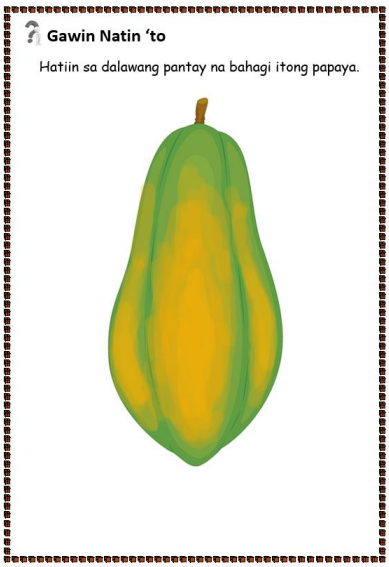
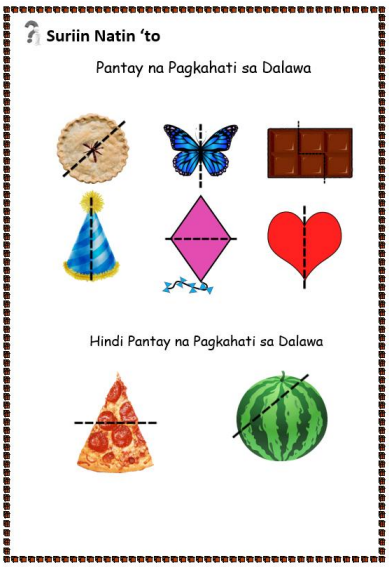
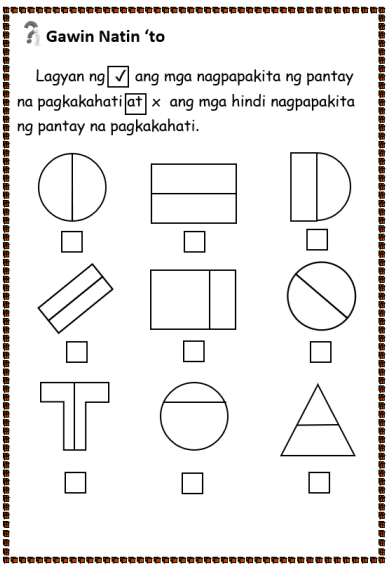
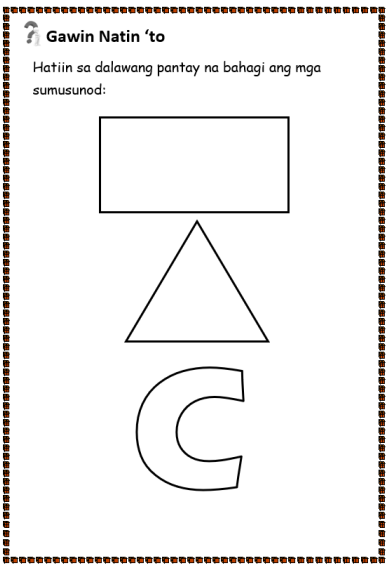
B.8. Samples of packaged technologies/news/information disseminated to the clientele.

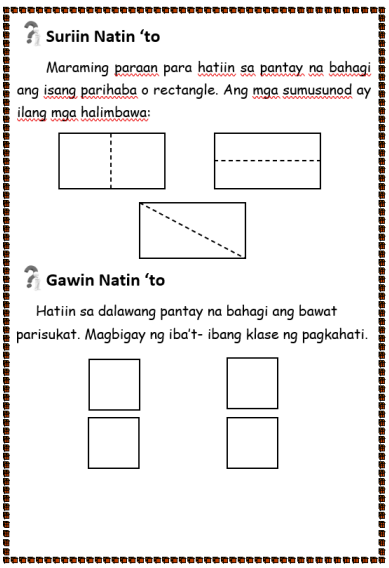
- **Instructional Materials Developed**





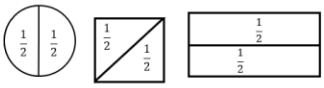






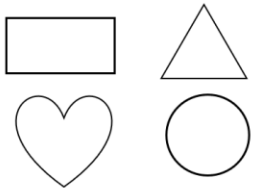
Isang Kalahati o One Half $\left(\frac{1}{2}\right)$

Ang isang piraso ng isang buo na hinati sa dalawang magkapantay na bahagi ay tinatawag na $\frac{1}{2}$ (*one half*).



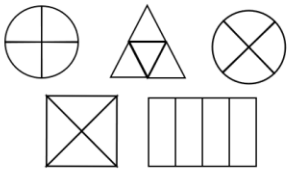
Gawin Natin 'to

Gumuhit ng mga bahaging nagpapakita ng $\frac{1}{2}$.

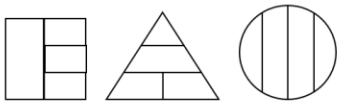


Suriin Natin 'to

Pantay na Pagkakahati sa Apat

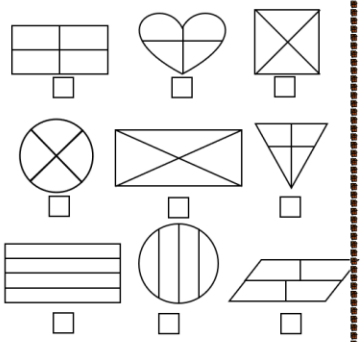


Hindi Pantay na Pagkahati sa Apat



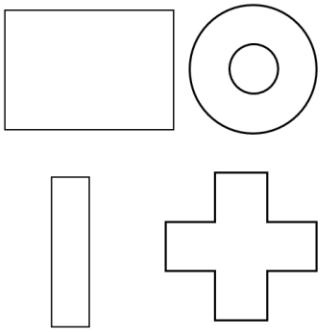
Gawin Natin 'to

Lagyan ng ✓ ang mga magpapakita ng pantay na pagkakahati at × ang mga hindi nagpapakita ng pantay na pagkakahati.



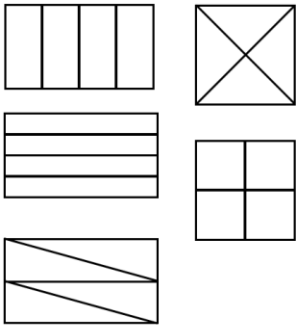
Gawin Natin 'to

Hatiin ang mga sumusunod na hugis sa apat na magkapantay-pantay na bahagi.

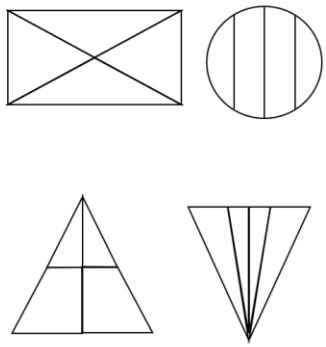


Suriin Natin 'to

May iba't ibang paraan ng paghati sa apat nang magkapantay. Ilan lamang sa mga ito ay:

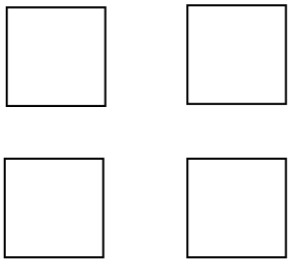


Ang mga sumusunod naman ay halimbawa ng nahati sa apat ngunit sa hindi magkakapantay na paraan at HINDI sila $\frac{1}{4}$.



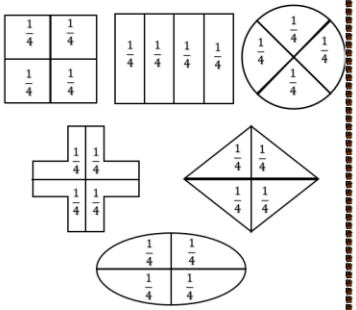
Gawin Natin 'to

Hatiin sa apat na magkapantay-pantay na bahagi ang bawat parisukat. Magbigay ng magkakaibang paraan pagkakahati.



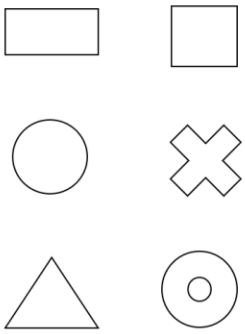
Isang Kapat o One Fourth $\left(\frac{1}{4}\right)$

Ang isang piraso ng isang buong hinati sa apat nang magkakapantay na bahagi ay tinatawag na *isang kapat o one fourth* $\left(\frac{1}{4}\right)$.



