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DEVELOPMENT AND EVALUATION OF SUPPLEMENTARY WORKSHEETS IN GENERAL MATHEMATICS FOR GRADE 11

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ABSTRACT

This study aimed to develop and evaluate Supplementary Worksheets in General Mathematics for Grade 11 learners of Dr. Vivencio B. Villamayor Integrated School, Schools Division of Rizal, during School Year 2024–2025. The descriptive method of research was used, with an adopted survey questionnaire from the DepEd Learning Resource Management and Development System (LRMDS). The worksheets were built on the ten least mastered skills in General Mathematics, which centered on functions, particularly rational, exponential, and logarithmic functions. Ten (10) experts and ten (10) teachers in Mathematics, chosen purposively, evaluated the developed learning material in terms of content, format, presentation and organization, and accuracy and up-to-datedness of information. Both groups of respondents rated the supplementary worksheets as Very Satisfactory on content, format, presentation, and organization (overall means from 3.71 to 3.80), and rated conceptual, factual, grammatical, computational, and typographical errors and obsolete information as Not Present. A t-test showed no significant difference between the evaluations of the two groups (p-values from .483 to .995 across criteria; overall $p = .725$). Comments and suggestions were also given to further improve the material, particularly the inclusion of more problem-solving items and the validation of the material through experimental groups. The results support the acceptability of the worksheets as supplementary material, while their effect on learner performance remains to be tested.

Keywords: *General Mathematics, worksheets, development, evaluation, supplementary learning materials, Grade 11*

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INTRODUCTION

Background of the Study

Mathematics has many practical applications and is therefore widely considered to be extremely important in daily life. It is impossible to envision a world without mathematics. Yet many students around the world also believe that mathematics is the hardest subject to learn, and many struggle to accept this difficulty.

Mathematical competence opens doors to productive futures, while a lack of it closes those doors. Students have different abilities, needs, and interests, yet everyone needs to be able to use mathematics in his or her personal life, in the workplace, and in further study.

Furthermore, mathematics plays a predominant role in everyday life. Learning mathematics helps students think analytically and develop better reasoning abilities, and it helps them build the lifelong learning skills needed to solve problems in life. Academically, however, mathematics is a subject that many students either love or hate. Research on a closely related quantitative subject, statistics, shows that it is disliked by learners who do not find figures interesting, especially those who are more inclined toward the social sciences (Prayoga & Abraham, 2017).

In the learning process, individuals interact with the environment, process information in their own unique ways, and require a unique environment for learning. Addressing the challenge of facilitating learning conditions while organizing such interactions should therefore be taken into consideration to help individuals optimize their learning (Singh, 2017).

Nowadays, however, many learners hold a negative perspective of mathematics because they find the subject complicated and difficult. One reason is that it can be dry and abstract, and much of its content does not seem particularly useful. Once learners find a topic hard to understand, they tend to attend to their own concerns instead of listening to their teachers during a discussion. This is commonly experienced by teachers who, aside from being professionals, must also act as psychologists. Such disengagement may contribute to the low performance of learners in different types of examinations and to the overall performance of the school.

Most students perceive mathematics negatively (Zakaria, Solfitri, Daud, & Abidin, 2013). The formulas and rules involved in a mathematics lesson have been linked to the negative attitudes and concerns that students tend to develop toward the subject (Altintas & Ilgün, 2017). Many students struggle with learning mathematics at some point, and for this reason they have to experiment with different learning styles. The learning styles of students define how they respond to stimuli in the context of learning.

Local and International Context

The Philippines' performance in international assessments illustrates the problem. In the Programme for International Student Assessment (PISA) 2018, conducted by the Organization for Economic Co-operation and Development (OECD) among 15-year-old learners, Filipino students scored 353 points in mathematics against an OECD average of 489, which placed the country second-lowest among the 79 participating countries and economies (OECD, 2019a, 2019b; Department of Education [DepEd], 2019). In PISA 2022, Filipino learners scored 355 points in mathematics among 81 participating systems, essentially unchanged from 2018 (OECD, 2023).

The earlier Trends in International Mathematics and Science Study (TIMSS) 2019 tells a similar story for younger learners. Filipino Grade 4 students scored 297 in mathematics, the lowest among the 58 countries that took the Grade 4 assessment. Only 19% of Filipino students reached at least the Low international benchmark, which means that they had "some basic mathematical knowledge," while 81% did not reach even this level; 6% reached the Intermediate benchmark and 1% the High benchmark (Mullis, Martin, Foy, Kelly, & Fishbein, 2020). Because the TIMSS learners

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of 2019 belong roughly to the cohort that reached Grade 11 in School Year 2024–2025, these results point to foundational gaps that may carry over into senior high school mathematics, although they are not a direct measure of Grade 11 learners.

Statement of the Problem

In the context of Dr. Vivencio B. Villamayor Integrated School (DVBVIS), the Grade 11 students manifest poor mathematical skills in the General Mathematics subject, and teachers experience limitations in the activities that can be given to learners. These conditions have contributed to decreasing academic performance, as reflected in the Mean Percentage Score (MPS) and Learning Outcome Assessment (LOA) during School Year 2024–2025.

