16, s. 2017, this study received official permits from the Schools Division Research Committee and informed consent from the Mathematics teachers and experts of Grade 6, with participant confidentiality ensured. The research was carried out in three stages: Least Mastered Competencies (LMC) identification based on the outcome of the Second Quarter Examination, development of the interactive contextualized e-learning resource based on the ASSURE model, and systematic validation of the resource using the DepEd LRMDS evaluation tool to ensure the quality and acceptability of the content for guiding teaching and learning.

### Statistical Treatment

To ensure an objective and accurate interpretation of the results, the Mean was used to determine the average rating for each indicator and the overall score in terms of content quality, instructional quality, technical quality, and accuracy, as evaluated by Grade 6 Mathematics teachers and instructional materials experts. T-test for independent samples was employed to determine whether there was a significant difference between the evaluations of the two groups of respondents. All inferences were tested at a significance level of  $\alpha = 0.05$ .

## Results and Discussion

### Problem 1: Interactive and Contextualized E-Learning Resource Developed

The developed e-learning resource serves as an interactive and contextualized digital intervention aimed at addressing the least mastered competency identified in the second quarter examination of Grade 6 pupils at Abinganan Elementary School. It was thoroughly designed using the six stages of the ASSURE Instructional Model, which ensured that the material followed a logical instructional sequence and remained aligned with the Grade 6 Mathematics curriculum.

Analyze Learners. Table 2 presents the initial competency analysis based on Second Quarter Examination results.

Learning Competencies	Mean Percentage Score	Mastery Level
Performs two or more different operations on whole numbers with or without exponents and grouping symbols.	61.11	Average Mastery

Table 2. Least Mastered Competency in Mathematics 6

This competency received the lowest mean percentage score among 17 learning competencies. It implies that a significant number of learners find it difficult to apply the order of operations properly, which is one of the fundamental skills of mathematics. Having discovered this gap, the researcher found it as an area of intervention.

*State Objectives.* This step involved formulating clear and quantifiable learning objectives to be used in designing the resource. These objectives focused on enabling learners to accurately perform series of operations involving whole numbers with or without exponents and grouping symbols. The researcher ensured that the material remained relevant and instructionally sound by aligning these objectives with the K to 12 Mathematics standards.

*Select Methods, Media, and Materials.* During this phase, the researcher chose an interactive digital platform to deliver the lesson. To make the learning experience interactive, features such as immediate feedback were integrated into the activities wherein learners receive instant notification of their accuracy, paired with comprehensive explanations of correct solutions. Furthermore, the content was contextualized through localized video lessons focusing on the identified least mastered competency and word problems rooted in the learners' daily lives.

*Utilize Media and Materials.* The researcher organized the selected material into a logical learning order. Preparations were made to ensure that the materials functioned properly on the learners' devices and that the video content was clear and easy to follow. The design adheres to a clear but efficient flow, where the concept is introduced by video lessons and then practiced with the use of interactive activities.

*Require Learner Participation.* It emphasizes active engagement. Instead of passively receiving information, learners are required to watch, think, and respond. The interactive exercises prompt them to apply the GEMDAS rule in solving problems, while the built-in feedback allows them to immediately recognize and correct their mistakes.

*Evaluate and Revise.* Finally, the researcher conducted a formal evaluation of the e-learning resource using the DepEd LRMDS Evaluation Rating Sheet. Feedback was gathered from Grade 6 Mathematics teachers and instructional material experts. Their insights were used to refine the content, improve instructional quality, and enhance technical features.

*Problem 2: Evaluation by Respondent Groups.* Table 3 presents the respondents' evaluation of the developed E-Learning Resource in Mathematics 6

Criteria	Mathematics Teachers	Instructional Material Experts	Overall Mean
Content Quality	3.92 Very Satisfactory	3.85 Very Satisfactory	3.88 Very Satisfactory
Instructional Quality	3.87 Very Satisfactory	3.83 Very Satisfactory	3.85 Very Satisfactory
Technical Quality	3.87 Very Satisfactory	3.79 Very Satisfactory	3.83 Very Satisfactory
Accuracy	3.93 Very Satisfactory	3.88 Very Satisfactory	3.90 Very Satisfactory
Overall Mean	3.90 Very Satisfactory	3.84 Very Satisfactory	3.87 Very Satisfactory

Table 3. Respondents' Evaluation on the Developed E-Learning Resource in Mathematics 6

The data presented in Table 3 reveal that the developed interactive contextualized e-learning resource in Mathematics 6 was consistently evaluated as Very Satisfactory across all criteria by both Grade 6 mathematics teachers and instructional materials experts. The overall mean rating of 3.87 indicates a high level of acceptability and quality of the developed intervention.