Gawin Natin 'to

Gumuhit ng mga bahaging nagpapakita ng $\frac{1}{4}$.

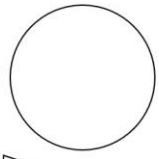


Name:_____
Edad:_____
Birthday:_____
School:_____
Grade Level:_____

Guhitan at itiman ang $\frac{1}{2}$ na bahagi ng mga sumusunod na hugis:

$\frac{1}{2}$

$\frac{1}{2}$



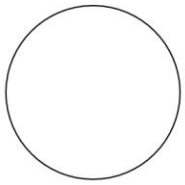
$\frac{1}{2}$

Guhitan at itiman ang $\frac{1}{3}$ na bahagi ng mga sumusunod na hugis:

$\frac{1}{3}$

$\frac{1}{3}$

$\frac{1}{3}$



Bilugan ang mas malaking fraction sa mga sumusunod:

1) $\frac{1}{2}$ $\frac{1}{5}$

2) $\frac{1}{5}$ $\frac{1}{8}$

3) $\frac{4}{9}$ $\frac{8}{9}$

4) $\frac{5}{7}$ $\frac{1}{3}$

5) $\frac{4}{15}$ $\frac{4}{6}$

6) $\frac{5}{6}$ $\frac{8}{19}$

7) $\frac{2}{3}$ $\frac{3}{2}$

Markahan ng ekis (X) kung saan sa number line makikita ang nakasulat na fraction.

1) $\frac{1}{2}$ 0 1

2) $\frac{1}{3}$ 0 1

3) $\frac{1}{8}$ 0 1

4) $\frac{3}{4}$ 0 1

5) $\frac{5}{6}$ 0 1

Markahan ng ekis (X) kung saan sa number line makikita ang nakasulat na fraction.

1) $\frac{1}{2}$ 0 1 2 3

2) $\frac{3}{4}$ 0 1 2 3

3) $\frac{3}{2}$ 0 1 2 3

4) $\frac{8}{3}$ 0 1 2 3

1) Iguhit ang fraction na $\frac{4}{8}$.

Ang fraction na ito ay katumbas ng _____.

2) Iguhit ang fraction na $\frac{5}{3}$.

Ang fraction na ito ay katumbas ng _____.

Sagutan ang mga sumusunod:

1) $\frac{3}{6} + \frac{1}{6} =$

2) $\frac{1}{2} + \frac{1}{4} =$

3) $\frac{2}{3} + \frac{2}{5} =$

4) $\frac{8}{9} - \frac{2}{9} =$

5) $\frac{5}{6} - \frac{1}{3} =$

CREDITS

This module was designed as part of a research project of the University of Southern Mindanao Graduate School, and funded by the USM Research and Development Office.

Authors: Leorence C. Tandog, PhD.
Debbie Marie B. Verzosa, PhD.
Illustrator: Kevin Harvy G. Catayas

UNIVERSITY OF SOUTHERN MINDANAO
GRADUATE SCHOOL
Kabacan, Cotabato

COUNTING BY TABULAR METHOD

Level 1

Activity 1: Stylish Combos

Ana has 3 shirts (red, yellow, white) and 2 jeans (gray, blue). She wants to know the number of ways she can pair her shirts and jeans. Help Ana by completing the table below.

Jeans \ Shirts	Red	Yellow	White
Gray	Gray Jeans, Red Shirt	Gray Jeans, Yellow Shirt	_____
Total Possible Outcomes = 2 choices for jeans x 3 choices for shirts = ___ possible pairings			
Blue	_____	_____	_____

UNIVERSITY OF SOUTHERN MINDANAO
GRADUATE SCHOOL
Kabacan, Cotabato

CONDITIONAL STATEMENTS

LEVEL 1. Introduction to Basic Concepts

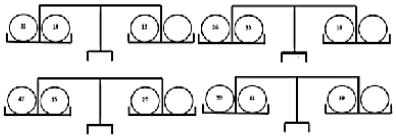
Activity 1: Find my Match!

Instructions:
Draw a line to match each antecedent/hypothesis with its corresponding consequence/conclusion of a conditional statements.

ANTECEDENT / HYPOTHESES	CONSEQUENCES / CONCLUSION	CONDITIONAL STATEMENTS (If/Then Statements)
I will study for my Math final test	I can't withdraw cash.	
The power goes out	I will get a better scores	If I will study for my Math final test, then I will get a better scores.
The ATM is offline	I might wake up late for school	
My android phone battery dies	I will use candles or flashlights	
I forget to set your alarm	I can no longer call and send text messages	

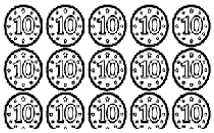
Activity 3: Scale Balancing

Let us balance the scale by adding numbers that make both sides equal.



Activity 4: Building Numbers by Tens

I. Let us observe the coins below and fill the blanks in the following statements.



LESSON 3 MODE

Mode is the most frequent value in a set of data and that value can be a number, word, or category.

Types of Mode
Unimodal - The data set has only one value that appears most often.
Bimodal - The data set has two values appear most often and equally.
Multimodal - The data set has three or more repeating values.
No Mode - The data set has no repeating values.

ACTIVITY 1 What's your MODE today?

Based on the given data sets, identify the number of each element, the mode and the type of mode. Item 1 is done for you.

Data Set	Number of each element	Which element/s has most number?	Mode/s	Type of Mode
	♥ = 8 ■ = 6 ▲ = 4	♥	♥	Unimodal
	Yellow = ____ Violet = ____ Blue = ____ Green = ____ Black = ____			
lansones, kamote, kamote, santol, kamote, lansones, sibuyas, santol, lansones, santol, kamote, sibuyas, santol, lansones,				
2, 12, 20, 22, 202, 2, 12, 20, 22, 202, 2, 12, 20, 22, 202, 2, 12, 20, 22, 202, 2, 12, 20, 22, 202, 2, 20, 2, 20, 2, 20, 2, 20, 2, 20				

Recognizing Patterns

Study each of the patterns below and supply the next two elements.

1. □ △ □ △ □ △ ___ ___
2. ▭ ▭ ▭ ▭ ___ ___
3. ⚅ ⚅ ⚅ ⚅ ___ ___
4. ▯ ▯ ▯ ▯ ▯ ▯ ___ ___
5. ▭ ▭ ▭ ▭ ▭ ▭ ___ ___

Let's try numbers!

Complete the sequence of numbers. Look at each of the sequence below and identi the last two terms in the given sequence.

1. ___, ___
2. 2, 4, 6, 8, 10, _____, _____
3. 19, 17, 15, 13, 11, _____, _____
4. 1, 3, 5, 27, 81, _____, _____
5. 30, 16, 8, 4, _____, _____
6. 5, 1, 2, 4, 7, 11, 15, _____, _____
7. 1, 2, 4, 24, 120, _____, _____
8. 78, 77, 75, 72, 68, _____, _____
9. 2, 2, 4, 12, 48, 240, _____, _____
10. 1, 5, 10, 14, 20, _____, _____

How Do You Get the Next Term?

Item A is composed of sequences with recognizable 'pattern'. Identify the operation needed to get t next term, whether addition or multiplication, in Column B. In Column C, identify the number ded or multiplied. Co th

COLUMN A	COLUMN B ad	COLUMN C
1) 7. 13. 19. 25. 31	addition	6
2) 3. 12. 48. 192		
3) 23. 20. 17. 14. 11		
4) 8. 1. -6. -13. -20		
5) 4. 2. 1. 1/2, 1/4,		

Let us Classify them!

Classify the sequences below according to common property. Place in the same box sequences with the same pattern.

2, 9, 16, 23	2, 4, 8, 16	1, 4, 16, 64
16, 12, 8, 4	3, 5, 7, 9	20, 15, 10, 5
27, 9, 3, 1		160, 80, 40, 20

Box A	Box B
Box C	Box D

Let us Classify them Further!

Classify the sequences below according to common property. Place in the same bo sequences with the same pattern.

2, 9, 16, 23	2, 4, 8, 16	1, 4, 16, 64
16, 12, 8, 4	3, 5, 7, 9	20, 15, 10, 5
27, 9, 3, 1		160, 80, 40, 20

Box A	Box B

Property common to sequences in Box A: _____

Property common to sequences in Box B: _____

Lesson 1: Introduction to Sets

Learning Competency: The learner describes well-defined collection of objects.

Activity 1– Sort, Explore, Think (SET)!