Learners who obtained a failing grade of 74 and below, equivalent to the descriptive rating of "did not meet expectations," affect not only their own performance but also the holistic performance of the entire class, which in turn contributes to the promotion rate of the school. Aside from learners' negative perceptions of mathematics, teachers observed that the lack of supplementary materials contributed to learners' difficulties in understanding concepts.

With the present condition of student performance in Mathematics at DVBVIS, the researcher, as a Mathematics teacher, considered it a call of duty to develop learning materials in the form of worksheets that will improve the performance of the learners and of the school in general. As an educator who cares for and loves her craft, the researcher pursued this study to develop supplementary worksheets in General Mathematics. The results of this endeavor are expected to help both teachers and students, which may lead to an improved conduct of the teaching and learning process.

Review of Related Literature

This section presents the literature and policy context that frame the study: the evidence on worksheets and instructional materials, the difficulties learners experience with the target topics, the role of attitudes toward mathematics, the Philippine policy context for learning resources, and related Philippine studies.

Worksheets and Instructional Materials in Mathematics

Syntheses of experimental research generally report favorable effects of well-designed learning materials. Kul, Çelik, and Aksu (2018) synthesized 54 studies with 58 effect sizes and reported a positive and high influence of educational material use on mathematics achievement. Focusing on worksheets specifically, Widodo et al. (2023) meta-analyzed 40 studies (45 comparisons) published from 2013 to 2022 and found an overall effect size of 1.281 on problem-solving skills, while Revano, Tanda, and Walles (2026) reported a Hedges' g of 1.600 across 38 effect sizes from 33 studies involving 2,465 students, although in science learning. These figures come from experimental and quasi-experimental designs and should be read as evidence that worksheets can be effective when carefully designed, not as an effect estimated in the present study.

Learner Difficulties with Functions, Exponentials, and Logarithms

The topics identified as least mastered by the Grade 11 learners in this study are well documented as difficult. Weber (2002) found that while all students in his study could compute exponents in simple cases, few could reason about the process of exponentiation, a prerequisite for understanding exponential and logarithmic functions. Chua and Wood (2005) classified the misconceptions and errors that persist when students work with logarithms. Cangelosi, Madrid, Cooper, Olson, and Hartter (2013), studying students from college algebra to Calculus II, found that the concept of negativity played a prominent role in most errors involving exponential expressions and that an underdeveloped conception of additive and multiplicative inverses was the root of these errors. These findings suggest that

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supplementary materials on these topics should make the inverse relationship between exponential and logarithmic functions explicit and should sequence rule-based practice carefully.

Attitudes toward Mathematics and Achievement

Learners' affective responses to mathematics are consistently related to their achievement. Barroso et al. (2021), in a meta-analysis of 223 studies (747 effect sizes), found a negative relation between mathematics anxiety and mathematics achievement ($r = -.28$). A larger meta-analysis of 906,311 participants by Caviola et al. (2022) examined mathematics performance and academic anxiety forms and likewise reported negative relations with performance. In a systematic review of 95 studies on secondary students, Wen and Dubé (2022) concluded that attitudes toward mathematics are multidimensional (affective, cognitive, and behavioral) and mostly positively related to achievement. These findings give a reason to design practice materials that are low-threat and scaffolded. Because the present study measured evaluators' ratings of the material and not learners' attitudes, this literature is used only as part of the rationale for the study.

The Philippine Policy Context for Learning Resources

DepEd Order No. 76, s. 2011 nationally adopted the Learning Resources Management and Development System (LRMDS) as a quality assurance system that supports regions, divisions, and schools in selecting and acquiring quality digital and non-digital resources in response to identified local educational needs (DepEd, 2011). The Guidelines and Processes for LRMDS Assessment and Evaluation set out the evaluation process and its rating sheets (DepEd, n.d.). For print resources, the rating sheet evaluates a material on four factors: content, format, presentation and organization, and accuracy and up-to-datedness of information. Each criterion is rated from 4 (Very Satisfactory) down to 1 (Not Satisfactory), and a material must meet a minimum score per factor, with the accuracy factor requiring that no errors be identified (DepEd, n.d.).

The subject of the worksheets is anchored in the K to 12 Senior High School Core Curriculum for General Mathematics, which states that at the end of the course, students must know how to solve problems involving rational, exponential, and logarithmic functions, solve business-related problems, and apply logic to real-life situations (DepEd, 2016). Under the Basic Education Learning Continuity Plan (DepEd Order No. 012, s. 2020), schools are directed to refer to the Most Essential Learning Competencies (MELCs) when creating learning activity sheets, self-learning modules, and other instructional materials (DepEd, 2020a, 2020b). Classroom assessment follows DepEd Order No. 8, s. 2015, which provides the grading components and descriptors, including the "did not meet expectations" descriptor for grades below 75 (DepEd, 2015).

