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Development of a Contextualized Teaching Portfolio for Higaonon Learners

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Abstract

Interpreting graphs is a vital skill for students to navigate the modern world. However, many continue to struggle with this skill, especially Indigenous learners who often find it difficult to relate mathematical content to their lived experiences. This study aimed to develop a contextualized teaching portfolio on graph interpretation tailored for Grade 8 Higaonon learners. The development followed the Successive Approximation Model (SAM), comprising three phases: Preparation, Development, and Implementation. During the development phase, the initial draft of the portfolio underwent expert validation and was revised based on the feedback received. The revised version was pilot-tested and further refined through iterative development. The improved portfolio was then implemented in a Grade 8 Higaonon class. Findings indicated that the contextualized teaching portfolio enhanced learners' engagement, understanding, and confidence in mathematics, which students attributed to its use of real-life contexts and interactive learning activities.

Keywords: contextualized teaching portfolio, graph interpretation, Higaonon learners, Successive Approximation Model (SAM)

1. Introduction

The ability to interpret and analyze graphs is an essential literacy skill for navigating today's information-rich world, where individuals are constantly exposed to data presented in graphical form (OECD and UNESCO Institute for Statistics, 2003). As emphasized by Glazer (2011), competence in graph interpretation is critical not only for making sense of current events but also for fostering scientific literacy. However, despite its importance, many students continue to struggle with interpreting graphs. Lowrie and Diezmann (2007) found that students often have difficulty understanding graphical information. This issue is particularly concerning in education, as graph interpretation tasks have been consistently included in previous cycles of PISA. Given this context, it is vital that students develop strong graph interpretation skills.

Indigenous learners encounter "educational challenges, including difficulty in understanding lessons (Cubillas, 2024). The Indigenous Peoples in the Philippines are among those with the lowest literacy rates (De Guzman et.al., 2021). Moreover, studies

show that indigenous student lag behind in terms of achievement, social and economic status (Napanoy & Peckley, 2020). Difficulties that Indigenous learners encounter in understanding lessons might impede their chance to par among Filipino learners. There is a pressing need to cope with the nonindigenous learners. "To effectively teach IPs learners, it is crucial to understand the world as perceived through their eyes. Connecting with and incorporating Indigenous perspectives in a deep and meaningful way in classrooms is central to the pedagogy of some teachers" (De Guzman et.al., 2021). According to Reyes et al. (2019), Contextualization is one of the keys of engaging the students in teaching learning process wherein the students can relate their situations on their lesson. Teaching and learning are effective when teachers use problems that are common and familiar to students' direct experiences especially in a context of a compelling "presenting problem" in order to shape understanding (Callahan & Switzer, 2019).

A teaching portfolio is a reflective, evidence-based collection of teaching materials, learner outputs, and self-evaluations that document and improve instructional practice. It includes artifacts such as lesson plans, student work, and reflective narratives, highlighting both teaching effectiveness and areas for growth (Carnegie Mellon University; Seldin, 2010). Beyond mere documentation, portfolios are seen as tools for professional development and for showcasing one's teaching philosophy (University of Texas at Austin; Vanderbilt University). Synthesizing these definitions operational to this study, a contextualized teaching portfolio is a collection of instructional units, assessment items, learner artifacts, and reflective teacher notes that are adapted to the cultural, social, and economic realities of a learner group.

There have been studies conducted that investigated the effects of contextualized learning in mathematics instruction. As determined by Buan, Ali, and Gomez (2021), the effectiveness of contextualized lessons in Mathematics have continually been proven to have increased student engagement, comprehension, and performance, with evidence that contextualized lesson materials allowed the students to link mathematical content to familiar, real-life experiences. Severally, such localized and culturally relevant lessons augmented student participation and a better understanding of abstract concepts. Jackaria, Buan, and Yuenyong (2019) agreed that students who were exposed to context-based instruction outperformed their peers in problem-solving tasks, where teachers did not only facilitate content mastery but also strengthened the students' reasoning and application skills essential to real-world problem solving.

Similarly, Saga and Buan (2024) showed that embedding agricultural contexts into probability lessons heightened student interest and improved retention, even among learners in rural and indigenous communities. Although several studies reported about the effectiveness of contextualized instruction in Mathematics, there remained a gap in addressing the specific needs of Indigenous learners, like the Higaonons. According to Doolittle and Glanfield (2007), mainstream pedagogical strategies may not sufficiently address the culturally embedded ways of knowing and learning within Indigenous communities.

Also, the study findings of Salandanan (2019) emphasized that traditional instruction often failed to connect with Indigenous learners' lived experiences, resulting in disengagement and underperformance, same study findings were found in what De De Guzman et.al. (2021) reported about the low-performing learners who experienced academic struggles, even in the subject mathematics, who were the Indigenous Peoples IPs in the Philippines, with the lowest literacy rates.

Undeniably, the conducted research and literature show that no similar conclusions were made on using contextualized mathematics instruction approach. With this, Mathematics teachers express their concerns on contextualizing the learning resource materials in K-12 Basic Education Curriculum. To provide answers to this issue, this research study was conducted to present the process of developing contextualized lessons

and determine student's academic performance and perception in the implementation of Grade 7 Mathematics lessons.

With the focus on the development of a contextualized teaching portfolio for Higaonon learners in teaching Graph Interpretation, this study aims to achieve the following objectives:

1) Develop contextualized teaching portfolio in interpreting graphs.

2) Investigate the performance of the learners in interpreting graphs.

3) Determine students' perceptions of contextualized teaching portfolio on interpreting graphs.

2. Methodology

2.1 Research Design

This study adopted descriptive research design. Its primary objective was to develop and refine a contextualized teaching portfolio aimed at enhancing graph interpretation skills among Grade 8 Higaonon learners. Descriptive statistics—particularly the mean—were used to interpret expert ratings and learners' performance.

2.2 Research Setting and Participants

This study was conducted in integrated schools of the division of Gingoog City, which serves learners from diverse backgrounds, including a significant population of Higaonon learners. These schools were purposefully selected as the research site due to its strong representation of the target Indigenous group for whom the contextualized materials were developed. The participants of the study were the 22 Grade 8 Higaonon learners, consisting of 14 females and 8 males. There were also teachers involved in the study who validated and observed. All phases of the study were conducted in accordance with ethical research standards, ensuring informed consent, voluntary participation, and confidentiality for all involved.

2.3 Research Instrument

The study employed four main instruments to gather data.

1) Evaluation Rating Sheet. This is adapted from DepEd's LRMDS Assessment & Evaluation Guidelines (2009), this rubric was used by three mathematics educators with doctoral degrees, including one Higaonon teacher to validate the contextualized teaching portfolio.

2) Pretest and posttest. This is one of the components of the contextualized teaching portfolio. This is an assessment of ten (10) contextualized PISA-type items. The pretest was administered before the intervention and a posttest was immediately done whereby the same questions were used.

2.4 Data Gathering Procedure

The first part of the study was the expert validation of the contextualized teaching portfolio. The evaluation rating sheet was used to gather the ratings. The next part was the administration of pretest. It was given to the learners prior to the intervention. 22 students were given an assessment and the test lasted nearly an hour. The teaching materials and learning materials of the contextualized teaching portfolio were implemented for seven (7) days. The final part was the administration of the posttest.