Directions: **Categorize** each object in the appropriate column (A, B, C, or D) based on shared characteristics, functions, or themes.

A	B	C	D
cabbage	camera		
Collection of _____	Collection of gadgets	Collection of objects that can be worn	Collection of _____

Activity 2. The Well-Defined Detective Mission!

Directions: Let us investigate whether each collection below is **a well-defined** or **not. A well-defined collection** has clear, objective membership. A collection of well-defined objects is called a set. A collection is **not well-defined** if membership is subjective, vague, or based on debatable criteria and considered **not a set**.

Collection of objects	Well-defined (Yes or No)	Justification	SET OR NOT SET
Counting number from 1-10.	Yes	Clear members: 1, 2, 3, 4, ...,10	Set
All difficult questions in the chapter test.	No	"Difficult" is subjective— a difficult question for one may be easy for another.	Not a set
All delicious fruits.			

NUMBER ARRANGEMENTS

Activity 1: Smallest and Biggest Number Possible

1. Let us arrange the given digits to form the smallest and greatest numbers possible

Digits	Smallest Possible Number	Greatest Possible Number	Smallest Possible 3-digit Number	Largest Possible 3-digit Number	Smallest Possible 2-digit Number	Largest Possible 2-digit Number
9, 3, 7, 2	2 379	9 732	237	973	23	97
1, 4, 6, 5						
8, 2, 3, 1						

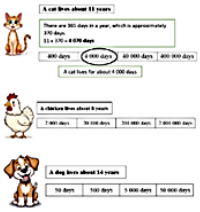
2. Given the digits **7, 1, 9,** and **5**
   a. Find the sum of the largest and smallest possible 3-digit number.
      Answer: ___ ___ ___ + ___ ___ ___ = _____
   b. Find the difference of the largest and sma lest possible 2-digit number
      Answer: ___ ___ − ___ ___ = _____
3. Using the digits **6, 3, 8, 2**, form the largest possible number increased by 100.
   Answer: ___ ___ ___ ___ + 100 = _____
4. Using the digits **9, 8, 1,** and **5**, form the smallest possible number and multiply it by 2.
   Answer: _____

Activity 2: Making Target Numbers

These kids are playing arranging cards to be the closest value as possible to the target number. Who do you think will win?

Activity 6: Estimating Products

Let us estimate the number of days these animals can live.



Activity 7: Quick Products

Let us quickly estimate products by rounding each numbers

1. **146 × 4** is approximately **150 x 4 = 600**
   The product is..... ☐ Less than 500 ☑ Greater than 500
2. **89 × 6** is approximately _____
   The product is greater than _____
3. **99 × 7** is
   The product is..... ☐ Less than 700 ☐ Greater than 700
4. The area of a rectangular lot is **141 x 398**, which of the following represent the best estimate of its area?
   a. 100 x 390 b. 100 x 400 c. 140 x 400 d. 140 x 300
5. An airplane flies about **13km/minute**. At this speed, about how many kilometers does it fly in an hour?
   Answer: _____

- **Terminal Reports**

University of Southern Mindanao
EXTENSION SERVICES OFFICE
Kabacan, North Cotabato

TERMINAL REPORT

Strengthening Mother-tongue based Education of Elementary Teachers in DepEd Cotabato/MBHTE BARMM through Instructional Materials Development and Validation

Philip Lester P. Benjamin
Project Leader

Sandra A. Nanding
Component Leader

Debbie Marie Verzosa
Leorence Tandog
Florie Jane Tamon
Rowel Madio
Roel Valenton
Anna Jean Garcia
Leonard Paleta
Meriam Rubio
Jeaneth Licaros
Daryl Mae Mamon
Jonald Pimentel
Jennifer Pama
Honey Vicent Valle
Members

I. Executive Summary

This extension project aims to strengthen mother-tongue based education in the DepEd Cotabato Division through the development of instructional materials and capacity building for elementary teachers. The project is grounded in promoting linguistic and cultural diversity, improving student learning outcomes, and addressing the specific needs of students in the region.

By providing students with the opportunity to learn in their mother-tongue, the project seeks to preserve and promote linguistic and cultural heritage. Research indicates that students learn better when taught in their mother-tongue, which underscores the importance of this initiative in improving academic outcomes.

The project's objectives include developing high-quality mother-tongue based instructional materials in elementary mathematics and validating these materials through data analysis and feedback from teachers, students, and parents. By tailoring materials to students' linguistic and cultural backgrounds and building teachers' capacity to teach in the mother-tongue, the project aims to enhance education quality and promote diversity in the region.

A courtesy call was made to Barangay Captain Hon. Lumambas and the principal of Nangaan Elementary School, Ma'am Salapudin, to introduce the CSM's extension project for the school year 2023-2024. This project aims to support elementary teachers in enhancing their teaching by providing supplementary instructional materials for challenging topics in mathematics. The CSM extension unit, in collaboration with faculty members, conducted an inception meeting and needs assessment on November 16, 2023. Subsequently, a training-workshop on instructional material (IM) development and validating a developed instructional material was held in December.

Through this initiative, the CSM seeks to contribute positively to the professional development of elementary teachers and ultimately enhance the quality of education provided to students.

II. Financial Report

Budget Utilization

Component	Allocation	Utilized	% Utlilized
Component 1: Development of high-quality mother-tongue based instructional materials in elementary mathematics that effectively engage and educate students.	1st Quarter	3,500	100%
	2nd Quarter	23,500	100%

Component 2: Validation of mother-tongue based instructional materials developed for elementary mathematics through feedback from teachers, students, and parents.	3rd Quarter	29,958.38	100%
	4th Quarter	2,978.38	100%

III. Major Activities Undertaken

In February 2023, we initiated contact with a local elementary school representative and introduced our extension project, receiving positive feedback and providing a detailed project plan. Subsequently, we gathered necessary documentation, including consent forms, and secured permission to proceed, using an existing memorandum of agreement for efficiency and compliance.

In March 2023, a thorough needs assessment highlighted a specific need for mathematics support among Maguindanaon tribe students, emphasizing the importance of mother-tongue instruction. This insight guided our project's focus.

By June 2023, significant progress was made in revising our learning materials, with meticulous content review to ensure quality and alignment with project objectives.

On November 16, 2023, we conducted an inception meeting and pre-test at Nangaan Elementary School, identifying the need to adjust some materials due to language evolution among students.

On December 6, 2023, we conducted a program divided into two parts. The first part was a training session led by Dr. Debbie Marie B. Verzosa on instructional material (IM) development and validation. The teachers responded positively to the training, expressing enthusiasm and appreciation for the insights shared. The second part of the program involved the dissemination of the IM to the teachers. Each teacher received a copy of the IM, along with guidance on its implementation. The teachers were encouraged to provide feedback and suggestions for further improvement. Overall, the program was a success, and we are confident that the IM will greatly benefit the students' learning experience.

IV. Problems met during the conduct of the project

1. Changes in purchase requests (PRs) created delays in procurement
2. Conflict in availability of team members and stakeholders
3. Delayed release of project budget
4. Unforeseen weather conditions disrupting field activities
5. Changes in government policies affecting project plans
6. Insufficient staffing and resources allocated

V. Recommendations

1. Establish a clear and streamlined process for PR creation and approval to minimize changes and delays.
2. Coordinate schedules in advance to ensure availability of all parties involved in project activities.
3. Advocate for timely release of project budgets and maintain regular communication with the funding agency.
4. Develop contingency plans for weather-related disruptions, such as rescheduling activities or implementing remote work arrangements.
5. Stay updated on government policies and regulations, and adapt project plans accordingly.
6. Allocate additional resources or personnel to address workload challenges and ensure timely project delivery.

VI. Project Impact/Output

The project is expected to at least generate the following:

Outputs:

- Developed and validated mathematics instructional materials tailored for mother-tongue based education.
- Improved mathematics academic performance and learning outcomes for students through the use of these materials.

Impact:

- Increased cultural pride and self-esteem among students as they see their language and culture represented in their education.
- Strengthened linguistic and cultural identity among students, fostering a sense of belonging and connection to their heritage.
- Enhanced quality of education in the area by providing effective and culturally relevant teaching materials, ultimately improving student engagement and understanding in mathematics.

