

INSTRUCTIONAL MATERIAL FOR ENHANCING LEARNERS' MATHEMATICS PROFICIENCY

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ABSTRACT

A key component of the teaching and learning process is the use of validated instructional materials. This study validated the researcher-made Instructional Material for grade 9 learners. It employed the descriptive quantitative research design involving 90 grade 9 learners and 5 Mathematics Master Teachers chosen through purposive sampling.

Findings revealed that the Instructional Material is Highly Valid in terms of its parts with regards to its objectives, structure, activities, and assessment. It was also found Highly Valid in terms of characteristics with regards to its accuracy, clarity, and suitability. Lastly, the perception of the learners on the use of the Instructional Material based on the structure and usability were Highly Structured and Highly Usable.

It was revealed that there was a significant change in the pretest and posttest scores of students which indicated an improvement of their knowledge on the topics taught. However, it was revealed that there is no significant relationship on the posttest scores and learner's perception on the use of the Instructional Material.

It is recommended that the Instructional Material be used on broader scope to improve the effectiveness and practicability of the Instructional Material.

Keywords:

Instructional material, objectives, content, activities, assessment, accuracy, clarity, suitability, structure, usability

INTRODUCTION

As early in 2016, following the implementation of K–12, Candelaria (2021) already noticed the gap in the students' knowledge and skills as well as the lack of instructional materials that the students used during the lesson. The lack of materials in public schools is somehow to blame for the low performance of the students. Additionally, students do not perform well in math because of the challenging content of the materials provided by the Department of Education.

On the second quarter of the school year 2022-2023, the researcher observed the lack of Math 9 PIVOT-Module in one of the Secondary School in Magdalena. The practice in the school is to give the modules to students during their mathematics time and retrieved it before the class ends; giving no time for the students to review their lessons at home. Likewise, the results of Trends in International Mathematics and Science Study (TIMSS) 2019 revealed that grade 9 students with many resources had higher mathematics and science scores on average than peers with fewer resources (Richardson, Barnes, Swensson, Wilkinson & Golding, 2020). Lastly, the learning material provided by the DepEd was insufficient; activities are redundant and boring, and the content is wanting. With that, this study was made to supplement the use of textbooks in Mathematics 9.

This also sought to validate Instructional Material for Enhancing Learners' Mathematics Proficiency. This research also answered the following questions:

1. What is the level of validation of the Instructional Material in terms of its Parts with regards to:
 - 1.1 Objectives;
 - 1.2 Content;
 - 1.3 Activities; and
 - 1.4 Assessment?
2. What is the level of validation of the Instructional Material in terms of its Characteristics with regards to:
 - 2.1 Accuracy;
 - 2.2 Clarity; and
 - 2.3 Suitability?
3. What is the learners' perception on the use of the Instructional Material based on the:
 - 3.1 Structure; and
 - 3.2 Usability?
4. What is the level of learner's mathematics proficiency in terms of:
 - 4.1 Pretest; and
 - 4.2 Posttest?
5. Is there a significant difference on learner's mathematics proficiency in terms of pretest and posttest?
6. Is there a significant relationship between the learners' mathematics proficiency in Mathematics and learners' perception on the use of the Instructional Material?

REVIEW OF RELATED LITERATURE

One of the solutions employed by DepEd to meet the standards of the K-12 Curriculum is the development of self-learning modules. A strong predictor of learners' satisfaction with learning and that the quality of services is related to structure and usability. A well-structured Instructional Material is one that addresses students' academic and learning needs. Paderes (2015) defined usability as the usefulness of the instructional materials.

The parts of the Instructional Material such as the objectives, contents, activities, and assessment were also explored in this study. Instructional Material must contain objectives. These are brief, clear statements that describe the desired learning outcomes of instruction. The study of Wolf and Akkaraju in 2014 proved that employing SMART objectives helps the instructor to engage in both student-centered teaching and good assessment practice. The researcher suggested to omit some activities and systematically include examples. Instructional Material should also contain systematic learning activities designed to help a student achieve a set of goals. Moreover, Instructional Material should have activities that will equip students to build transferable abilities, such as working together to solve real-world problems, reflecting on their ideas, developing their critical and creative thinking skills, demonstrating initiative, and examining analytical skills. To test whether there is an improvement in student's proficiency level, an assessment tool is included in the module. This serves as the pretest and posttest.