2.5 Data Analysis

Descriptive statistics were used to determine the overall mean rating of the contextualized teaching portfolio based on the evaluations provided by expert validators. Additionally, content analysis was employed to analyze qualitative data gathered from

classroom observations and interview transcripts. This method allowed for the identification of recurring themes, patterns, and categories that emerged from participants' responses. The content analysis approach was adapted from Bengtsson (2016), which involves systematic procedures of decontextualization, recontextualization, categorization, and compilation to ensure rigorous interpretation of qualitative data.

3. Results and Discussion

3.1 Process in the Development of Contextualized Teaching Portfolio

The development of contextualized teaching portfolio in this study followed the SAM or Successive Approximation Model. The SAM method is defined as a method of successive approximations to an appropriate attention model (Mason and Strike, 2003). SAM is a process meant to support the effective design and development of engaging and interactive learning events (Allen & Sites, 2012).

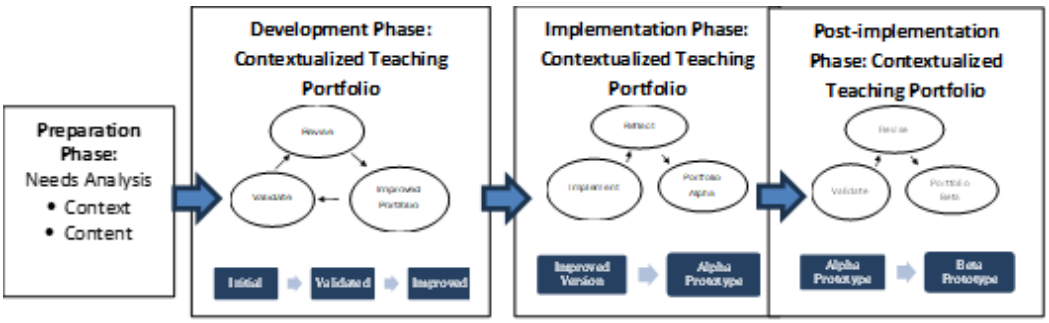


Figure 1. Framework in Developing the Contextualized Teaching Portfolio

Figure 1 shows the framework used in developing the contextualized teaching portfolio following the SAM framework. Development of the contextualized teaching portfolio involves three main phases: Preparation, Development, and Implementation. This design supports the effective design and development of engaging and interactive learning.

3.1.1 Preparation Phase

In the Preparation Phase, a needs analysis was conducted across four Higaonon community schools. This involved interviews with both mathematics teachers and Higaonon learners to gather insights into their experiences, challenges, and needs related to mathematics instruction. The following quotes are the responses from the interviewees:

> "Kanang basic na topic oh, like magbasa ug bar graph! Kabantay mo Ma'am? Pabasaha gani nag mga graphs sila dyun ipa determine dyun sila! Mag struggle.." (T1)
> (Translation: Basic topic like interpreting bar graph is difficult for my learners! Have you noticed that? Let them read and interpret graphs! They struggle..)

> "Mao jud! Ag ka lisodan sila kanang mag hatag ka multi-step solving sa graphs: pangitaa ni, dyun eh solve na!... Maglisod oi… naa na gani siguro na sa elementary, they need to interpret graphs, peru they struggle jud" (T3)
> (Translation: That's true! They struggle when they are given multi-step solving problem in graphs such as 'find this and then solve that'…It is a struggle… Interpreting graphs might one of the competencies in elementary but still they struggle.")

> "Usually let them read the books. Pabasahon sila dayun ipa summarize by asking them to write the definition and differentiate the graphs. … Oo, para naa sila background daan ba… unsa diay nang book sa school? Gamiton nato na oi.." (T3)
> (Translation: Usually let the learners read the book… After reading, let the learners summarize by asking them to write the definition and differentiate the graphs…for the learners to have fundamental knowledge first and to make use the resources at school.)

> "For me, I think they are not familiar jud… Maybe because we don't use it also in teaching? For me lang ha." (T2)
> (Translation: For me, the learners are not familiar with real-life situations involving graphs or data... Maybe because we don't use it also in teaching? That's my own perception.)

In the interview with five teachers, T1 affirmed that learners struggled with graph interpretation, a concern similarly raised by T2, T3, and T4. T3 further emphasized that learners found multi-step graph problems particularly challenging. Additionally, T4 and T5 supported T2's observation that learners had limited exposure to real-life contexts that were meaningful and familiar to them. T3 also noted that the predominance of textbook-driven instruction, with minimal experience-based integration, hindered learners' ability to relate mathematical concepts to their everyday experiences. Therefore, it can be inferred that the lack of contextualized, real-life applications significantly contributed to the learners' difficulties in graph interpretation. These findings highlight the importance of adopting more relevant, experience-based teaching strategies to bridge the gap between abstract mathematical concepts and learners' daily lives.

Meanwhile, in the interview with 12 learners, L5's response reflects the sentiments also expressed by L1, L2, L6, L8, and L9, indicating that many learners' experience anxiety and confusion when confronted with unfamiliar mathematical lessons, particularly those involving the interpretation of trends and the prediction of outcomes, as specifically noted by L4. Additionally, L11's perception, supported by the responses of L1 and L9, suggests that mathematics—particularly graph interpretation—is perceived as irrelevant to the Higaonon community. This perceived disconnect between the curriculum and the learners' real-life experiences has contributed to the belief that mathematics holds little practical value in their daily lives.

> "Ag kahadlok ko Ma'am kay!.. Ambot ngano lisoran kos Math?" (L5)
> (Translation: I am afraid Ma'am…I don't know why Math is difficult for me.)

> "…tanan man topic Ma'am, basta Math… (Follow-up question 3) Oo, maglisod Ma'am. Kanang mag kuan (predict) ka kun usay mahitabo sa sunod? Dili man ko kabalo." (L4)
> (Translation: …I find all the topic in math difficult, when its Math… Yes, I find predicting trends difficult. I don't know how.)

> "Dili ko ganahan sa math Ma'am kay kalibog ko…dili man japon namo magamit na ang graphs Ma'am kay Higaonon man mi" (L11)
> (Translation: I don't like Math because I am confused with it… Anyway, it is not useful to us Higaonon.)

3.1.2 Development Phase

Following the identification of key learning gaps in the Preparation Phase, the researcher aligned the study with the MATATAG K to 10 Curriculum under the K to 12 Program. The topic of graph interpretation was introduced in the 4th quarter of Mathematics 8, making it the focal point for the development of instructional materials.

Table 1: Learning Outcomes on Interpreting Graphs

Identified Competency	**Learning Outcome** The learners will be able to…	**Indicators of Contextualization**
Investigate, interpret, and analyze graphs (pie graph, line graph, bar graph).	Interpret a pie graph to determine the amount allocated to each fund in a given budget plan.	Used a common context of learner who gets weekly allowance.
	Solve multi-step problems involving budget pie graph.	Based on specific needs of the learners.
	Identify the pie graph that illustrates the distribution of the 4Ps allowance.	Incorporated 4Ps as a real-life context of learners' allowance.
	Investigate the bar graph of colored candies to identify valid statements.	Used familiar practices at home or school such as receiving a reward candies.
	Find the average business profit within a given period.	Involved monthly earnings from small-scale businesses like farming.
	Justify a gain or loss in business profit within a given period.	Applied local income trends, showing profit or loss from harvest.