VII. Photos

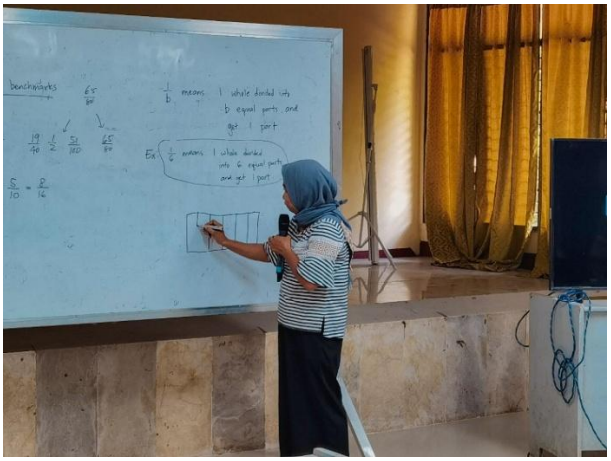
Inception Meeting with Teachers of Nangaan Elementary School

Conduct of needs assessment and Pre-test

Pilot Test

Visit at Nangaan Elementary School






Training on IM Development and Validation of IM with the resource person Dr. Verzosa.


Teachers from Nangaan Elementary School participate in a training session on Instructional Material (IM) development, featuring Dr. Verzosa as the resource speaker.

Strengthening Barangay High Schools: Validation and Implementation of Representation-Based Learning Materials for Independent Study of Mathematics in Remote Schools

Leorence C. Tandog, Ph.D.
Project Team Leader

Funded by

USM Fund 101

Terminal Report
March 2026

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato

ABSTRACT

Strengthening Barangay High Schools: Validation and Implementation of Representation-Based Learning Materials for Independent Study of Mathematics in Remote Schools

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This extension project aimed to improve mathematics learning in barangay high schools, with Salvacion High School in Cotabato serving as the primary beneficiary, through the development and implementation of representation-based, self-instructional learning materials. The project responded to persistent challenges faced by barangay high schools in the Philippines, including the shortage of qualified teachers, limited instructional resources, and consistently low performance in national achievement assessments. It built on a research initiative launched in 2021 that introduced representation-based instructional materials, which demonstrated positive effects on students' understanding of mathematics and science.

The project engaged faculty members and graduate students from the PhD in Education and MST in Mathematics programs in collaborative lesson study, materials development, and action research. A systematic implementation process was followed, which included baseline data collection, teacher training, material development, validation and refinement, and classroom implementation. As a result, the project produced Learning Activity Pages (LAPs) designed to support independent learning and address identified learning gaps in mathematics in a remote area. The implementation was conducted at Salvacion High School with the active support of the teachers and the school heads. The effectiveness of the intervention was assessed using pre- and post-tests on mathematical achievement and numeracy, student feedback, and teacher observations. Findings indicated a significant improvement in the numeracy skills of the student respondents, particularly in the various mathematical thinking skills. Moreover, the school beneficiary demonstrated enhanced overall performance, as reflected in their better rankings in district-wide competitions and increase in the number of senior high school students who qualified to enroll at USM based on USMCEE score.

The results of the project provided empirical evidence to support further refinement and possible scaling of the developed materials for use in other low-resource educational settings. Overall, the project contributed to the advancement of inclusive, equitable, and quality education by empowering students and teachers through accessible, research-based, and context-responsive learning resources.

Keywords: *Representation-Based Learning, Self-Instructional Materials, Learning Activity Sheets, Mathematics Education, Barangay High Schools*

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A. BASIC INFORMATION		
1. Title	Strengthening Barangay High Schools: Validation and Implementation of Representation-Based Learning Materials for Independent Study of Mathematics in Remote Schools	
2. Status	☐ Ongoing ☐ Completed	
3. Project Leader Study Leader	**Dr. Leorence C. Tandog** College of Science and Mathematics	
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4. Lead Unit/College	College of Science and Mathematics	
Collaborating Unit/College	DepEd Cotabato Division/ USM Graduate School	
5. Category	☐ Program ☑ Project ☐ Study	
6. Classification	☐ Research	☐ Development ☑ Extension
	☐ Basic ☐ Applied	☐ Pilot Testing ☐ Prototype Development ☐ Tech. Promotion/Commercialization
7. Thematic Area	☑ Quality Learning, Skills Development, and Literacy ☐ Social Development, and Strong Institutions ☐ Preservation of Culture ☐ Environmental Protection, Conservation, and Risk Reduction ☐ Food Security and Poverty Reduction ☐ Good Health and Well-being ☐ Innovations in Science, Engineering, and Technology ☐ Sustainable Entrepreneurship and Management	
8. Sustainable and Development Goals	☐ No Poverty ☐ Zero Hunger ☐ Good Health & Well-Being ☑ Quality Education ☐ Gender Equality ☐ Clean Water & Sanitation ☐ Affordable and Clean Energy ☐ Decent Work & Economic Growth	☐ Reduced Inequalities ☐ Sustainable Cities & Communities ☐ Responsible Consumption & Production ☐ Climate Action ☐ Life Below Water ☐ Life on Land ☐ Peace, Justice and Strong Institutions ☐ Partnership for the Goals

	☐ Industry Innovation & Infrastructure	
9. Project Duration	One year	
10. Project Location	Matalam, Cotabato	
11. Total Budget	PhP 60,000	

TERMINAL REPORT

B. TECHNICAL DESCRIPTION

Rationale

The performance of Philippine barangay high schools has long been perceived as inferior due to persistent challenges—foremost among them is the lack of qualified teachers. Teacher shortage is a critical issue in many rural areas globally but is particularly acute in barangay schools. These institutions often serve as entry points for novice teachers who are frequently assigned to teach out-of-field subjects due to staffing limitations and the small number of class sections typically offered in remote locations. Serving predominantly underprivileged and marginalized communities, barangay schools are often overlooked in favor of larger, better-resourced institutions.

In 2021, our team initiated a multi-dimensional response to the urgent educational disruptions brought about by the COVID-19 pandemic. This involved the development of instructional materials and technological tools designed to support student learning under constrained conditions. We introduced teaching innovations that featured interactive elements, visual aids, and manipulable representations. These efforts resulted in notable improvements in students' understanding of mathematics and science concepts.

Building on the success of that initiative, faculty members and graduate students from the PhD in Education and MST major in Mathematics programs engaged in a collaborative lesson study. This led to the development of research-based lessons and Learning Activity Pages (LAPs) that employ multiple representational approaches. These materials are designed to enable students to grasp essential concepts and skills even with minimal teacher supervision—or in the absence of a teacher altogether.

With these resources now prepared for validation, this extension project seeks to address the unique educational challenges faced by barangay schools through their strategic deployment and use.

Significance

This extension project was significant in addressing the persistent teacher shortage in barangay schools through the development of learning materials (LMs) that support independent learning. These materials were contextualized to reflect the realities of local school settings and the mathematical deficiencies of target learners, making them more relevant and responsive to the needs of barangay students. The initiative contributed to the long-term improvement of barangay high schools by enhancing instruction through the use of high-quality, research-based resources.

In addition to promoting content mastery, the materials foster lifelong learning by integrating soft skills such as number sense, critical thinking, problem-solving, and self-efficacy. These competencies continue to prepare students for real-world challenges and academic success. The project also aimed to enhance students' chances of admission to tertiary education, a critical pathway to socio-economic advancement and improved quality of life, particularly for learners in remote areas.

Grounded in lesson study and collaborative educational research conducted by faculty members of the Mathematics Department and graduate students, the project supported professional development and strengthened academic–community partnerships.

Furthermore, this initiative aligned with the broader goal of achieving inclusive and equitable quality education. The approach and materials can be adapted for use in other low-resource schools across the country, positioning the project as a potential model for broader implementation. By supporting barangay high schools, this project helps ensure that Filipino learners have access to meaningful and quality learning experiences, regardless of their geographic location.

Objectives

This project aimed to enhance the mathematics education received by students in barangay high schools in DepEd Cotabato with the use of carefully designed and validated self-instructional LMs.

The specific objectives of the extension project were to:

1. **strengthen** mathematics teachers' capacity to develop representation-based, self-instructional materials and to conduct action research or design-based research using these materials;

2. **engage** teachers in the collaborative development of research lessons and the design of self-instructional learning materials (LMs) in the form of Learning Activity Pages (LAPs);

3. **validate, pilot-test, and refine** activity sheets to effectively facilitate independent learning of mathematics concepts and skills;

4. **enhance** mathematics performance and numerical literacy among barangay high school students through the implementation of action research using the developed instructional materials; and

5. **improve** the overall performance of the target school and increase the chances of its senior high school (SHS) students being admitted to the University of Southern Mindanao (USM).