Aside from the parts of the Instructional Material, the accuracy, clarity, and suitability of the Instructional Material were also rated in this study. Accuracy pertains to how the Instructional Material is well-written and provided correct information. Maulana et al. (2016) defined instructional clarity as the capacity to deliver instruction clearly and concisely. Paderes (2015) defined suitability as the appropriateness of the instructional materials to students and teachers.

The pretest-posttest instrument indicates statistically significant knowledge increases for each course component and for the entire course. Pretests can establish students' prior knowledge at the start of the semester, while posttests assess learning at the end of the course.

The researcher supposes that some educational problems can be addressed by locally developing and utilizing instructional materials for Grade 9 students. The research of Villanueva (2019) and Candelaria (2021) both proved that using localized modules increases the academic performance of the students in Mathematics. The two study both focuses on Algebra. Meanwhile, Oco (2022) utilized a teacher made self-learning modules with integration of financial literacy and science to improve the level of academic performance and appreciation of students in mathematics.

METHODOLOGY

It employed the descriptive quantitative research design involving 90 grade 9 learners from Magdalena Integrated National High School chosen through purposive sampling. 5 Mathematics Master Teachers from several school in Laguna validated and rated the Instructional Material. A validated 40-item pretest and posttest were also validated. Permission to conduct the study had been secured. The validated 40-item pretest was administered. The Instructional Material was distributed and used by the two sections of Grade 9 of Magdalena Integrated National High School. The researcher taught 3 topics which are Radicals, Simplifying Radicals and Operations on Radicals. The researcher was permitted to teach the two sections for three weeks. Then, the validated 40-item posttest was given. The scores in pretest and posttest were used to answer the research questions. The researcher collected quantitative data concurrently and analyzed the data.

RESULT AND DISCUSSION

Level of Validation on the Parts of the Instructional Material

In this study, the level of validation on the parts of the Instructional Material was determined by mean and standard deviation. The parts of the Instructional Material include objectives, content, activities and assessment.

Table 1. Level of Validation of the Instructional Material in Terms of its Parts with regards to Objectives

Statement	Mean	SD	Remarks
<i>The objectives of Instructional Material are specific, measurable, attainable, relevant and time bound.</i>	4.77	0.42	Always
<i>The objectives of Instructional Material are in accordance with the K-12 curriculum guide.</i>	4.72	0.53	Always
<i>The objectives of Instructional Material are compatible with its content.</i>	4.65	0.54	Always
<i>The objectives of Instructional Material describe what the students will do to demonstrate learning.</i>	4.76	0.48	Always
<i>The objectives of Instructional Material are sufficiently challenging to the learners.</i>	4.75	0.46	Always

Overall Mean = 4.73

Standard Deviation = 0.31

Verbal Interpretation = Highly Valid

Legend:

Rating	Scale	Remarks	Verbal Interpretation
5	4.20 – 5.00	Always	Highly Valid
4	3.40 – 4.19	Often	Valid
3	2.60 – 3.39	Sometimes	Fairly Valid
2	1.80 – 2.59	Rarely	Less Valid

1 1.00 – 1.79 Never Invalid

Table 1 shows that the objectives of Instructional Material are always specific, measurable, attainable, relevant and time bound ($M=4.77$, $SD=0.42$). Likewise, the objectives always describe what the students will do to demonstrate learning ($M=4.76$, $SD=0.48$). Furthermore, the objectives of the Instructional Material are always compatible with its content ($M=4.65$, $SD=0.54$). The overall level of validation of the Instructional Material in terms of its parts with regards to objectives is Highly Valid ($OM=4.73$, $SD=0.31$).

This means that the objectives of the lessons included in the Instructional Material are in accordance with the curriculum guide and aligned with its content.