In this phase, the contextualized teaching portfolio was systematically developed based on the identified competencies and the specific learning needs of the Higaonon learners. The development process followed an iterative cycle, progressing from the initial draft to the validated version, and ultimately to the improved version which was used in the implementation phase. The portfolio comprised three key components: Contextualized Assessment, Teaching Materials, and Learning Materials, all carefully aligned to ensure relevance and responsiveness to the learners' real-life experiences.

3.1.3 Assessment

The initial version of the assessment underwent expert validation. After the validation, suggested reversion was provided, which the researcher considered in the refinement of the contextualized teaching portfolio. Key adjustments included the replacement of the term "budget scheme" with "budget plan" to ensure familiarity of terms. Additionally, informal local terms were replaced with formal Higaonon vocabulary, as advised by the Higaonon validator. Visual materials, such as the pie graph, were reconstructed to reflect these updated terms. Further improvements involved formatting revisions to improve readability, such as consolidating answer options onto a single page, and refining the phrasing of instructions. These revisions leaded to the development of the validated version of the contextualized teaching portfolio.

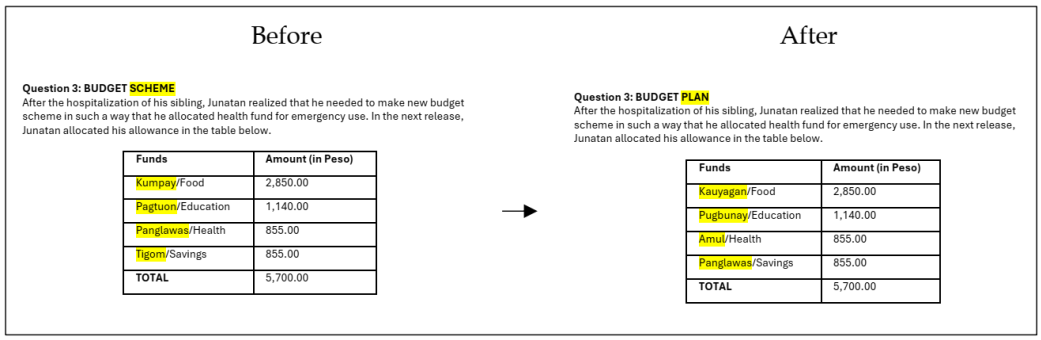


Figure 2 Sample Revision of Assessment Based on Validation

Figure 2 shows the revision of informal Higaonon terms to formal terms done. According to E3, "In the Assessment, revise the following terms: *Kumpay to Kauyagan, Pagtuon to Pugbunay, Tigom to Amul, and Panglawas to Puglawa"* and "I suggest, instead of Budget Scheme, use Budget Plan for more relevant." The title was also changed from budget scheme to budget plan for more relevance.

The validated version of the assessment was subsequently subjected to pilot testing. After the pilot, several items were retained without modification, while others were refined based on feedback from observers and the perceptions of the learners. Completing a table was included to support learners in accurately completing the tasks. To enhance the focus of the assessment, tasks that initially required learners to draw bar graph were modified to determine graph representing the data set. Additionally, supplementary questions of average (mean) and interpretation reasoning were incorporated to ensure the assessment effectively targeted the intended competencies. The refinement led to the development of the improved version.

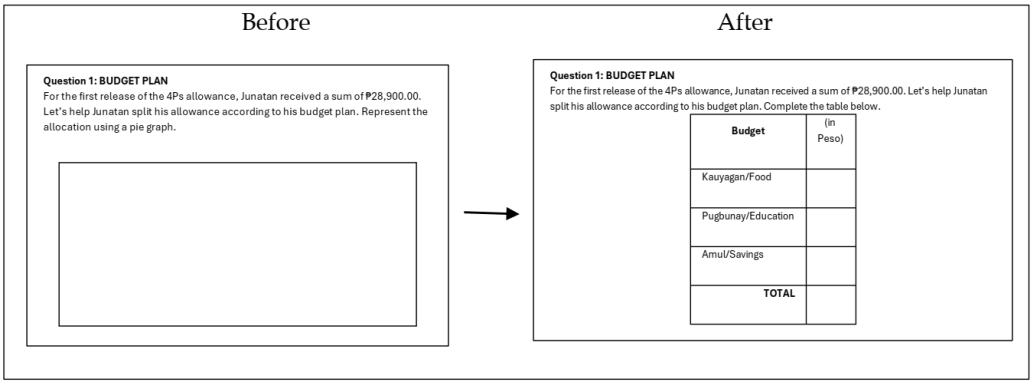


Figure 3. Sample Revision of Assessment based on Pilot Testing Result

As shown in Figure 4, Assessment particularly the Budget Plan - question 1 was enhanced from constructed-response type to complete-the-table item. Similarly, Colored Candies - question 1 were adjusted from constructed-response type to multiple-choice. Figure 4 addresses the comment of L3 *"kulang ko time so pug ansir ko test (L3)"* (Translation: Time in answering the PISA-type items was not enough). Through interview, the comment referred to Budget Plan – question 1 and Colored Candies - question 1.

The improved version of the assessment was used in the implementation phase. After the implementation, minor revisions were made based on the learners' perception. The amounts were adjusted to ensure they were contextually appropriate and manageable for learner computation. Situational details were also revised to better align with real-life

contexts and to ensure the problems were solvable based on the recalculated budget plan. The output of the refinement led to the development of the alpha prototype.

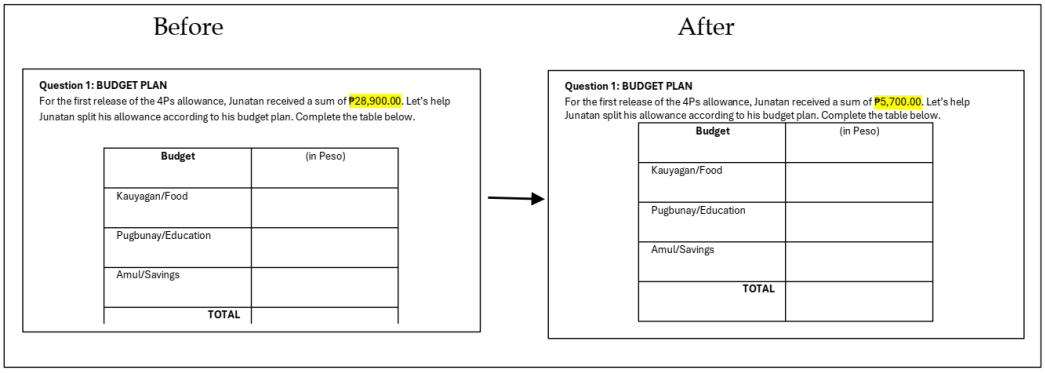


Figure 4. Sample Revision of Assessment based on Implementation Result

Figure 4 presents the revision made to the Budget Plan – Question 1, where the original amount of ₱28,900.00 was reduced to ₱5,700.00. This modification was informed by the follow-up interviews conducted with learners after the administration of the posttest. Representative learner feedback included statements such as, *"Dako kayo ang amount sa 4Ps, Ma'am"* (Translation: "The 4Ps amount is large, Ma'am"), *"Sayun raman Ma'am, pero dugay lang ko nahuman suma kay dako kayo amount"* (Translation: "It was easy, Ma'am, but I took a long time to finish solving because the amount was large"), and *"Nadugay ko suma sa percentage Ma'am kay dako ang number"* (Translation: "I was delayed in solving the percentage because the numbers were big, Ma'am"). Based on these learner insights, the amount was revised to align with the average 4Ps allowance received by the learners – appropriate to the learners' contextual and improve computational efficiency.