1. Review of Related Literature

Barangay high schools, formerly known as barrio high schools, were established in 1964 to provide wider access to secondary education (Orata, 1979). Since then, additional barangay high schools have opened with the passage of RA 6054 or the "Barrio High School Charter" in 1969. The establishment of barangay high schools is considered as equalizing opportunity for all Filipino children to access education regardless of their place of residence or economic condition. The performance of Philippine barangay schools has always been viewed to be inferior. In 1987 the Department of Education (DepEd) temporarily halted the opening of barangay high schools with acknowledgement that the quality of instruction in most of the barangay high schools suffered as evidenced by poor results in national achievement tests (DepEd DO 69, s. 1987). Self-regulated and independent study is vital in cases where teachers are not available to facilitate learning. Effective LMs significantly support independent learning since resources that can be learned without needing the assistance of a teacher can empower students to take control of their studies, learn at their own pace, and develop self-discipline and independent thinking. Research shows that supplemental printed materials significantly facilitate successful learning of math concepts (Brown and Gilmer, 2009) and self-instructional worked examples are effective in the development of both conceptual and procedural knowledge (Sheldon, 2013).

In 2021, we initiated a multi-dimensional approach to respond to the challenges that emerged from the urgent educational adaptations driven by the pandemic through material and technology tools development (Tandog & Verzosa, 2021). Our project introduced teaching innovations that utilized interactive elements, visual features, storytelling, and manipulable representations. Various studies have shown that these features and tools enhance learning (De las Peñas & Bautista, 2008), facilitate visualization (Taka, Taka, & Budinski, 2010), and develop creativity (Shelomovskiy & Nosulya, 2012). Representation is an important element in the study of mathematics and is considered at the heart of cognitions associated with mathematical activity (Kaput, 1987).

2. Methodology

A. Development Phase:

1. Baseline Data Collection / Needs Assessment

Surveys were conducted on school performance and admission SHS graduates to college to profile Salvacion High School. Ocular visits and interviews with teachers and school heads assessed existing learning resources, identified students' learning gaps, and considered contextual factors for project implementation. A diagnostic pretest was also administered to determine specific student needs to guide material development.

2. Planning and Training

An orientation introduced project goals, and the learning needs to be addressed. Training was conducted on the representation approach, scaffolding techniques, action research, and design-based research to support teachers in material development. Plans of activities for developing, reviewing, validating, and pilot-testing instructional materials were prepared.

3. Development, Validation, Pilot Testing, and Refinement

Instructional materials were developed collaboratively by MST and PhD students with faculty of the Mathematics and Statistics Department as subject experts. Faculty and students validated the content, and pilot testing involved selected high school students to assess engagement and learning outcomes. Materials were refined using feedback from needs assessment, validation, and pilot testing to suit students' capabilities and curriculum requirements.

4. Packaging and Reproduction of LAPs

Final layouts considered cost-efficiency, readability, and usability. LAPs were reproduced for target beneficiaries, and implementation feedback informed refinement for potential future use, patenting, and wider dissemination.

C. Implementation Phase

The project was implemented at Salvacion High School, an annex of Kibia High School. Support was provided to teachers and the TIC during student engagement, outputs were evaluated to guide ongoing support, and action research assessed improvements in learning outcomes.

D. Evaluation Phase

Project effectiveness was measured through comparison of pretest and posttest scores, student outputs, and teacher observations. Student feedback was gathered through interviews and focus groups. Impact on school operations was assessed via principal and teachers' narratives on how the materials addressed teacher scarcity and improved school performance.

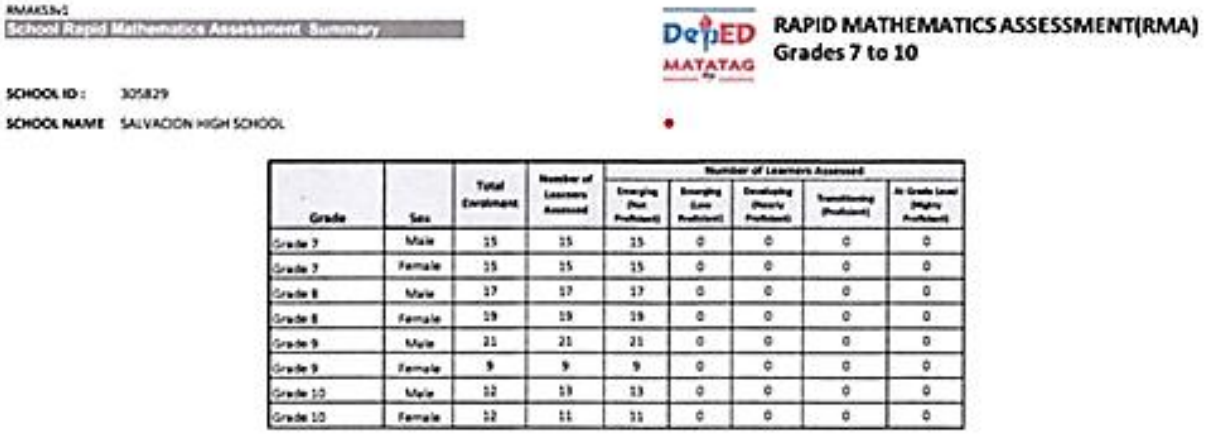
3. Results and Discussion

Baseline data

An ocular site visit and interviews conducted with the teachers and the former Principal of Salvacion High School at the start of the extension project revealed critical gaps in instructional support for mathematics education. One of the most pressing issues identified was the lack of learning resources, particularly in mathematics, as the Department of Education (DepEd) has been unable to provide textbooks for the subject. Additionally, it was found that none of the teachers in junior high school specialized in mathematics. Instead, mathematics classes are handled by teachers with academic backgrounds in Science and Filipino, underscoring the urgent need for subject-specific instructional support.

Figure 1. MST Math students and Salvacion HS teachers during initial site visit

Secondary data on the results of the Rapid Mathematics Assessment (RMA) for Grades 7–10 at Salvacion High School revealed that none of the students in the partner school demonstrated proficiency in the cognitive domain at their current grade level. This finding aligns with the recently released EDCOM 2 report, which indicated that only 0.40% of Grade 12 students in the Philippines attained the minimum level of competency (Second Congressional Commission on Education [EDCOM II], 2026). The RMA further revealed that most of the target students, despite being in high school, possess mathematics competencies equivalent to Grade 2 level, with the highest observed competency reaching only up to Grade 4 level.



School Rapid Mathematics Assessment Summary

DepED MATATAG

RAPID MATHEMATICS ASSESSMENT(RMA)
Grades 7 to 10

SCHOOL ID : 305829

SCHOOL NAME : SALVACION HIGH SCHOOL

Grade	Sex	Total Enrolment	Number of Learners Assessed	Number of Learners Assessed				
Grade 7	Male	15	15	15	0	0	0	0
Grade 7	Female	15	15	15	0	0	0	0
Grade 8	Male	17	17	17	0	0	0	0
Grade 8	Female	19	19	19	0	0	0	0
Grade 9	Male	21	21	21	0	0	0	0
Grade 9	Female	9	9	9	0	0	0	0
Grade 10	Male	12	13	13	0	0	0	0
Grade 10	Female	12	11	11	0	0	0	0

Figure 2. Rapid Mathematics Assessment Result for Grades 7-10.

A diagnostic test was administered to Grades 7-10 students to assess their number sense across three key categories: Numbers; Operations and Computational Estimation; and Data Sense Making.

Figure 3. Salvacion HS junior high school students taking the diagnostic test

The results of the diagnostic tests, as shown in Figure 4, indicate overall low performance, underscoring significant gaps in foundational mathematical understanding and reasoning. Particularly low performance was observed in the domain of numbers, where several high students still showed difficulty in reading and writing numbers and in identifying place values.