Related Philippine Studies

Several Philippine studies have developed and validated supplementary materials in mathematics. Lacea and Buscano (2023) developed learning activity sheets on least mastered competencies (rational expressions and linear equations and inequalities), had them evaluated by three groups of evaluators, and compared the ratings using one-way analysis of variance, a design closely parallel to the expert-versus-teacher comparison in this study. Mijares (2023) validated a supplementary learning material using the LRMDS rating sheet and reported Very Satisfactory ratings on all factors. Parcon and Bearneza (2024) documented the relationship between mathematical skills and General Mathematics performance of Grade 11 students in a Philippine public national high school, which underscores the need for support materials in this subject.

Synthesis

Taken together, the literature indicates that (a) well-designed worksheets and instructional materials can improve mathematics learning; (b) the topics on exponential, logarithmic, and rational functions are conceptually demanding

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and error-prone; (c) learners' attitudes and anxiety are related to achievement; and (d) Philippine policy supports the development of supplementary resources that are aligned with the curriculum and subjected to quality evaluation using the LRMDS. The present study contributes to this body of work by developing worksheets for the least mastered General Mathematics skills of a specific school and by evaluating them through experts and teachers using the DepEd LRMDS criteria.

Theoretical and Conceptual Framework

Theoretical Framework

The development of the worksheets draws on several complementary theories of learning and instructional design.

From a constructivist standpoint, Vygotsky's (1978) concept of the zone of proximal development holds that learners accomplish with guidance what they cannot yet accomplish alone. Worksheets can serve as mediated tasks that move learners from assisted to independent performance. Wood, Bruner, and Ross (1976) described scaffolding functions, such as reducing the degrees of freedom of a task, marking critical features, and controlling frustration, which can be built into worksheets through worked examples, hints, and graduated exercises.

Cognitive load theory (Sweller, 1988; Sweller, van Merriënboer, & Paas, 2019) explains why novices learn better from worked examples than from unguided problem solving, since means–ends problem solving can overload working memory. Accordingly, the worksheets can present worked examples first and then gradually fade support. Gagné, Wager, Golas, and Keller's (2005) events of instruction provide a sequence for each worksheet: stating the objective, recalling prerequisite knowledge, presenting content, providing guidance, eliciting practice, giving feedback, and assessing performance. Mayer's (2020) principles of multimedia learning, such as coherence, signaling, and spatial contiguity, guide the layout and illustrations of the material, which corresponds to the format criterion of the LRMDS rating sheet.

As a process model, the ADDIE approach to instructional design (Branch, 2009) frames the study: analysis (identification of the least mastered skills), design and development (preparation of the worksheets), and evaluation (rating by experts and teachers using the LRMDS criteria). The implementation phase, in which learners use the material, and the summative evaluation of its effect on learning were beyond the scope of this study.

Conceptual Framework

Figure 1 summarizes the conceptual framework of the study in an input–process–output form.

Figure 1. Conceptual framework of the study

Input	Process	Output
• Top ten least mastered skills in General Mathematics, SY 2024–2025 • Learners' MPS and LOA results • DepEd LRMDS evaluation criteria • K to 12 General Mathematics curriculum guide and MELCs	• Analysis of least mastered skills • Design and development of the Supplementary Worksheets • Evaluation by ten experts and ten Mathematics teachers • Comparison of the two groups' evaluations (t-test) • Collection of comments and suggestions	• Evaluated Supplementary Worksheets in General Mathematics for Grade 11 • Ratings on content, format, presentation and organization, and accuracy and up-to-datedness • Revisions based on the comments and suggestions of the evaluators

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Research Questions

This study aimed to develop and evaluate supplementary worksheets in General Mathematics for Grade 11 students of Dr. Vivencio B. Villamayor Integrated School in the Division of Rizal during School Year 2024–2025. Specifically, it sought answers to the following research questions:

1. What topics in General Mathematics may be developed into Supplementary Worksheets based on the top ten least mastered skills for School Year 2024–2025?
2. What is the evaluation of the selected Mathematics teachers and expert respondents on the developed Supplementary Worksheets in General Mathematics for Grade 11 students in terms of the following criteria: (a) content; (b) format; (c) presentation and organization; and (d) accuracy and up-to-datedness of information?
3. Is there a significant difference between the evaluations of the two groups of respondents on the developed Supplementary Worksheets in General Mathematics for Grade 11 in terms of the aforementioned criteria?
4. What are the comments and suggestions of the two groups of respondents to further improve the developed Supplementary Worksheets in General Mathematics for Grade 11?

Hypothesis

In relation to the third research question, the following null hypothesis was tested at the 0.05 level of significance: there is no significant difference between the evaluations of the two groups of respondents on the developed Supplementary Worksheets in General Mathematics for Grade 11 in terms of content, format, presentation and organization, and accuracy and up-to-datedness of information.