Content Quality (overall M=3.88, Very Satisfactory) confirm that the material is curriculum-aligned and effectively addresses the identified least mastered competency. Instructional Quality (overall M=3.85, Very Satisfactory) indicated that the built-in feedback and contextualization are essential scaffolding in the Zone of Proximal Development of the learner

(Turro & Giducos, 2025; Balingway & Felix, 2025). Technical Quality (overall M = 3.83, Very Satisfactory) indicates that the Evaluate and Revise stages of the ASSURE model were properly implemented, which led to the creation of a technically adequate instrument that helps to decrease cognitive load. Accuracy scored the highest overall mean (M = 3.82, Very Satisfactory), confirming that the resource was accurate, reliable, and free from factual and grammatical errors.

*Problem 3: Significant Differences Among Respondent Groups. Table 4 presents the results of the independent samples t-test comparing evaluations of the two groups of respondents.*

Criteria	Groupings	Mean	t	p-value	Remarks
Content Quality	Teachers	3.92	1.074	.30	Not Significant
	Experts	3.85			
Instructional Quality	Teachers	3.87	0.439	.67	Not Significant
	Experts	3.83			
Technical Quality	Teachers	3.87	0.928	.36	Not Significant
	Experts	3.79			
Accuracy	Teachers	3.93	0.769	.45	Not Significant
	Experts	3.88			

*Table 4. Analysis of Difference on the Respondents' Evaluation on the Developed E-Learning Resource in Mathematics 6*

The data reveal that both groups of respondents rated the developed e-learning resource very satisfactory across all criteria. Teachers consistently gave slightly higher mean ratings compared to the experts. In terms of content quality, teachers obtained a mean of 3.92 while experts recorded 3.85. A similar pattern is observed in instructional quality where teachers scored 3.87 and experts scored 3.83. For technical quality, teachers gave a mean of 3.87 while experts rated it at 3.79. In accuracy, teachers again provided the highest mean of 3.93 compared to 3.88 from experts.

Despite these small numerical differences, all computed p-values ranged from 0.30 to 0.67, which are higher than the 0.05 level of significance. Consequently, the null hypothesis was failed to reject for all criteria as well as for the overall mean. This indicates that there is no statistically significant difference between the evaluations of teachers and experts. The pattern indicates that there is a strong degree of consensus between the two groups, as both of them rated the material in the same descriptive range.

## Conclusion and Recommendations

Based on the findings, the following conclusions were derived:

1. A systematically designed and contextualized e-learning resource can effectively address specific learning difficulties among Grade 6 pupils, particularly in applying the correct order of operations. The use of the ASSURE model ensured that the material was learner centered, curriculum aligned, and instructionally sound, which contributed to the relevance and potential effectiveness of the resource.
2. The developed interactive contextualized e-learning resource effectively met established standards for instructional materials in terms of accuracy, relevance, pedagogy, and technical functionality. The consistently very satisfactory ratings across all domains indicate that the material is suitable for classroom use and successfully addresses the identified least mastered competency on order of operations among Grade 6 learners.
3. The developed e-learning resource successfully met the expectations of both teachers and experts, which means it was effective in addressing the study's goal of creating a resource that is both pedagogically sound and technically acceptable. The absence of a significant difference in ratings also implies that the material is relevant, well-designed, and fits the Grade 6 Mathematics instruction because it was perceived both in classroom and specialist terms.

### Recommendations

1. The developed e-learning resource may improve through increased multimedia content usage, a better user interface, and a renewed setting of the contextualized video lectures so that the content can be visually interactive and in line with the current digital preference of Grade 6 learners.
2. Following the final revisions of the interactive e-learning resource in Mathematics 6, an experimental or quasi-experimental research is to be performed among the elementary schools of the Bambang II District to empirically

quantify the substantial effects of the resource on the academic performance and conceptual mastery levels of the pupils in the Order of Operations.

3. School administrators may support the implementation of similar contextualized digital materials through provision of access to devices, good internet connectivity and training of teachers on how to use interactive learning technologies effectively.
4. Future researchers are encouraged to carry out both experimental and longitudinal studies to gain a clearer understanding of the long-term effectiveness of the developed e-learning resource.

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## Competing Interests Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

## Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study; all data used were obtained from previously published sources as cited in the reference list.

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## Appendices

No appendices are attached to this study.