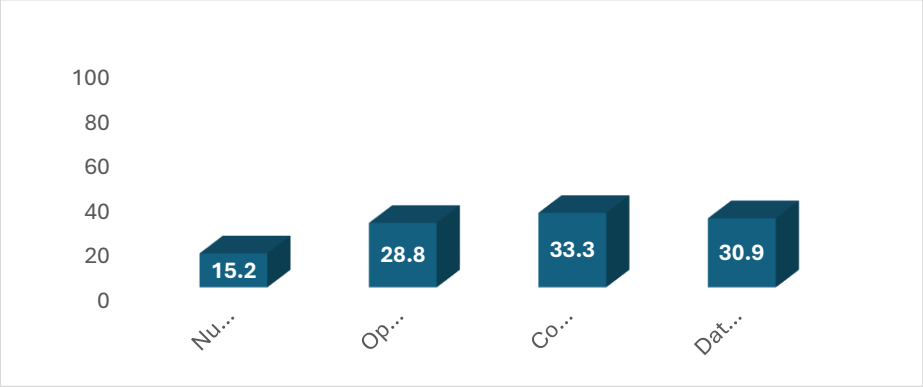


Figure 4. Average Percent Scores of Students in Diagnostic Test Items

A separate diagnostic test was also conducted to Senior High School students to determine their potential of passing a college admission test, particularly, the USM CEE. Of the 31 students, only 5 (16.1%) could potentially pass the set percentage cut-off score for board courses, another 5 (16.1%) for board courses while the majority (21 or 61.7%) would not qualify to any programs based on their performance on the test that included items that best predict USM-CEE.

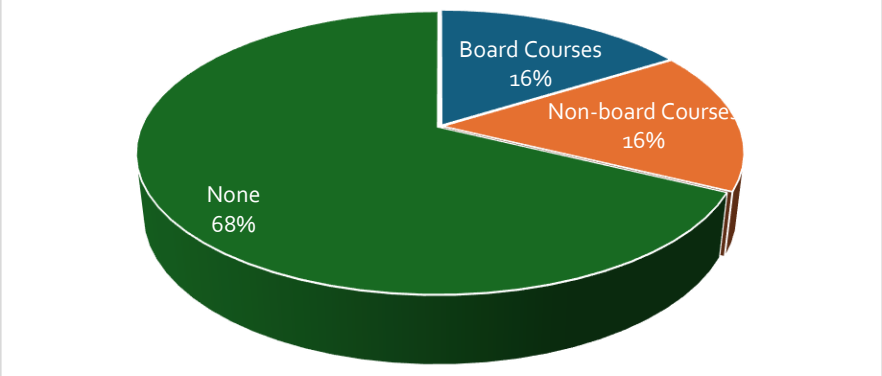


Figure 5. Percent Distribution of Respondents According to their Potential Performance in USM-CEE

Figure 6. Salvacion HS senior high school students taking the diagnostic test

Overall, the performance results from the various assessments are consistent with the findings of the EDCOM 2 report and reveal a pressing need to strengthen mathematics instruction in the identified partner school. These findings validate the focus of the extension project on developing representation-based, self-instructional LMs designed to reinforce foundational skills and promote independent learning. The targeted interventions, implemented through Learning Activity Pages (LAPs), aim to address these deficiencies systematically beginning with number concepts and progressing to operations and estimation within meaningful problem contexts, ultimately extending toward higher-order mathematical thinking skills.

A meeting was conducted in August 2025 with the newly assigned principal of Salvacion High School, followed by a separate meeting in September 2025 with the teachers, to orient them on the extension project, the results of the diagnostic assessments, and the developed instructional materials intended to improve students' mathematics competency. They were also informed about the proposed interventions and the ways in which they could assist and collaborate, particularly in conducting action research. A personal invitation to participate in the capacity-building program on instructional material (IM) development was likewise extended during these meetings.

Figure 7. Courtesy meeting with the new principal of Salvacion High School.

Figure 8. Orientation meeting with Salvacion HS teachers.

Capacity Building of Teachers

This project started with the enhancement of teachers' capacity in instructional material development and the conduct of action research as essential inputs to the implementation of the extension program. To achieve this objective, two seminar-workshops were conducted, with participants including graduate students engaged in curriculum development, teachers from the extension site, and other interested educators.

The first was a two-day seminar-workshop designed to strengthen three key areas of professional growth: instructional material development using representation-based approaches, the conduct of action research, and an understanding of design-based research. The seminar was carefully structured to enable participants to develop effective curriculum materials while simultaneously engaging in action research to improve instructional practice. Design-based research was introduced to equip participants—particularly the graduate students—with the research skills necessary for the continuous refinement of the developed materials for wide-scale distribution.

Figure 9. Seminar-workshop publication material and attendees

The seminar provided a space for participants to collaborate, share ideas, and create instructional tools they can apply in their own classrooms, and possible action research while implementing the innovations. The seminar workshop was attended by 72 teachers who highly rated the various aspects of the seminar with an overall rating of 4.71 (excellent). It also contributed to professional growth of teachers, including those from the beneficiary school with the PRC approved 8 CPD points for the seminar.

Figure 10. Seminar participants presenting their developed LM and collaborating for possible action research

The second workshop seminar was conducted as result of some challenges in the initial implementation of the LMs developed. Some students have difficulty reading texts and understanding activity instructions. There also seemed to be other preferences for learning. This seminar explored alternative pathways to numeracy and literacy. Still grounded in the principles of the representation-based approach, it emphasized how zines—small, self-published booklets—can serve as powerful tools to enhance both numeracy and literacy development. Training participants explored how to design and integrate zines into their teaching practices through hands-on activities such as creating sample zines, collaborating with peers, and developing classroom applications that align with curriculum goals. The one-day seminar workshop was awarded 4 CPD points by PRC.

Figure 11. Seminar publication material and certificate awarded

By the end of the one-workshop, teacher participants were equipped with both theoretical grounding and practical tools to implement zine-making as a pedagogical strategy that bridges literacy and numeracy learning in innovative and meaningful ways. The seminar workshop ended with presentation and critiquing of the zines developed by the participants.

Figure 12. Sample of zines produced by seminar participants

The seminar workshop was attended by 102 teachers, who rated the event very highly, giving it an overall score of 4.88 (excellent), reflecting strong satisfaction with the content, organization, and practical applicability of the activities. The comments extracted from the

Overall Training Evaluation Sheets has three themes:

1. Positive and Enriching Training Experience. Participants described the training as enriching, insightful, and valuable, indicating that the session provided meaningful learning experiences. Many reported gaining new knowledge and insights. The creativity introduced with zines generated interest among participants in adopting creative approaches as instructional tools.

2. Contribution to Professional Practice. Participants acknowledged that the seminar enhanced their knowledge and skills, enabling them to improve and adapt their professional practice. They noted that the session provided practical ideas and tools to support their teaching, particularly in numeracy and literacy instruction.

3: Desire for Continuous Professional Development. Participants expressed strong interest in attending additional seminars and training programs, particularly those focused on strengthening pedagogy and instructional skills. They also suggested incorporating digital or software-based demonstrations, such as Canva and other applications, to better support teachers who prefer computer-based activities over handmade outputs.

Figure 13. Participants of the seminar-workshop with MST and PhD Ed Math Students