Significance of the Study

The results of this study may benefit the following:

- Grade 11 students, who may use the worksheets as additional practice on the skills they find most difficult, with tasks that are aligned with the curriculum and evaluated for quality.
- Mathematics teachers, who may use the worksheets to address the limited range of activities available for teaching General Mathematics and may adapt the development and evaluation process for other topics.
- School heads and curriculum planners, who may use the findings as evidence in decisions on the development, reproduction, and quality assurance of supplementary learning resources, and in addressing the school's MPS and LOA results.
- Future researchers, who may use the study as a basis for testing the effectiveness of the worksheets or for developing similar materials for other subjects and grade levels.

Scope and Delimitations

The study covered the development of Supplementary Worksheets in General Mathematics for Grade 11 based on the top ten least mastered skills of the learners of Dr. Vivencio B. Villamayor Integrated School in School Year 2024–2025, and their evaluation by twenty purposively chosen respondents (ten experts and ten Mathematics teachers) using the adopted DepEd LRMDS questionnaire. The study was limited to the evaluation of the material on four criteria and to a comparison of the two groups of evaluators. It did not include a tryout of the worksheets with learners nor a measurement of their effect on learner performance.

Definition of Terms

The following terms are defined as they are used in this study:

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Supplementary Worksheets. Printed practice sheets in General Mathematics developed by the researcher to support learners in the least mastered skills, used in addition to the regular textbook and lessons.

General Mathematics. The Grade 11 core subject in senior high school that covers functions, including rational, exponential, and logarithmic functions, business mathematics, and logic.

Least mastered skills. The ten competencies in General Mathematics with the lowest mastery among the Grade 11 learners of DVBVIS in School Year 2024–2025, which served as the basis for the worksheets.

Experts. The ten respondents with expertise in Mathematics who evaluated the worksheets.

Mathematics teachers. The ten teacher respondents in Mathematics who evaluated the worksheets.

LRMDS. The DepEd Learning Resources Management and Development System, from which the evaluation questionnaire was adopted.

Verbal interpretation (VI). The descriptive rating that corresponds to a mean rating, such as Very Satisfactory (VS) or Not Present (NP).

Mean Percentage Score (MPS) and Learning Outcome Assessment (LOA). The school's measures of learner performance reflected the decreasing academic performance in Mathematics during School Year 2024–2025.

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METHODS

Research Design

The study used the descriptive method of research, as it was the most appropriate way to determine the evaluation of the developed learning materials. Descriptive survey research is concerned with present phenomena in terms of conditions, practices, beliefs, processes, relationships, or trends (Salaria, 2012). It is usually used to collect data about people's interpretations, attitudes, opinions, practices, and perceptions. It may involve comparison or contrast and attempts to discuss relationships among non-manipulated variables, and it is described as a systematic survey of an area of interest. This method was adopted by the researcher because it fits the purpose of determining how the developed material is evaluated by its intended evaluators. The development of the material was guided by the ADDIE approach to instructional design (Branch, 2009), limited to the analysis, design, development, and evaluation phases.

Locale and Time of the Study

The study was conducted at Dr. Vivencio B. Villamayor Integrated School in the Schools Division of Rizal during School Year 2024–2025.

Participants and Sources of Data

Twenty (20) teacher respondents, comprising ten (10) experts and ten (10) Mathematics teachers, evaluated the developed learning material. They were chosen purposively, a non-probability technique in which respondents are selected for their knowledge and relevance to the purpose of the study (Etikan, Musa, & Alkassim, 2016). The topics of the worksheets were based on the top ten least mastered skills in General Mathematics of the Grade 11 students of DVBVIS for School Year 2024–2025, which served as a source of data for the first research question.

Development of the Supplementary Worksheets

The worksheets were developed following the analysis, design, development, and evaluation phases of the ADDIE approach. In the analysis phase, the least mastered skills of the Grade 11 learners in General Mathematics for School Year 2024–2025 were identified and ranked (Table 1), and these were matched with the corresponding competencies in the K to 12 General Mathematics curriculum guide. In the design and development phases, the researcher prepared the worksheets on the ten identified skills, taking into account the content, format, presentation and organization, and accuracy criteria of the DepEd LRMDS so that the material would meet these criteria when evaluated. In the evaluation phase, the worksheets were evaluated by the experts and the Mathematics teachers using the instrument described below.

Research Instrument

An adopted survey questionnaire from the DepEd Learning Resources Management and Development System (LRMDS) was used to evaluate the materials based on four criteria: (1) content, (2) format, (3) presentation and organization, and (4) accuracy and up-to-datedness of information. The content criterion has seven items, the presentation and organization criterion has five items, and the accuracy criterion has six items. The format criterion has eighteen items grouped into five aspects: print, illustrations, design and layout, paper and binding, and size and weight of the resource.

In the DepEd rating sheet for print resources, each criterion in the content, format, and presentation and organization factors is rated from 4 (Very Satisfactory) to 1 (Not Satisfactory), with 3 for Satisfactory or Not Applicable and 2 for Poor. For the accuracy and up-to-datedness factor, the rating of 4 means that the error is Not Present (NP), while lower

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ratings mean that the error is present and requires correction (DepEd, n.d.). Respondents were also invited to give comments and suggestions to improve the material.