Table 2. Level of Validation of the Instructional Material in Terms of its Parts with regards to Content

Statement	Mean	SD	Remarks
<i>Heading titles consist of key words that describe the content or function of the text which follows.</i>	4.86	0.35	Always
<i>The Content is direct to the point and is not redundant and boring.</i>	4.78	0.47	Always
<i>The Content provides adequate guidance and information.</i>	4.48	0.73	Always
<i>Contains topics that are practically related to each other.</i>	4.64	0.58	Always
<i>The Contents are parallel with the objectives and activities.</i>	4.47	0.70	Always

Overall Mean = 4.65

Standard Deviation = 0.37

Verbal Interpretation = Highly Valid

Table 2 presents the level of the Instructional Material in terms of its parts with regards to content. It shows that heading titles always consist of key words that describe the content or function of the text which follows ($M=4.86$, $SD=0.35$). It was revealed that the contents are not redundant and boring ($M=4.78$, $SD=0.47$) and are always parallel with the objectives and activities ($M=4.47$, $SD=0.70$). Overall, the level of validation of the Instructional Material in terms of its parts with regards to content is Highly Valid ($OM=4.65$, $SD=0.37$).

This proves that the contents of the Instructional Material are parallel with the objectives and activities. The contents are not redundant but interesting enough for the students. The researcher omitted some activities and systematically include examples. Furthermore, making certain that the instructional materials are pertinent to the needs of the students is a better approach to learn new information.

Table 3. Level of Validation of the Instructional Material in Terms of its Parts with regards to Activities

Statement	Mean	SD	Remarks
<i>The Instructional Material provides questions that develop the students' higher-order thinking skills</i>	4.45	0.75	Always
<i>The Instructional Material provides adequate exercises suitable to the level of the users.</i>	4.75	0.50	Always

<i>The Instructional Material develops the mathematical skills of the learners.</i>	4.74	0.55	Always
<i>The Instructional Material provides an opportunity for group interaction and group-based learning methods.</i>	4.33	0.75	Always
<i>The Learning Activities conforms with the learning objectives.</i>	4.67	0.55	Always

Overall Mean = 4.59

Standard Deviation = 0.41

Verbal Interpretation = Highly Valid

As shown in Table 3, the respondents evaluated the Instructional Material in terms of activities. It can be noted that the Instructional Material *always* provides adequate exercises suitable to the level of the users ($M=4.75$, $SD=0.50$), develops the mathematical skills of the learners ($M=4.74$, $SD=0.55$), and provides an opportunity for group interaction and group-based learning methods ($M=4.33$, $SD=0.75$). The overall level of validation of the Instructional Material in terms of its parts with regards to activities has verbal interpretation of *Highly valid* ($OM=4.59$, $SD=0.41$).

This means that the Instructional Material provided adequate exercises suitable to the level of the learners and develops their mathematical skills of the learners. Undeniably, Instructional materials that are suited to the level of the learners can improve the teaching-learning process.

Table 4. Level of Validation of the Instructional Material in Terms of its Parts with regards to Assessment

Statement	Mean	SD	Remarks
The questions are clearly worded, concise and grammatically correct.	4.79	0.44	Always
The assessment is answerable within the time given to the students.	4.40	0.69	Always
The level of difficulty of the assessment is appropriate for the competency or competencies being assessed.	4.39	0.67	Always
Assessment tool instructions and assessment conditions are clearly identified.	4.80	0.43	Always
The assessment is aligned with the learning objectives.	4.75	0.48	Always

Overall Mean = 4.63

Standard Deviation = 0.34

Verbal Interpretation = Highly Valid

Table 4 shows the level of acceptability of the Instructional Material in terms of assessment. It was revealed that the Assessment tool instructions and assessment conditions are clearly identified ($M=4.80$, $SD=0.43$), and the questions are clearly worded, concise and grammatically correct ($M=4.79$, $SD=0.44$). It can also be noted that the level of difficulty of the assessment is appropriate for the competency or competencies being assessed ($M=4.39$, $SD=0.67$). The overall level of validation of the Instructional Material in terms of its parts with regards to assessment has verbal interpretation of *highly valid* ($OM=4.63$, $SD=0.34$).

The result indicates that the assessment made were clearly understandable and aligned to the competencies being assessed. Indeed, assessment is essential in the teaching and learning process.

Level of Validation on Characteristics of the Instructional Material

In this study, the level of validation on the characteristics of the Instructional Material was determined by mean and standard deviation. The characteristics of the Instructional Material include its accuracy, clarity and Suitability.