Design, Development, Validation, and Development of LMs

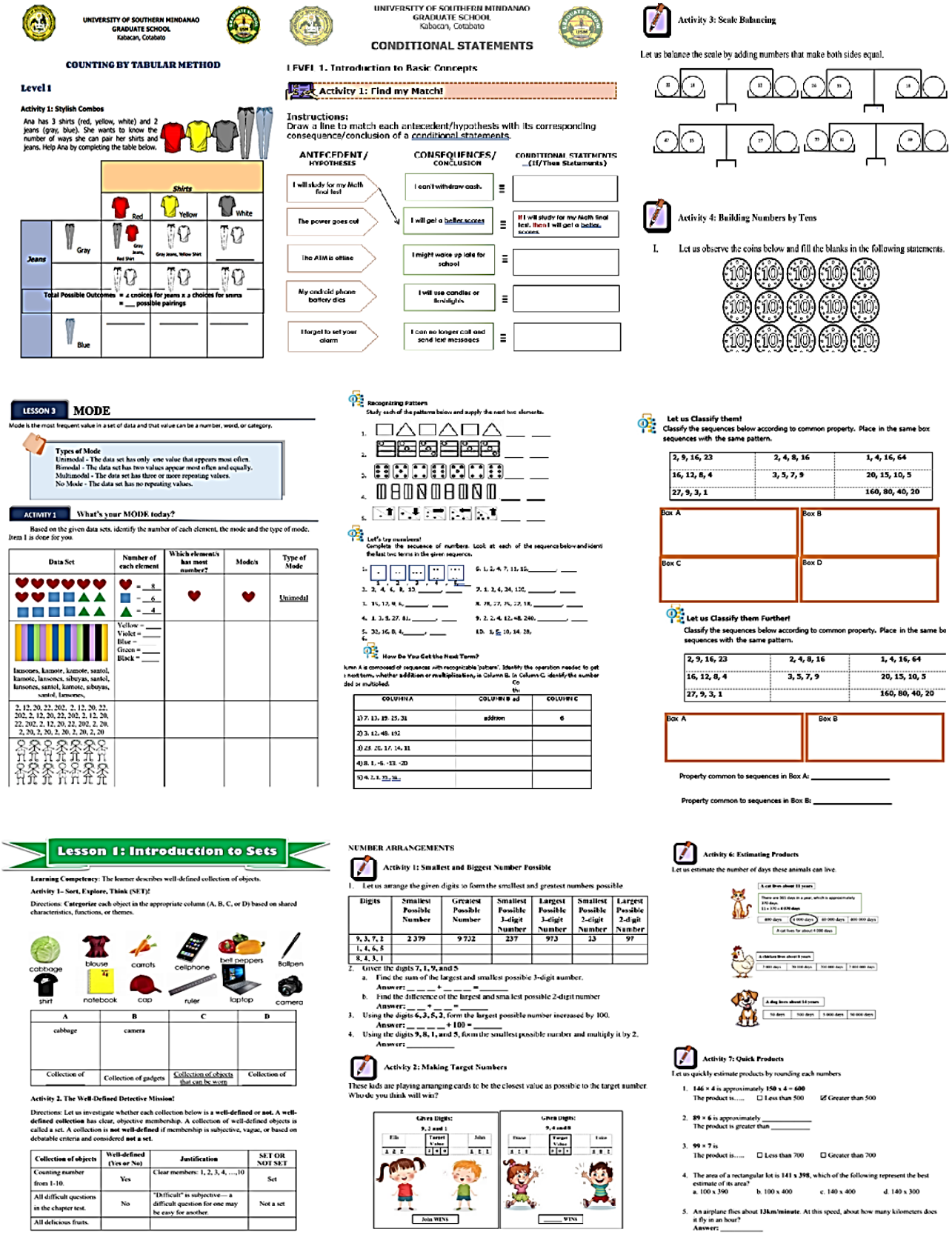
The extension project initially intended to involve the mathematics teacher at the beneficiary school; however, this did not materialize due to the absence of a designated mathematics teacher. The design and development of the instructional materials were therefore undertaken collaboratively by PhD and MST students, together with faculty members from the Department of Mathematics and Statistics serving as subject matter experts.

The development was anchored on the positive outcomes of a previous research initiative (Tandog & Verzosa, 2021), as well as on the initially developed LMs and the Professional Learning Community (PLC) structure for lesson study and pedagogical sharing established during the previous extension project (Tandog et al., 2022). The LMs prioritized the development of mathematical thinking and skills, with curriculum content serving primarily as a vehicle for cultivating the identified competencies. This approach seeks to address gaps in basic education, where instruction often tends to emphasize content coverage over the development of mathematical thinking and conceptual understanding.

The developed materials emerged from research lesson study conducted by the assigned groups and were guided by representation-based frameworks deemed appropriate by each group, including the Multiple Representation Approach (MRA), Concrete–Representational–Abstract (CRA), Representation Construction Approach (RCA), Concept Attainment (CA), and other related approaches, as shown in the following table.

Table 1. Mathematical thinking skills and content coverage of developed LMs.

Mathematical Thinking Skill	**Content**	**Topics**	**Framework**	**Validation**
Number Sense and Estimation	Numbers and Number Sense	-Number	- McKintosh/MRA	Complete
		-Operations (Multiplication)	-Array Models	(on-going)
		-Fractions	-RCA	Complete
Proportional Reasoning		-Percents	-Proportional Thinking	Complete
Relational Thinking	Sets	-Sets and Set Operations	-RCA -CA	Complete
Data Sense Making/ Quanti-tative Reasoning	-Descriptive Statistics	-Data Presentation -Average & spread	Microlearning	Complete
Predicting/Induct ive Reasoning	Patterns and Sequences	-Number Sequence	Inductive Learning Model	Complete
		-Arithmetic/ Geometric Seq		(On-going)
Spatial Reasoning	Geometry	-Polygons	-CA -Van Heile -CRA	Complete
		-Areas and Perimeter		(On-going)
Logical Reasoning	Mathematical Logic	- Conditional Statements	-CRA -Van Heile	Complete
Probabilistic Thinking	Combinatoric s	-Counting Techniques	-CRA	Complete
		-Combination -Permutation	-CA -CRA	(On-going)
	Probability	-Simple Probability		(On-going)
Symbolic Thinking	Algebra	-Alg. Expressions		(On-going)
Problem Solving		-Linear Equation		(On-going)
Measuring	Measurement		-	(On-going)



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COUNTING BY TABULAR METHOD

Level I

Activity 1: Stylish Combos

Ana has 3 shirts (red, yellow, white) and 2 jeans (gray, blue). She wants to know the number of ways she can pair her shirts and jeans. Help Ana by completing the table below.

Jeans \ Shirts	Red	Yellow	White
Gray	Gray Jeans, Red Shirt	Gray Jeans, Yellow Shirt	_____
Blue	_____	_____	_____

Total Possible Outcomes = # choices for jeans x # choices for shirts = ___ possible pairings

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CONDITIONAL STATEMENTS

LEVEL 1. Introduction to Basic Concepts

Activity 1: Find my Match!

Instructions:
Draw a line to match each antecedent/hypothesis with its corresponding consequence/conclusion of a conditional statements.

ANTECEDENT / HYPOTHESES	CONSEQUENCES / CONCLUSION	CONDITIONAL STATEMENTS ...(If/Then Statements)
I will study for my Math final test	I can't withdraw cash.	
The power goes out	I will get a better scores	If I will study for my Math final test, then I will get a better scores.
The ATM is offline	I might wake up late for school	
My cell/cel phone battery dies	I will use candles or flashlights	
I forget to set your alarm	I can no longer call and send text messages	

Activity 3: Scale Balancing

Let us balance the scale by adding numbers that make both sides equal.

Activity 4: Building Numbers by Tens

I. Let us observe the coins below and fill the blanks in the following statements.

LESSON 3 MODE

Mode is the most frequent value in a set of data and that value can be a number, word, or category.

Types of Mode
Unimodal - The data set has only one value that appears most often.
Bimodal - The data set has two values appear most often and equally.
Multimodal - The data set has three or more repeating values.
No Mode - The data set has no repeating values.

ACTIVITY 1 What's your MODE today?

Based on the given data sets, identify the number of each element, the mode and the type of mode. Item 1 is done for you.

Data Set	Number of each element	Which element/s has most number?	Mode/s	Type of Mode
	♥ = 8 ■ = 6 ▲ = 4	♥	♥	Unimodal
lansones, kamote, kamote, santol, kamote, lansones, sibuyas, santol, lansones, santol, kamote, sibuyas, santol, lansones,	Yellow = ___ Violet = ___ Blue = ___ Green = ___ Black = ___			
2, 12, 20, 22, 202, 2, 12, 20, 22, 202, 2, 12, 20, 22, 202, 2, 12, 20, 22, 202, 2, 12, 20, 22, 202, 2, 20, 2, 20, 2, 20, 2, 20, 2, 20				

Recognizing Pattern
Study each of the patterns below and supply the next two elements.

Let's try numbers!
Complete the sequence of numbers. Look at each of the sequence below and identi the last two terms in the given sequence.

How Do You Get the Next Term?
Item A is composed of sequences with recognizable 'pattern'. Identify the operation needed to get next term, whether addition or multiplication, in Column B. In Column C, identify the number del or multiplied.

COLUMN A	COLUMN B ad	COLUMN C
1) 7, 13, 19, 25, 31	addition	6
2) 3, 12, 48, 192		
3) 25, 20, 17, 14, 11		
4) 8, 1, -6, -13, -20		
5) 4, 2, 1, ½, ¼,		

Let us Classify them!
Classify the sequences below according to common property. Place in the same box sequences with the same pattern.

2, 9, 16, 23	2, 4, 8, 16	1, 4, 16, 64
16, 12, 8, 4	3, 5, 7, 9	20, 15, 10, 5
27, 9, 3, 1		160, 80, 40, 20

Box A	Box B
Box C	Box D

Let us Classify them Further!
Classify the sequences below according to common property. Place in the same be sequences with the same pattern.