The official rating sheet gives item ratings and pass scores for each factor but does not define ranges of mean ratings. The verbal interpretation of the mean ratings in this study was therefore based on the following scale, which was adapted by the researcher from the DepEd rating sheet.

Data Gathering Procedure

Permission to conduct the research was secured from the Schools Division Office of Rizal through the Schools Division Superintendent to administer the survey questionnaire to Mathematics teachers and experts in the targeted schools. With the approval of the principal's office, the researcher started data gathering among the respondents. The developed supplementary worksheets were evaluated by the Mathematics teachers (module writers) and experts in Mathematics in terms of content, format, presentation and organization, and accuracy and up-to-datedness of information. The data were then collected, tallied, and tabulated. From the results, the researcher completed the final research report.

Data Analysis

The least mastered skills were ranked to identify the topics for the worksheets. The evaluation data were treated using the mean and standard deviation, and the means were given their corresponding verbal interpretations. To determine whether the evaluations of the two groups of respondents differed significantly, a t-test was used at the 0.05 level of significance. A p-value greater than 0.05 led to the decision to fail to reject (FR) the null hypothesis, interpreted as not significant (NS). Comments and suggestions were summarized and reported as given.

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RESULTS

Research Question 1: Topics Developed into Supplementary Worksheets

Table 1. Top Ten Least Mastered Skills in General Mathematics

Least Mastered Skills	Rank
Solving Logarithmic Equations	1
Solving Exponential Functions	2
One-to-one Functions	3
Graphing of Rational Functions	4
Zeroes of Rational Functions	5
Rational Inequalities	6
Rational Equations	7
Rational Functions	8
Operations in Functions	9
Evaluating Functions	10

Note. Skills are ranked from the least mastered (1) to the tenth least mastered (10).

The learning competencies in Table 1 were identified as the top ten least mastered skills of Grade 11 students in General Mathematics. These served as the basis for the development of the Supplementary Worksheets in General Mathematics for Grade 11 students.

Research Question 2: Evaluation of the Supplementary Worksheets

Content

Table 2. Evaluation of the Supplementary Worksheets in General Mathematics for Grade 11 Students in terms of Content

Content	Mathematics Experts		Mathematics Teachers	
	Mean	VI	Mean	VI
1. Content is suitable to the student's level of development	3.90	VS	3.87	VS

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Content	Mathematics Experts		Mathematics Teachers	
	Mean	VI	Mean	VI
2. Material contributes to the achievement of specific objectives of the subject area and grade/year level for which it is intended	3.80	VS	3.81	VS
3. Material provides for the development of higher cognitive skills such as critical thinking, creativity, learning by doing, inquiry, problem solving, etc.	3.80	VS	3.77	VS
4. Material is free of ideological, cultural, religious, racial, and gender biases and prejudices	3.90	VS	3.84	VS
5. Material enhances the development of desirable values and traits	3.90	VS	3.77	VS
6. Material has the potential to arouse interest of target reader	3.70	VS	3.77	VS
7. Adequate warning/cautionary notes are provided in topics and activities where safety and health are of concern	3.60	VS	3.65	VS
Overall	**3.80**	**VS**	**3.78**	**VS**

Note. VI = verbal interpretation; VS = Very Satisfactory.

As shown in Table 2, both groups of respondents evaluated the developed supplementary worksheets as Very Satisfactory in terms of content, with overall means of 3.80 for the Mathematics experts and 3.78 for the Mathematics teachers.

Format

Table 3. Evaluation of the Supplementary Worksheets in General Mathematics for Grade 11 Students in terms of Format

Format	Mathematics Experts		Mathematics Teachers	
	Mean	VI	Mean	VI
1. Prints				
1.1 Size of letters is appropriate to the intended user	3.70	VS	3.81	VS
1.2 Spaces between letters and words facilitate reading	3.80	VS	3.74	VS
1.3 Font is easy to read	3.90	VS	3.81	VS

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Format	Mathematics Experts		Mathematics Teachers	
	Mean	**VI**	**Mean**	**VI**
1.4 Printing is of good quality (i.e., no broken letters, even density, correct alignment, properly placed screen registration)	3.60	VS	3.71	VS
Overall	**3.75**	**VS**	**3.77**	**VS**
2. Illustrations				
2.1 Simple and easily recognizable	3.70	VS	3.77	VS
2.2 Clarify and supplement the text	3.80	VS	3.77	VS
2.3 Properly labelled or captioned	3.80	VS	3.81	VS
2.4 Realistic / appropriate colors	3.80	VS	3.87	VS
2.5 Attractive and appealing	3.70	VS	3.70	VS
2.6 Culturally relevant	3.70	VS	3.65	VS
Overall	**3.75**	**VS**	**3.76**	**VS**
3. Design and Layout				
3.1 Attractive and pleasing to look at	3.80	VS	3.65	VS
3.2 Simple (i.e., does not distract the attention of the reader)	3.60	VS	3.81	VS
3.3 Adequate illustration in relation to text	3.70	VS	3.71	VS
3.4 Harmonious blending of elements (e.g., illustrations and text)	3.70	VS	3.61	VS
Overall	**3.70**	**VS**	**3.69**	**VS**
4. Paper and Binding				
4.1 Paper used contributes to easy reading	3.70	VS	3.65	VS
4.2 Durable binding to withstand frequent use	3.60	VS	3.61	VS
Overall	**3.65**	**VS**	**3.63**	**VS**