The alpha prototype of the assessment underwent further refinement after submitting the contextualized teaching portfolio to the EPS in mathematics. The contextual scenarios were shortened and made more direct to improve readability and ensure learners remained focused on the core tasks. The medical emergency problem was streamlined while preserving its computational objective, allowing learners to concentrate on essential reasoning skills. Additional items were incorporated to assess graph interpretation, particularly in determining accurate statements based on bar graphs, ensuring the comprehensive evaluation of the intended competencies. Continuous numbering was implemented for consistency across the assessment. Selected items were retained without modification, as they effectively met the assessment goals in their original form.

The beta prototype of assessment in this study consists of PISA-type items based on three real-life contexts—Budget Plan, Colored Candies, and Business Profit: 3 to 4 items each. In developing the contextualized PISA-type items, alignment of context with learners' real-life experiences was assured. The budget plan item, based on the *Pantawid Pamilyang Pilipino Program* or the so-called 4Ps, which is the source of learners' allowance, then used to teach pie graphs. The colored candies question was adapted from a sample item in the PISA, contextualized to reflect the Higaonon learners' experiences of getting reward as they helped their parents during the harvesting of tiger grass, sweet potatoes, and upland rice. The business profit item reflected learners' exposure to small-scale community businesses and was used to teach line graphs.

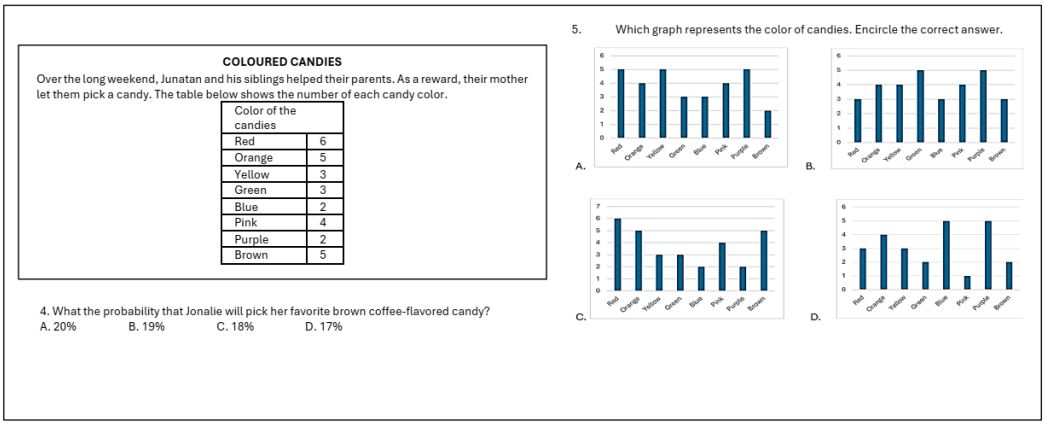


Figure 5. Sample Items of the Assessment

The initial version of the teaching material underwent expert validation. Based on the comments, refinements were made. One of the key adjustments involved defining time allocations for each activity, and refining guidelines for the presentation of visuals based on available facilities in the school. Instructional scaffolding was further strengthened by initially utilizing tabular data to simplify tasks and progressively develop learners' data interpretation skills. Additionally, interactive springboard activities such as "A True Statement" were integrated to activate prior knowledge. It was emphasized that the option to present outputs in vernacular was allowed. Finally, the inclusion of meaningful, real-life activities such as *Line Graph of My Experience* designed to provide opportunities for learners to apply graph construction and interpretation to their personal contexts. The output in this revision was the validated version of the contextualized teaching portfolio.

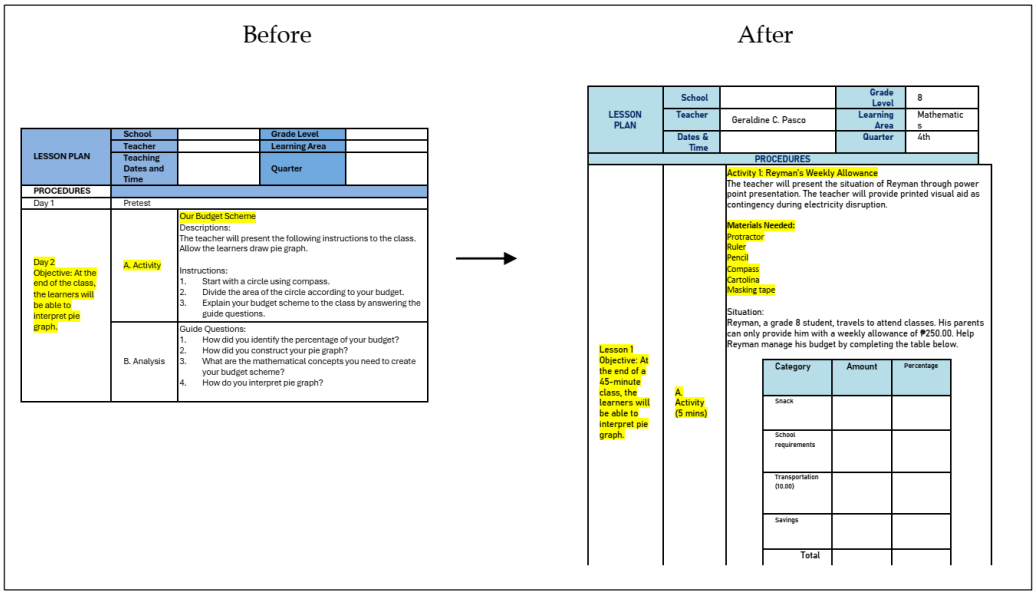


Figure 6. Sample Revision of teaching material based on Validation

This revision from generic to contextualized familiar name was made in direct response to the evaluator's recommendation to enhance learner connection by incorporating a character or name that is familiar and relevant within the learners' community, "…maybe make it more personal to the learners, use a character known in the community or a name of a well-known student…"

The validated version was used in pilot testing. After it was tried out, the refinement of the contextualized teaching portfolio involved several significant enhancements. Key revisions included the extension of lessons on pie graph, bar graph, and line graph interpretation from single day to two-day sessions, providing learners with sufficient time for mastery of the targeted competencies. Instructions for graph construction were systematically scaffolded to offer clearer, step-by-step guidance that supported learners in building accurate graphing skills. To further promote active learning and application, additional collaborative and practical activities such as student-led data collection were incorporated. The portfolio was also aligned with grade-level standards, ensuring that probability concepts were introduced appropriately, with simple event probability taught in Grade 8 and compound event probability reserved for Grade 10, in accordance with the curriculum. After the refinement of the validated version, the improved version was developed which was used during the implementation.