Table 5. Level of Validation of the Instructional Material in Terms of its Characteristics with regards to Accuracy

Statement	Mean	SD	Remarks
The Instructional Material provides correct information.	4.83	0.38	Always
The Instructional Material provides realistic examples.	4.85	0.36	Always
Technical terms are consistently explained and/or introduced.	4.75	0.46	Always
The topics are well-arranged to provide a sequence of understanding.	4.36	0.76	Always
The website version of Instructional Material contains the same objectives, content, and learning activities with the Instructional Material in print.	4.46	0.68	Always

Overall Mean = 4.65

Standard Deviation = 0.35

Verbal Interpretation = Highly Valid

Table 5 presents the level of validation of the Instructional Material in terms of its characteristics with regards to accuracy. It indicates that the Instructional Material *always* provides realistic examples (M=4.85, SD=0.36), and correct information (M=4.83, SD=0.38). Likewise, the topics are always well-arranged to provide a sequence of understanding (M=4.36, SD=0.76). The overall level of validation of the Instructional Material in terms of its characteristics with regards to accuracy is interpreted as *Highly Valid* (OM=4.65, SD=0.35).

The results reflected that the topics in the Instructional Material are well written and provided information. The Instructional Material is well-arranged to provide a sequence of understanding.

Table 6. Level of Validation of the Instructional Material in Terms of its Characteristics with regards to Clarity

Statement	Mean	SD	Remarks
The Table of Contents provided content and its corresponding page number, consistent with the module's contents.	4.86	0.40	Always
The format of the Instructional Material is easy to understand.	4.81	0.42	Always
The exercises have clear instructions to students.	4.81	0.49	Always
The meaning of the text is clear for the students.	4.75	0.48	Always
Each part of the module is well-written.	4.81	0.47	Always

Overall Mean = 4.81

Standard Deviation = 0.30

Verbal Interpretation = Highly Valid

Table 6 above shows level of validation of the Instructional Material in terms of its characteristics with regards to clarity. The Table of Contents provided content and its corresponding page number, consistent with the module's contents (M=4.86, SD=0.40). The respondents were convinced that the Instructional Material is easy to understand (M=4.81, SD=0.42) and well-written (M=4.81, SD=0.47).

Furthermore, the meaning of the text is clear for the students ($M=4.75$, $SD=0.48$). Overall, the level of validation of the Instructional Material in terms of its characteristics with regards to clarity is interpreted as *Highly Valid* ($OM=4.81$, $SD=0.30$) which indicates that the Instructional Material is well written.

Maulana et al. (2016) defined instructional clarity as the capacity to deliver instruction clearly and concisely. Certainly, Instructional Materials that have a good quality of layout can improve the teaching-learning process.

Table 7. Level of Validation of the Instructional Material in Terms of its Characteristics with regards to Suitability

Statement	Mean	SD	Remarks
The overall Instructional Material is appropriate to the age, maturity, and experience of the students.	4.87	0.33	Always
The overall Instructional Material arouses interest of the students.	4.77	0.47	Always
The Instructional Material is free from ideological, cultural, religious, racial, and gender biases and prejudices.	4.40	0.71	Always
The Quick Response (QR) codes are all working, and the Website version of the Instructional Material is easy to navigate.	4.49	0.65	Always
The Instructional Material can be reproduced at low-cost.	4.85	0.39	Always

Overall Mean = 4.63

Standard Deviation = 0.57

Verbal Interpretation = *Highly Valid*

As shown in Table 7, the respondents evaluated the Instructional Material in terms of its characteristics with regards to suitability. It was revealed that the overall Instructional Material is appropriate to the age, maturity, and experience of the students ($M=4.87$, $SD=0.33$). Likewise, the Instructional Material can be reproduced at low-cost ($M=4.85$, $SD=0.39$). The Instructional Material is also free from ideological, cultural, religious, racial, and gender biases and prejudices ($M=4.40$, $SD=0.71$). Overall, the level of validation of the Instructional Material in terms of its characteristics with regards to suitability is *Highly Valid* ($M=4.63$, $SD=0.57$).

This showed that the Instructional Material arouses interest of the students because it is appropriate to their level. Indeed, the use of contextualized materials plays a significant practice to deliver instructions relevant to students' needs and interests.

Level of Learners' Perception on the Use of the Instructional Material

In this study, the level of learner's perception on the use of the Instructional Material in terms of its structure and usability was determined by mean and standard deviation.