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Format	Mathematics Experts		Mathematics Teachers	
	Mean	VI	Mean	VI
5. Size and Weight of Resource				
5.1 Easy to handle	3.70	VS	3.68	VS
5.2 Relatively light	3.70	VS	3.71	VS
Overall	**3.70**	**VS**	**3.69**	**VS**
Grand Mean	**3.71**	**VS**	**3.71**	**VS**

Note. VI = verbal interpretation; VS = Very Satisfactory.

As shown in Table 3, the experts evaluated the developed material as Very Satisfactory with respect to format, with a grand mean of 3.71. Each aspect of format (prints, illustrations, design and layout, paper and binding, and size and weight of resource) was likewise rated Very Satisfactory. The teacher respondents, with overall means of 3.77, 3.76, 3.69, 3.63, and 3.69 for the five aspects, respectively, and a grand mean of 3.71, also gave Very Satisfactory ratings for all aspects.

Presentation and Organization

Table 4. Evaluation of the Supplementary Worksheets in General Mathematics for Grade 11 Students in terms of Presentation and Organization

Presentation and Organization	Mathematics Experts		Mathematics Teachers	
	Mean	VI	Mean	VI
1. Presentation is engaging, interesting, and understandable	3.80	VS	3.71	VS
2. There is a logical and smooth flow of ideas	3.80	VS	3.77	VS
3. Vocabulary level is adapted to the target reader's likely experience and level of understanding	3.90	VS	3.71	VS
4. Length of sentences is suited to the comprehension level of the target reader	3.80	VS	3.77	VS
5. Sentences and paragraph structures are varied and interesting to the target reader	3.70	VS	3.71	VS
Overall Mean	**3.80**	**VS**	**3.74**	**VS**

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Note. VI = verbal interpretation; VS = Very Satisfactory.

As shown in Table 4, the experts and the teachers evaluated the presentation and organization of the developed material as Very Satisfactory, with overall means of 3.80 and 3.74, respectively.

Accuracy and Up-to-Datedness of Information

Table 5. Evaluation of the Supplementary Worksheets in General Mathematics for Grade 11 Students in terms of Accuracy and Up-to-Datedness of Information

Accuracy and Up-to-Datedness of Information	Mathematics Experts		Mathematics Teachers	
	Mean	VI	Mean	VI
1. Conceptual errors	3.70	NP	3.65	NP
2. Factual errors	3.80	NP	3.74	NP
3. Grammatical errors	3.80	NP	3.68	NP
4. Computational errors	3.80	NP	3.77	NP
5. Obsolete information	3.90	NP	3.71	NP
6. Typographical and other minor errors (e.g., inappropriate or unclear illustrations, missing labels, wrong captions, etc.)	3.70	NP	3.58	NP
Overall	**3.78**	**NP**	**3.69**	**NP**

Note. VI = verbal interpretation; NP = Not Present.

As shown in Table 5, both groups of respondents rated conceptual, factual, grammatical, computational, typographical, and other minor errors, as well as obsolete information, as Not Present in the developed Supplementary Worksheets in General Mathematics (overall means of 3.78 for the experts and 3.69 for the teachers).

Summary of Evaluations across Criteria

Table 7. Summary of the Evaluations of the Two Groups of Respondents across the Four Criteria

Criterion	Mathematics Experts		Mathematics Teachers	
	Mean	VI	Mean	VI
Content	3.80	VS	3.78	VS
Format	3.71	VS	3.71	VS
Presentation and Organization	3.80	VS	3.74	VS

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Accuracy and Up-to-datedness of Information	3.78	NP	3.69	NP

Note. VI = verbal interpretation; VS = Very Satisfactory; NP = Not Present. Values are taken from Tables 2 to 5.

Table 7 shows that the mean ratings of both groups were consistently high across the four criteria, ranging from 3.69 to 3.80. The experts gave their highest mean ratings to content and to presentation and organization (3.80 each), while the teachers gave their highest mean rating to content (3.78). The lowest mean rating of the experts was for format (3.71), and that of the teachers was for accuracy and up-to-datedness (3.69).