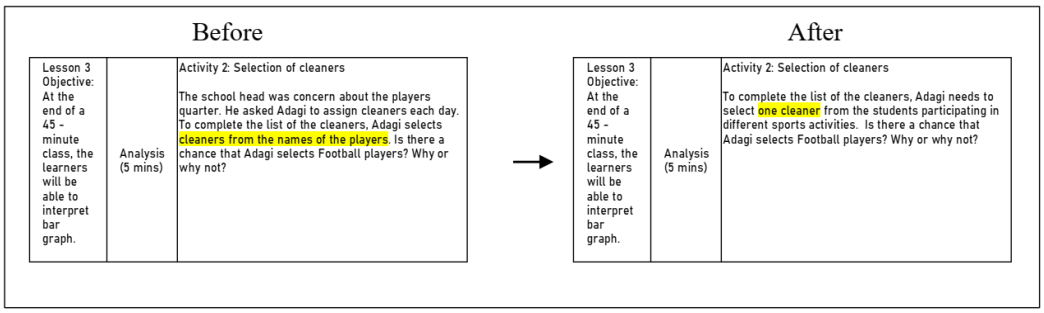


Figure 7. Sample Revision of Teaching Materials based on Pilot Testing Result

Figure 7 shows revision that addresses the suggestion of the observer, *"The target learners of this portfolio are grade 8. Maybe, simple event probability can be taught in this level. Because compound event probability is one of the competencies in grade 10… I suggest, in lesson 3-activity 2, emphasize that Adagi needs to select ONE cleaner only."* The statement "To complete the list of the cleaners, Adagi selects cleaners from the names of the players. Adagi selects cleaners from the names of the players" may cause confusion. Thus, it was restated to "To complete the list of the cleaners, Adagi needs to select ONE cleaner from the names of the players"

After the implementation, the researcher reflected on the implementation of the improved version of contextualized teaching portfolio. The teaching portfolio underwent further refinement. Key adjustments included emphasizing the need to provide individual copies of activity sheets to ensure active participation, support independent learning, and promote equitable access to resources. Lesson 5 – Absence Quantity was strengthened by adding a step requiring students to present collected data using a line graph, reinforcing their skills in data visualization. Additionally, the guide questions in Lesson 5 were refined to place greater emphasis on practical data interpretation and application. The revision made in the improved version led to the development of the alpha prototype of the contextualized teaching portfolio.

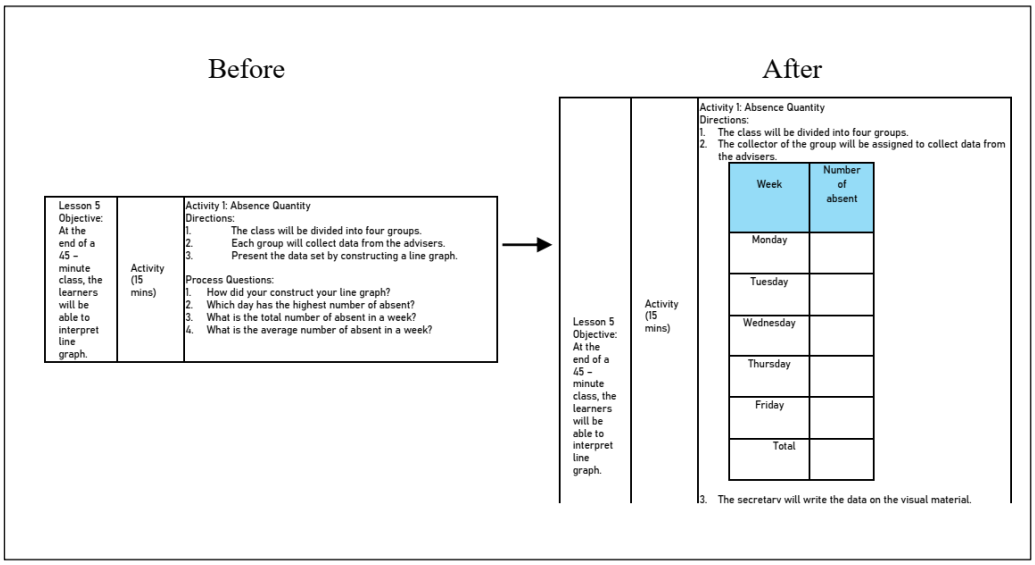
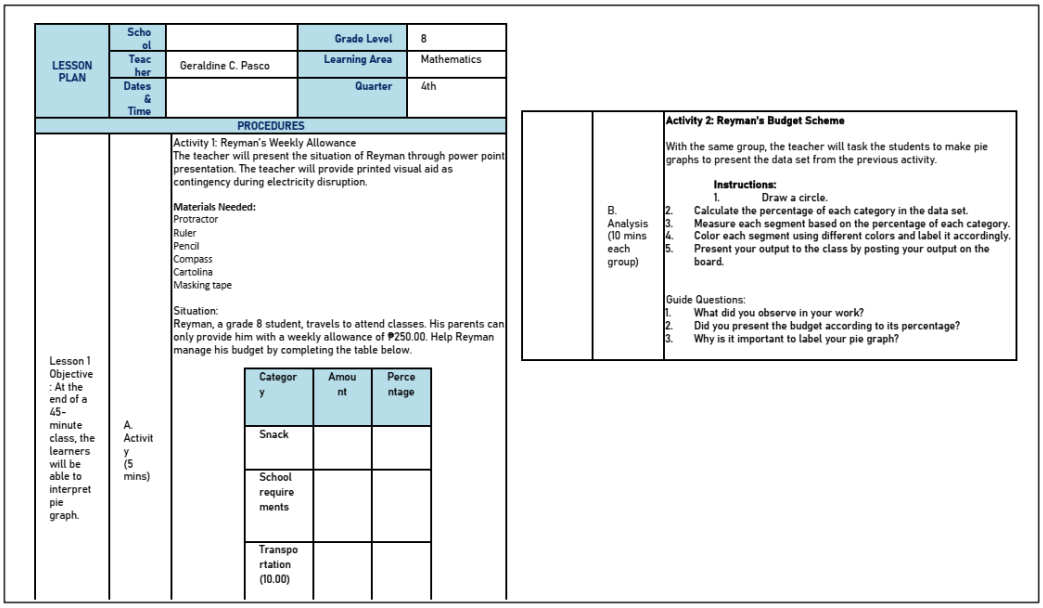


Figure 8. Sample Revision of Teaching Materials based on Implementation Result

The revision in Figure 8 emerged from the adjustments implemented by the researcher during the classroom delivery of the lesson. These modifications were found essential to strengthen learners' data visualization skills and to address instructional needs observed in real-time.

The alpha portfolio was further improved by enhancing the clarity and accuracy of visual representations, particularly in the presentation of bar and line graphs. The required instructional materials, such as a large-scale protractor and meter stick, were explicitly identified to support effective lesson delivery. Additionally, the roles and responsibilities of each group member during collaborative activities were clearly defined to promote accountability, structure, and effective teamwork throughout the learning process.

The teaching materials included a 6-day period: Days 1 to 2 covered pie graphs, Days 3 to 4 bar graphs, and Days 5 to 6 line graphs, through the use of familiar and meaningful contexts, in teaching graph interpretation. For pie graphs, weekly allowance budgeting was chosen, reflecting the common experience of learners who live away from their families and receive allowances on weekends. For bar graphs, the school intramurals, or a regular event during the 3rd quarter had served as a relatable context. The line graph lesson was anchored on student absences relevant to classroom issues. Additionally, recent LGU assistance to the Higaonon communities, for instance, cash aid and medical services were provided as authentic context, as the learners were often more informed than their parents. Thus, these real-life situations had enhanced instructional relevance and learner engagement.