Table 8. Level of Learners' Perception on the Use of the Instructional Material based on the Structure

Statement	Mean	SD	Remarks
The illustrations in the module contribute to my acquisitions of concepts, understanding and skills in mathematics.	4.61	0.51	Always
The IM uses well defined language which is easy to understand.	4.51	0.64	Always

Proper spacing is observed in between texts, sentences, and paragraphs including margin and indentation to avoid congested page.	4.53	0.64	Always
The module is properly organized in such a way that all the parts compliment with one another and each part contains clear directions for me to follow.	4.46	0.66	Always
The website version of the Instructional Material has the same content with the printed version of the Instructional Material.	4.56	0.69	Always

Overall Mean = 4.53

Standard Deviation = 0.36

Verbal Interpretation = *Highly Structured*

As perceived by the respondents, the Instructional Material uses illustrations that contribute to the acquisitions of concepts, understanding and skills in Mathematics ($M=4.61$, $SD=0.51$). Moreover, the website version of the Instructional Material has the same content with the printed version of the Instructional Material ($M=4.56$, $SD=0.69$). Furthermore, the module is properly organized in such a way that all the parts compliment with one another and each part contains clear directions for me to follow ($M=4.46$, $SD=0.66$). As shown in Table 8, learner's perception on the use of the Instructional Material based on the structure is verbally interpreted as *Highly Structured* ($OM=4.63$, $SD=0.36$).

It confirmed that the structure of the Instructional Materials has positive impact towards learners' perception on the use of the Instructional material. Oco (2022) underscored that positive appreciation of the teacher-made modules would help students enhance their problem-solving abilities and learning independence.

Table 9. Level of Learners' Perception on the Use of the Instructional Material based on the Usability

Statement	Mean	SD	Remarks
The Instructional Material contains activities that will enhance my cognitive development.	4.70	0.53	Always
The Instructional Material contains activities that are useful to improve my mathematical skills.	4.61	0.53	Always
The Instructional Material contains challenging activities that used my creativity, intelligence, and ability.	4.69	0.53	Always
The References provided additional readings, which helped me deepen my understanding of the lessons.	4.73	0.49	Always
The website version of the Instructional Material is helpful to me because I can easily access the lesson anytime and anywhere.	4.61	0.57	Always

Overall Mean = 4.67

Standard Deviation = 0.33

Verbal Interpretation = *Highly Usable*

Table 9 presents Learner's Perception on the Use of the Instructional Material based on the Usability. It was revealed that the references provided additional readings, which helped deepen learners' understanding of the lessons ($M=4.73$, $SD=0.49$). Moreover, the Instructional Material contains activities that will enhance learner's cognitive development ($M=4.70$, $SD=0.53$), and improve mathematical skills ($M=4.61$, $SD=0.53$). The level of learner's perception on the use of the Instructional Material based on the usability is *Highly Usable* ($OM=4.67$, $SD=0.33$).

It can be concluded that the Instructional Material is *highly usable* as perceived by the learners. This is supported by Paderes (2015) who indicated that highly usable materials should be utilized during the lesson presentation to facilitate learning.

Learner's Mathematics Proficiency in terms of Pretest and Posttest

In this study, the level of learner's mathematics proficiency in terms of pretest and posttest were also determined by frequency table, mean and standard deviation. The pretest and posttest questions were validated by 5 Master Teachers from several schools in Laguna.

The level of learners' Mathematics proficiency prior to using the Instructional Material was determined by pretest results (Table 8). It was revealed that 43 out of 90 students did not meet expectation during the pretest. Likewise, 47 out of 90 students performed fairly satisfactorily.

Table 10. Level of Learner's Mathematics Proficiency in terms of Pretest and Posttest

Score	PRETEST		POSTTEST		Mastery Level Descriptive Equivalent
	f	%	f	%	
33-40	0	0	4	4	Outstanding
25-32	0	0	19	21	Very Satisfactory
17-24	0	0	41	46	Satisfactory
9-16	47	52	26	29	Fairly Satisfactory
0-8	43	48	0	0	Did Not Meet Expectation
Total	90	100	90	100	

Pretest Mean=11.17

Pretest SD=2.99

Posttest Mean=25.01

Posttest SD=5.85

The level of learners' Mathematics proficiency was then determined after they were exposed to the Instructional Material, as shown in Table 8. 26 out of 90 students performed fairly satisfactorily. Almost half of the respondents (41 out of 90 students) performed satisfactorily. Likewise, 19 out of 90 students performed very satisfactorily. Lastly, only 4 out of 90 students performed outstanding in the posttest. The pretest mean score is 11.17 with SD of 2.99, while the posttest mean score is 25.01 with SD of 5.85. This means that on average, learners performed fairly satisfactorily during the pretest. While, after being exposed to the Instructional Material, learner's average performance became satisfactory.