Research Question 3: Difference between the Evaluations of the Two Groups

Table 6. Significant Difference in the Evaluation of the Two Groups of Respondents on the Developed Supplementary Worksheet in General Mathematics for Grade 11 Students

Variables	Group	Mean	SD	Mean Diff.	t	df	p-value	Ho	VI
Content	Mathematics experts	3.80	0.34	.02	.136	39	.892	FR	NS
	Mathematics teachers	3.78	0.33						
Format	Mathematics experts	3.71	0.38	.00	.007	39	.995	FR	NS
	Mathematics teachers	3.71	0.57						
Presentation and Organization	Mathematics experts	3.80	0.44	.06	.429	39	.670	FR	NS
	Mathematics teachers	3.74	0.40						
Accuracy and Up-to-datedness	Mathematics experts	3.78	0.33	.10	.708	39	.483	FR	NS
	Mathematics teachers	3.69	0.38						
Overall	**Mathematics experts**	**3.77**	**0.41**	**.04**	**.355**	**39**	**.725**	**FR**	**NS**
	Mathematics teachers	**3.73**	**0.32**						

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Note. Mean Diff. = mean difference; Ho = decision on the null hypothesis; FR = fail to reject; VI = verbal interpretation; NS = not significant ($p > .05$).

As shown in Table 6, no significant difference was found between the evaluations of the two groups of respondents on the developed supplementary worksheets in terms of content, format, presentation and organization, and accuracy and up-to-datedness of information, since the obtained p-values of .892, .995, .670, and .483, respectively, exceed the 0.05 level of significance. The overall p-value of .725 likewise indicates no significant difference. Thus, the researcher failed to reject the null hypothesis.

Research Question 4: Comments and Suggestions

The comments and suggestions of the two groups of respondents to improve the Supplementary Worksheets in General Mathematics for Grade 11 were as follows.

Comments:

(a) The learning material presented is a great tool in honing, engaging, and motivating the active participation of the younger generation of learners to practice self-learning;
(b) The Supplementary Worksheet is very timely and relevant to the subject; and
(c) Superb activities and application.

Suggestions:

(a) Encourage students to think beyond literal questions; include questions such as problem-solving and other questions that make students calculate information instead of simply recalling facts; and
(b) Have the material validated by using experimental groups to determine its effectiveness.

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DISCUSSION

Interpretation of Findings

The ten least mastered skills in General Mathematics (Table 1) concentrate on functions, particularly rational, exponential, and logarithmic functions and their related equations and inequalities. This is consistent with the literature, which documents persistent difficulties in exponentiation, logarithms, and the inverse relationships among them (Cangelosi et al., 2013; Chua & Wood, 2005; Weber, 2002). Basing the worksheets on these competencies directly addresses the learning gaps that, according to the school's MPS and LOA results, contributed to the decreasing academic performance of Grade 11 learners, and responds to teachers' observation that the lack of supplementary materials makes concepts difficult to understand. It also follows the direction of DepEd's guidance that learning materials be anchored on the essential competencies (DepEd, 2020a, 2020b).

In terms of content, both groups rated the developed material as Very Satisfactory (Table 2). This means that the material is suitable to the student's level of development, is free of ideological, cultural, religious, racial, and gender biases and prejudices, enhances the development of desirable values and traits, and contributes to the achievement of the specific objectives of the subject area and grade/year level for which it is intended. The findings imply that the Supplementary Worksheet in General Mathematics contains clear content that enables students to understand the different lessons presented for each type of learner. The lowest-rated content item, on adequate warning or cautionary notes (3.60 and 3.65), was still within the Very Satisfactory rating, and this item is of limited relevance to a mathematics worksheet where few safety concerns arise.

In terms of format, the experts and the teachers rated every aspect (prints, illustrations, design and layout, paper and binding, and size and weight of resource) as Very Satisfactory (Table 3). The teacher respondents agreed that the material is handy and can be brought anywhere with ease, has a format appropriate for the target readers, and has a well-illustrated design and layout. The data show that the format of the instructional material is basic and suitable to the level of learners and, at the same time, relevant to their day-to-day activities. The findings imply that the format of the Supplementary Worksheet in General Mathematics is easy to read, with appropriate colors and properly labeled or captioned illustrations. These qualities are consistent with multimedia design principles that favor clear signaling and the close placement of text and illustrations (Mayer, 2020). Paper and binding received the lowest aspect means (3.65 for the experts and 3.63 for the teachers), although these remained Very Satisfactory; because print durability depends on production, this aspect may be improved when the worksheets are reproduced for wider use.

The presentation and organization of the material were likewise rated Very Satisfactory (Table 4). The presentation is suited to the comprehension level of the target reader and shows a logical and smooth flow of ideas, and the vocabulary level is adapted to the target reader's likely experience and level of understanding. This implies that the presentation and organization of the Supplementary Worksheet in General Mathematics are well matched to the learners, as evidenced by the discussion of the topics in the worksheets. A logical sequence and an appropriate language level are also the features that instructional design models, such as Gagné's events of instruction (Gagné et al., 2005) and cognitive load theory (Sweller et al., 2019), identify as important in lowering unnecessary demands on novice learners.