LESSON PLAN	School		Grade Level	8
	Teacher	Geraldine C. Pasco	Learning Area	Mathematics
	Dates & Time		Quarter	4th

PROCEDURES

Lesson 1 Objective : At the end of a 45-minute class, the learners will be able to interpret pie graph.	A. Activity (5 mins)	Activity 1: Reyman's Weekly Allowance The teacher will present the situation of Reyman through power point presentation. The teacher will provide printed visual aid as contingency during electricity disruption. **Materials Needed:** Protractor Ruler Pencil Compass Cartolina Masking tape Situation: Reyman, a grade 8 student, travels to attend classes. His parents can only provide him with a weekly allowance of ₱250.00. Help Reyman manage his budget by completing the table below.		
	B. Analysis (10 mins each group)	**Activity 2: Reyman's Budget Scheme** With the same group, the teacher will task the students to make pie graphs to present the data set from the previous activity. **Instructions:** 1. Draw a circle. 2. Calculate the percentage of each category in the data set. 3. Measure each segment based on the percentage of each category. 4. Color each segment using different colors and label it accordingly. 5. Present your output to the class by posting your output on the board. Guide Questions: 1. What did you observe in your work? 2. Did you present the budget according to its percentage? 3. Why is it important to label your pie graph?		

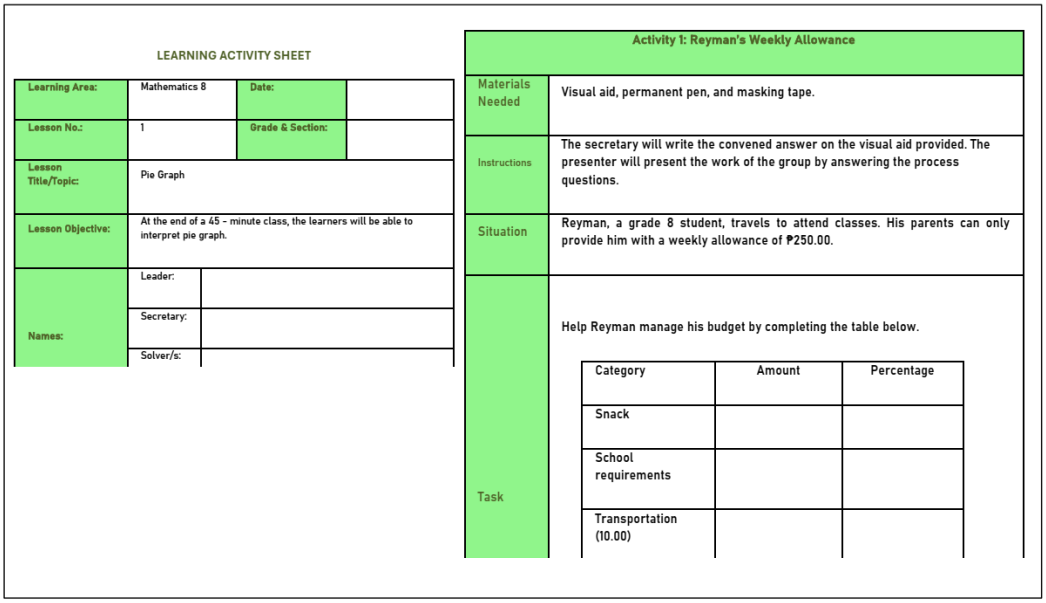
Category	Amount	Percentage
Snack		
School requirements		
Transportation (10.00)		

Figure 9. Sample Teaching Material

Figure 9 shows the teaching of pie graphs, with the utilization of the context of budgeting weekly allowances, a familiar situation for learners who received money from their guardians during weekend, while visiting the neighboring mountains, a scenario full of meaningful learning context.

3.1.4 Learning materials

The learning materials developed for this portfolio primarily consisted of activity sheets carefully designed to align with the improvements made in the teaching materials. As the contextualized teaching portfolio underwent a series of revisions—based on validation, pilot testing, classroom implementation, and expert feedback—the corresponding learning materials were likewise updated to ensure consistency, coherence, and instructional alignment. For every day of instruction, three focused activities were provided. In total, eighteen (18) activity sheets were developed across the learning sessions. These activity sheets were aligned with the contextualized examples and scenarios introduced in the teaching materials.



LEARNING ACTIVITY SHEET

Learning Area:	Mathematics 8	Date:	
Lesson No.:	1	Grade & Section:	
Lesson Title/Topic:	Pie Graph		
Lesson Objective:	At the end of a 45 - minute class, the learners will be able to interpret pie graph.		
Names:	Leader:		
	Secretary:		
	Solver/s:		

Activity 1: Reyman's Weekly Allowance

Materials Needed	Visual aid, permanent pen, and masking tape.
Instructions	The secretary will write the convened answer on the visual aid provided. The presenter will present the work of the group by answering the process questions.
Situation	Reyman, a grade 8 student, travels to attend classes. His parents can only provide him with a weekly allowance of ₱250.00.
Task	Help Reyman manage his budget by completing the table below.

Category	Amount	Percentage
Snack		
School requirements		
Transportation (10.00)		

Figure 10. Sample Learning Material

Table 2: Summary of Rating for Print Resources

FACTORS	TOTAL POINTS			Mean	Remarks
	Evaluator 1	Evaluator 2	Evaluator 3		
1. Content	27	27	28	27	Passed
2. Format	72	70	72	71	Passed
3. Presentation and Organization	20	20	20	20	Passed
4. Accuracy and Up-to-datedness of Information	24	24	24	24	Passed

Table 2 shows the summary of rating for the contextualized teaching portfolio. The mean score of 27 in the content criterion substantially exceeded the minimum required score of 21 points according to the evaluation guidelines. For the format criterion, the portfolio achieved a mean score of 71 points, surpassing the minimum passing score of 54 out of 72. In terms of presentation and organization, the portfolio received a perfect score of 20, which was well above the required 15 points. Furthermore, the portfolio attained the required perfect score of 24 points in the accuracy and up-to-datedness of information criterion. The expert validation concluded that the contextualized teaching portfolio "Passed" all criteria, indicating that it was instructionally sound, well-organized, and contextually appropriate for Grade 8 Higaonon learners. It was implied that the portfolio was ready for implementation, though the evaluators provided constructive feedback.

3.1.5 Implementation Phase

The improved version of the contextualized teaching portfolio was utilized during the implementation phase. This implementation took place at a school located within the Higaonon community, during the fourth quarter. The intervention involved only 1 section of Grade 8, composed of 22 Higaonon learners, where 14 were females, while the remaining 8 were males, who participated in both the pretest and posttest. The implementation spanned 9 days, with the researcher serving as the implementer of the contextualized teaching portfolio.

Following the implementation phase, the alpha prototype of the contextualized teaching portfolio underwent a final round of validation. Insights gained from the pilot, full implementation, and the validation of the education specialist in Mathematics informed the development of a refined and enhanced beta prototype of the contextualized teaching portfolio.

3.2 Investigation of Performance

To address the second research objective, the study investigated the performance of Higaonon learners before and after the implementation of the contextualized teaching portfolio. This study noted the improvements of the learners' output in the assessment and analyzed the significant difference between the pretest and the posttest score.