Difference on Learner's Mathematics Proficiency in terms of Pretest and Posttest

In this study, the significant difference on learner's mathematics proficiency in terms of pretest and posttest was also determined by Paired T-test. To easily see the improvement of the students' Mathematics Proficiency, the result of the students' pretest and posttest were compared in Table 11. Table 11 shows the mean, mean difference, computed t-value, p-value and its analysis.

Table 11. Difference between Pretest and Posttest

	Mean	Mean Difference	t	p-value	Analysis
Pretest	56.92				
Posttest	61.48	4.567	2.848	.006	Significant

df=89 at 0.05 level of significance

The statistical tool that was used to determine the difference between pretest and posttest among the three airlines is Paired T-test. The pretest has a mean of 56.92 and a SD of 19.902 while posttest has a mean of 61.48 and 23.208 SD. Pretest and posttest have a mean difference of 4.567. The test of difference has a t of 2.848 with a p-value of 0.006 ($p < 0.05$) which signifies that there is a significant difference between the ratings. The result shows that there was a significant improvement in the services of the three airlines after quiet sometime.

Similarly, the research of Villanueva (2019) and Candelaria (2021) both proved that using localized modules increases the academic performance of the students in Mathematics. The result is also supported by the study of Oco (2022) which utilized a teacher made self-learning modules with integration of financial literacy and science that improve the level of academic performance and appreciation of students in mathematics.

Relationship between the Learners' Mathematics Proficiency and Learners' Perception on the Use of the Instructional Material

In this study, the Significant Relationship between the Learners' Mathematics Proficiency in Mathematics in terms of Posttest and Learners' Perception on the Use of the Instructional Material was also determined. The data were statistically treated using Pearson correlation coefficient (r).

Table 12. Relationship between Posttest Scores and Learner's Perception on the Use of the Instructional Material

<i>Learners' Mathematics Proficiency</i>	<i>Learner's Perception</i>	<i>r value</i>	<i>p-value</i>	<i>Degree of Correlation</i>	<i>Analysis</i>
<i>Posttest</i>	<i>Structure</i>	0.104	0.330	Very Weak	Not Significant
	<i>Usability</i>	-0.033	0.758	Very Weak	Not Significant

The Posttest Scores and the Learner's Perception on the Use of the Instructional Material in terms Structure show a computed value of (r value = 0.104; $p < 0.05$) interpreted as *Not Significant*. Posttest Scores and Learner's Perception on the Use of the Instructional Material in terms Usability show a computed value of (r value = -0.033; $p > 0.05$) interpreted as *Not Significant*.

The result indicates that Posttest Scores and Learner's Perception has no significant relationship. This is contrary to the finding of Oco (2022) which revealed that the way a student feels about a subject is very significant because it can improve the level of academic performance and appreciation of students in mathematics. Learner's perception can make the subject more appealing to them and inspire them to study its contents.

CONCLUSION

The result indicates a significant difference between the pretest and posttest mean scores of the learners before and after the administration of the Instructional Material. Therefore, the hypothesis that there is no significant difference on the level of students' performance in mathematics in terms of the Pretest and Posttest should be rejected. This further implies that creating learning materials that are reliable, useful, and efficient would help students enhance their problem-solving abilities and learning independence.

Meanwhile, the hypothesis that there is no significant relationship between the learners' performance in mathematics in terms of posttest and learners' perception on the use the Instructional Material should be accepted.

RECOMMENDATIONS

1. The school may initiate conducting a workshop on the development of modules. The school may reproduce the validated Instructional Material and distribute it to all the students as a supplement or replacement to textbooks.
2. The Instructional Material only contains topics of 2nd quarter. Thus, it is recommended for mathematics teachers to develop Instructional Material that will contain topics for the rest of the quarter.
3. Future researchers may utilize the Instructional Material in another school in the district of Laguna. Similar studies may also be conducted on other subjects to strengthen learners' performances across learning areas.

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