With regard to accuracy and up-to-datedness, the respondents rated computational, conceptual, factual, grammatical, and typographical errors, as well as obsolete information, as Not Present in the developed Supplementary Worksheets (Table 5). This implies that the material was carefully proofread to ensure that it is free of errors and that it comprises the accurate information needed to enhance students' performance in General Mathematics. It should be noted, however, that the accuracy factor is the strictest factor in the DepEd rating sheet, where a material is expected to have no identified errors (DepEd, n.d.). Mean ratings below 4.00 (3.58 to 3.90 across the items) indicate that at least some

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evaluators noted minor issues, and these should be traced to the evaluators' individual ratings and corrected in the final version of the worksheets.

The absence of significant differences between the evaluations of the experts and the teachers on all four criteria (Tables 6 and 7) shows that both groups of respondents have similar evaluations of the developed learning material. This agreement between two groups with different vantage points strengthens confidence in the favorable ratings and is similar in design to related Philippine studies that compared the ratings of different groups of evaluators on locally developed learning activity sheets (Lacea & Buscano, 2023; Mijares, 2023). However, with only ten respondents per group, the comparison has limited statistical power to detect small differences, so the non-significant result is best interpreted as a consistency in ratings rather than as proof that the two groups' views are equivalent.

The respondents' comments reinforce these findings: the material was described as a great tool for engaging and motivating learners to practice self-learning, as timely and relevant to the subject, and as having superb activities and applications. These qualities respond to the concerns raised in the introduction regarding learners' negative perceptions of mathematics and the dryness and abstractness of the subject, and to the evidence that attitudes and anxiety are related to achievement (Barroso et al., 2021; Wen & Dubé, 2022). The suggestions, on the other hand, point to two directions for improvement. The first is to increase the proportion of problem-solving items that require learners to calculate rather than merely recall information; this is consistent with the content item on the development of higher cognitive skills, which was among the lower-rated content items (3.80 for the experts and 3.77 for the teachers). The second is to validate the material through experimental groups to determine its effectiveness, which is the step that connects favorable evaluation to the experimental evidence that worksheets can improve problem solving (Widodo et al., 2023).

Implications

For practice, the findings suggest that the worksheets are ready to be used as supplementary material in General Mathematics after the evaluators' suggestions have been incorporated. For the school, the study demonstrates a replicable process of identifying least mastered skills from assessment results, developing aligned materials, and subjecting them to LRMDS-based evaluation before use. For research, the study provides a basis for a quasi-experimental tryout of the worksheets.

Limitations

The findings should be read in light of the following limitations. First, the study involved a small, purposively chosen group of twenty evaluators within one school division, and the material was evaluated through expert and teacher judgment using a descriptive design; the results may not generalize to other schools. Second, the study did not test the effect of the worksheets on learners' actual performance and did not collect learners' own feedback; hence, the evidence supports the quality of the material but not yet its effectiveness in improving learner performance. This is consistent with the evaluators' suggestion that the material be validated through experimental groups. Third, ratings were high and close to the ceiling of the four-point scale, which limits the ability of the instrument to discriminate between aspects of the material. Fourth, the topics were drawn from the school's own least mastered skills in a single school year and from the curriculum guide in use at the time, so the worksheets may need to be updated as the General Mathematics curriculum is revised.

Conclusions

From the findings of the study, the following conclusions were drawn:

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1. The topics of the Supplementary Worksheet in General Mathematics were drawn from the ten least mastered skills of the learners, which center on rational, exponential, and logarithmic functions and on operations on and evaluation of functions.
2. The developed Supplementary Worksheet in General Mathematics comprises activities that are suitable for the different learning needs of the learners.
3. The developed Supplementary Worksheet in General Mathematics provides learning tasks that have the potential to enhance the performance of the learner in Mathematics 11, subject to validation of its effectiveness through experimental testing.
4. The evaluations of the two groups of respondents on the developed Supplementary Worksheet in General Mathematics do not differ significantly in terms of content, format, presentation and organization, and accuracy and up-to-datedness.
5. The suggestions and recommendations of the evaluators should be incorporated to improve the developed learning material.

Recommendations

Based on the findings and conclusions, the following are recommended:

1. Incorporate the evaluators' suggestions into the final version of the worksheets, particularly by adding problem-solving items that require learners to calculate and apply information rather than simply recall facts.
2. Review the individual evaluators' ratings on the accuracy and up-to-datedness criterion and correct any minor errors noted before the worksheets are reproduced.
3. Validate the effectiveness of the Supplementary Worksheets using experimental groups, for example through a pretest–posttest or quasi-experimental tryout, to determine their effect on the performance of Grade 11 learners in General Mathematics.
4. Make the worksheets available to General Mathematics teachers as supplementary material for the least mastered skills identified in this study, and update them in line with the current curriculum and competencies.
5. Future studies may include learners as respondents, use larger and more varied groups of evaluators, and report the factor-level scores against the LRMDS pass scores together with an appropriate test of the difference between evaluator groups.

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