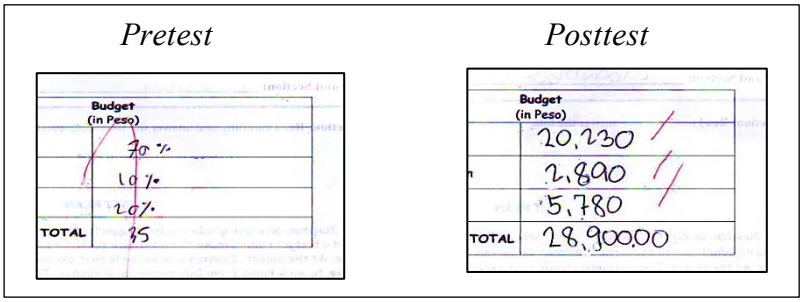


Figure 11. Comparison Between Pretest Output and Posttest Output (1)

Figure 11 shows the comparison between the pretest and posttest output. Initially, in the pretest, the learner provided incorrectly computed percentage reflecting gaps in accuracy. In the posttest, however, learners demonstrated enhanced competence by correctly and accurately computing the corresponding budget amounts in pesos.

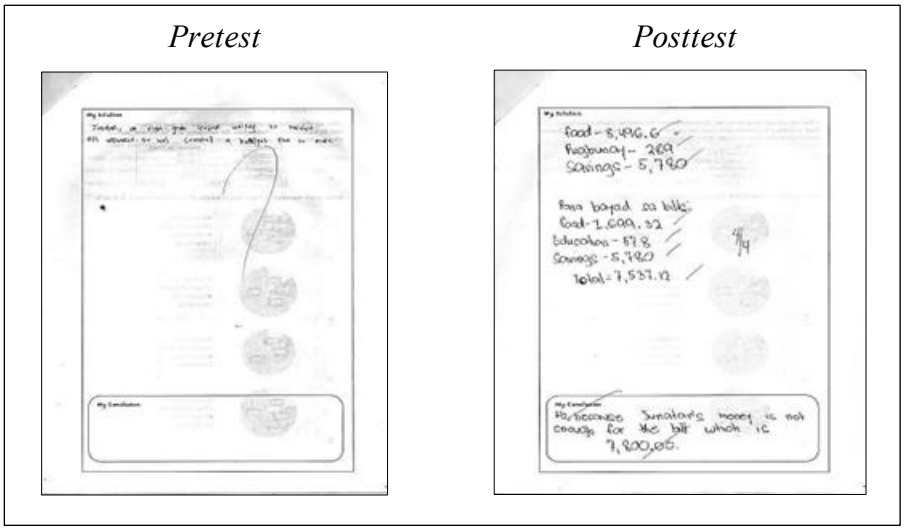


Figure 12. Comparison Between Pretest Output and Posttest Output (2)

Based on the comparison of the pretest and posttest output in figure 12, there is a noticeable improvement in computational skill and the ability to draw logical conclusions. In the pretest, the learner's response shows minimal attempt to solve the problem, lacks detailed computation, and final answer is missing. In contrast, the posttest output indicated

that the learner is able to compute allocations, break down expenses, and present the data with labeling.

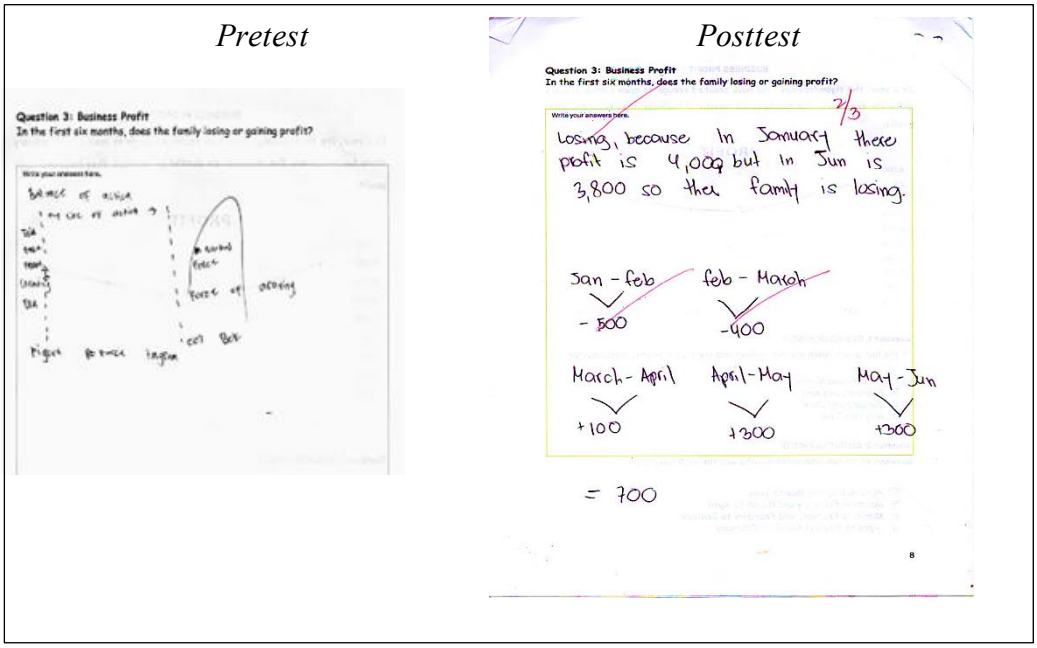


Figure 13. Comparison Between Pretest Output and Posttest Output (2)

The comparison between the pretest and posttest responses in figure 13 reveals significant improvement in interpreting graphs. In the pretest, the student responded with irrelevant concepts. In contrast, the posttest demonstrates a marked improvement in interpreting graphs. The student correctly interpreted the nature of the problem, broke down monthly profit or loss calculations, and demonstrated the ability to perform multi-step arithmetic reasoning. Specifically, the student computed the net change in profit over a six-month period and attempted to derive a conclusion from the accumulated values.

The collective analysis of Figures 12, 13, and 14 reveals substantial improvement in the learner's competence, particularly in graph interpretation. Initially, the pretest responses reflect significant gaps, including incorrect percentage calculations, minimal attempts at solving problems, lack of detailed computation, and irrelevant responses to graph-related tasks. These indicate limited skills of interpreting graphs. However, the posttest outputs demonstrate clear progress in interpreting graphical data. Overall, the improvement from pretest to posttest suggests improvement in the learner's competence in interpreting graphs.

Table 3: Comparison of Pretest and Posttest Scores

Measure	Mean	SD	t(21)	p-value
Pretest Score	2.27	1.27		
Posttest Score	9.00	2.82	13.76	<.001**

It could be implied that a significant improvement in the performance in pretests (M = 2.27, SD = 1.27) compared to posttests (M = 0.00, SD = 2.82), $t(21) = 13.76$, $p < .001$ was evident. The increase in mean scores indicated that the learners made substantial progress.

This statistically significant result confirmed that the observed improvement was not due to chance, but rather a result of the contextualized teaching materials grounded in real-life experiences.

These findings were consistent with previous research findings of Buan, Ali, and Gomez (2021) that reported about contextualized Mathematics lessons having significantly improved learners' engagement and comprehension, while Jackaria, Buan, and Yuenyong (2019) demonstrated that the students performed better in Mathematics classrooms when lessons were based on real-life contexts.

Similarly, such findings could be referred to what Monteiro and Ainley (2004) underscored about the importance of interpreting graphs through real-life contexts rather than focusing solely on technical skills, which findings also affirmed what the Frontiers in Education highlighted about the educational value of situational data in fostering deeper and more meaningful data analysis (Gardner et al., 2022), confirming that engaging learners with real-world, "messy" data and incorporating collaborative activities were able to enhance the learners' ability to interpret graphs even more effectively.

3.3 Respondents' Perceptions on Contextualized Teaching Portfolio

As this study had specific focus on determining the learners' perceptions of the contextualized teaching portfolio, the learners' perceptions were gathered through open-ended responses, resulting to 3 perceptions:

Perception 1. Relevant to real life experiences

In this study, most of the responses highlighted how the lesson content was closely related to the learners' real-life experiences. The following quotes are the selected responses of the learners:

> *"Nakasabut ko, kay tanan ang ipanhatag ni Ma'am nga situation is about sa among life." (L9)*
> (Translation: "I understand the lesson because the given situations are about life experience.)

> *"Oo ...kay naka relate ko kay (parehas ni) si Reyman nga walay kwarta nay 4Ps. Dali ra mahurot ang kwarta kay mahal na tanan…nahitabo jud sa among life ang problem ni maam." (L7)*
> (Translation: Yes… because I can relate to Reyman (character in the activity) who don't have money, but he got 4Ps. Money is quickly spend because all the goods are expensive…the situations in the problems were really our experience.)

> *"ye…kana nga mga situation is nakahatag sa ako og pagkahibaw…ganahan sad ko kay nakasabot nako inohon ang pag graph.." (L4)*
> (Translation: "Yes…the given situations in our activity gave me understanding in constructing graphs and interpreting graphs.)

The perception expressed by L9, who emphasized that "the situations are about life experiences," resonates with the responses of Learners 5, 6, 7, and 15, indicating that the contextualized teaching portfolio were connected to the real-life experiences of the Higaonon learners. Similarly, L7 consistent with the perception of L6 and L18 remarks that "they can relate to the situations used in the lesson" Furthermore, the perception of L4 is aligned with the responses of L10, L12, L15, and L22, all of which expressed positive emotional responses toward the learning activities.

Perception 2. Enhance Learning Through Graph Activities

The responses from the perception questionnaire mostly stated better comprehension of graphs.

> *"...daghan jud mi na learn kay ma'am sa iyang activities og enjoy mi sa activities." (L1)*
> (Translation: I have learned a lot from the activities of the teacher, and I enjoyed the activities.)

> *L17: "Makasabot jud kay kami jud ang mabuhat sa among activity, mag survey mi, mag interview mi ug naka report mi. Kami ray mag explain. Daghan kayo challenges nga maka lingaw og maka paningkamot ka." (L17)*
> *(Translation: "I really understand the lesson because we are the one who do the activity. We are the ones who survey, interview, report, and explain. There are many challenges that were enjoyable and motivating."*

The perception of L1 indicated that the activities included in the portfolio enhanced learning and provided enjoyable experiences, which is consistent with the perceptions of L4, L6, L9, L12, L17, and L18. Similarly, the perception of L17 aligned with the responses of L6, L9, L11, L15, and L7, who emphasized that they gained greater enjoyment and understanding when engaged in hands-on activities.

Perception 3. Preference for Contextualized Instruction

The responses showed preference for contextualization of lessons in Mathematics.

> *"Hoo Ma'am, kay panday sa pakasabut daw kalingawki tag paliman, imako hain so baya I leksiyon hi ma'am day ko math kay ugkalingaw kay tain a topic hadi kaylang agkalingaw kundi adpakasabut a tungkay" (L9)*
> (Translation: "Yes, I will recommend this method because it help us enjoy and understand the lesson.)

> *" Yes, kay chada ug nalingaw pod mi. kun inanhi ang paagi ni Ma'am Abie, maka tabang jud sa amo." (L12)*
> *(Translation: "Yes, because the activities are very nice, and we are very enjoy. If Ma'am Abie follows this method, it could really help us understand our lessons in mathematics."*

The responses of L9 and L12 to the question, *"Will you recommend your teacher to use this method of teaching in mathematics lessons?"* both expressed strong support for the continued use of the contextualized teaching approach. These responses were consistent with those of L1, L6, L7, and L15, indicating a recurring positive perception among the learners.

Overall, the content analysis indicated that the contextualized teaching portfolio was relevant to the real-life experiences of the Higaonon learners, enhanced their understanding of graph interpretation, recommended as more engaging and more fun.

4. Conclusion and Recommendation

The portfolio was developed following the SAM Successive Approximation Model, a framework involving 3 phases: Preparation, Development, and Implementation. The preparation phase highlighted learners' struggles with graph interpretation, particularly in identifying patterns, making predictions, and connecting data to real-life experiences. The development phase produced a contextualized teaching portfolio with assessment,

teaching materials, and learning resources. After validation by experts, key revisions were implemented to improve clarity, cultural appropriateness, and assessment methods. During implementation, the improved prototype was piloted in a Grade 8 class, composed of Higaonon learners, in the indigenous community.

The results of the study revealed a significant improvement in the learners' performance following the implementation of the contextualized teaching portfolio, evidenced by the mean score that increased notably from the pretest ($M = 2.27$, $SD = 1.20$) to the posttest ($M = 9.00$, $SD = 2.69$), with a substantial t-value ($t(21) = 13.76$, $p < .001$), indicating a statistically significant positive impact of the intervention.

Given the foregoing summary of findings, the following conclusions were drawn:

1. The implementation of the contextualized teaching portfolio significantly improved learners' performance in interpreting graph. This statistically significant improvement confirmed that the observed improvement was not due to chance, but rather a result of the contextualized teaching materials grounded in real-life experiences.

2. Learners expressed positive perceptions toward the contextualized teaching portfolio, with notable appreciation for activities that linked Mathematics concepts to real-life situations and hands-on learning experiences.

Given the foregoing conclusions, the following recommendations are presented:

Mathematics educators may integrate contextualized teaching portfolios that were grounded on real-life experiences, integrate them into classroom instruction, particularly when teaching graph interpretation. The significant improvement in learners' performance confirmed the effectiveness of context-based strategies in enhancing mathematical understanding, thus educational planners and curriculum developers may consider adopting and scaling this approach to support learners' engagement and improve achievement in Mathematics, specifically in culturally diverse or marginalized contexts.

School administrators and curriculum designers may continue the integration of contextualized teaching portfolios that would connect mathematical concepts to real-life situations, including the related hands-on activities.

Teachers may be exposed to trainings on how contextualized materials would be developed appropriately, and how to implement these learning materials in the classroom.

Students, such as the Grade 8 Higaonon learners may cite several views about the local materials that they could see in their environment, and suggest to teachers how these materials could be incorporated in their lessons.

Future researchers may conduct a follow-up study about this matter, or delve into other cultural groups where insufficient learning materials would be seen, and find out about the possibilities of contextualizing the classroom lessons, with abstract Mathematical concepts being translated into real-life situations, for a better understanding among the indigenous learners.

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