2, 9, 16, 23	2, 4, 8, 16	1, 4, 16, 64
16, 12, 8, 4	3, 5, 7, 9	20, 15, 10, 5
27, 9, 3, 1		160, 80, 40, 20

Box A	Box B

Property common to sequences in Box A: _____

Property common to sequences in Box B: _____

Lesson 1: Introduction to Sets

Learning Competency: The learner describes well-defined collection of objects.

Activity 1– Sort, Explore, Think (SET)!

Directions: Categorize each object in the appropriate column (A, B, C, or D) based on shared characteristics, functions, or themes.

cabbage, blouse, carrots, cellphone, bell peppers, Ballpen, shirt, notebook, cap, ruler, laptop, camera

A	B	C	D
cabbage	camera		
Collection of	Collection of gadgets	Collection of objects that can be worn	Collection of

Activity 2. The Well-Defined Detective Mission!

Directions: Let us investigate whether each collection below is a well-defined or not. A well-defined collection has clear, objective membership. A collection of well-defined objects is called a set. A collection is not well-defined if membership is subjective, vague, or based on debatable criteria and considered not a set.

Collection of objects	Well-defined (Yes or No)	Justification	SET OR NOT SET
Counting number from 1-10.	Yes	Clear members: 1, 2, 3, 4, ...,10	Set
All difficult questions in the chapter test.	No	"Difficult" is subjective— a difficult question for one may be easy for another.	Not a set
All delicious fruits.			

NUMBER ARRANGEMENTS

Activity 1: Smallest and Biggest Number Possible

1. Let us arrange the given digits to form the smallest and greatest numbers possible

Digits	Smallest Possible Number	Greatest Possible Number	Smallest Possible 3-digit Number	Largest Possible 3-digit Number	Smallest Possible 2-digit Number	Largest Possible 2-digit Number
9, 3, 7, 2	2 379	9 732	237	973	23	97
1, 4, 6, 5						
8, 4, 3, 1						

2. Given the digits 7, 1, 9, and 5
   a. Find the sum of the largest and smallest possible 3-digit number.
      Answer: ___ ___ ___ + ___ ___ ___ = ___
   b. Find the difference of the largest and sma lest possible 2-digit number
      Answer: ___ ___ − ___ ___ = ___
3. Using the digits 6, 3, 5, 2, form the largest possible number increased by 100.
   Answer: ___ ___ ___ ___ + 100 = ___
4. Using the digits 9, 8, 1, and 5, form the smallest possible number and multiply it by 2.
   Answer: ___

Activity 2: Making Target Numbers

These kids are playing arranging cards to be the closest value as possible to the target number. Who do you think will win?

Given Digits: 9, 2 and 1 — Ella, Target Value 321, John — Join WINS

Given Digits: 9, 4 and 8 — Diane, Target Value 948, Jake — _____ WINS

Activity 6: Estimating Products

Let us estimate the number of days these animals can live.

Activity 7: Quick Products

Let us quickly estimate products by rounding each numbers

1. 146 × 4 is approximately 150 x 4 = 600
   The product is..... ☐ Less than 500 ☑ Greater than 500
2. 89 × 6 is approximately _____
   The product is greater than _____
3. 99 × 7 is
   The product is..... ☐ Less than 700 ☐ Greater than 700
4. The area of a rectangular lot is 141 x 398, which of the following represent the best estimate of its area?
   a. 100 x 390 b. 100 x 400 c. 140 x 400 d. 140 x 300
5. An airplane flies about 13km/minute. At this speed, about how many kilometers does it fly in an hour?
   Answer: _____

Figure 14. Samples of developed LMs

The initial review of the developed materials was conducted online, with PhD Mathematics Education students serving not only as reviewers but also as critics who provided suggestions for improvement. The validation process was conducted primarily face-to-face with faculty members from the Department of Mathematics and Statistics, who served as subject matter experts.

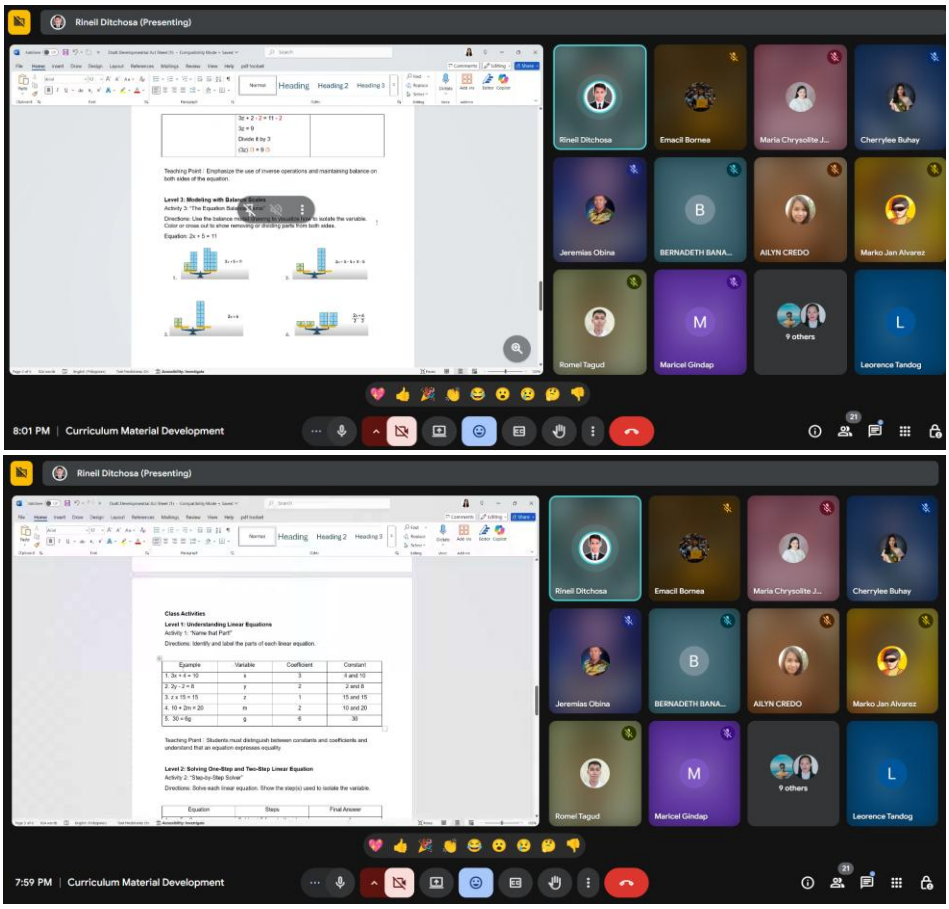


Figure 15. Online meetings and presentations of developed LMs

The pilot testing of the developed LMs varied across groups. Some groups conducted pilot tests with students in their respective schools. Others selected a small number of students who shared similar characteristics with the target users to implement the materials and determine whether, after using them, the students were able to answer the intended pretest items. Revisions were made based on the results of these pilot tests.

For several groups, the initial implementation of the validated materials in the beneficiary school functioned as pilot testing, with revisions undertaken topic by topic. Adjustments were made including in the pacing of instruction and the number of activities assigned, based on how students interacted with the materials in the preceding lessons.

Implementation of LMs

After the preliminary arrangements and school visits, implementation commenced in mid-September 2026, with MST and PhD students taking the lead in deploying the (LMs) they had developed, under the guidance of faculty members from the Department of Mathematics and Statistics. The extension project team was allocated every Friday by the partner school for the implementation of the LMs.

Figure 15. PhD Ed and MST math students during deployment and implementation of LMs

At the start of deployment, several student difficulties in using the materials were observed:

- Numbered instructions were interpreted as test items to be answered.
- Lettered examples were perceived as multiple-choice options to be encircled.
- Black-and-white printing rendered color-highlighted important texts unnoticeable.

These observations indicated underlying issues in reading comprehension and test-taking habits. The LM writers suggested color printing to make important texts more noticeable. Adjustments in numbering and formatting were also considered. However, upon reflection, the original numbering and example formats were retained to address students' tendency to treat lettered items as multiple-choice options and to encircle answers mechanically without fully comprehending the instructions or content. Table 2 shows the schedule of implementation of different LMs.

Table 2. Schedule of LM deployment and implementation

Mathematical Thinking Skill	**Content**	**Topics**	**Dates Implemented**	**Grade Level**
Number Sense and Estimation	Numbers and Number Sense	-Number	September, October	Grades 7-12
		-Operations (Multiplication)	For Implementation	
		-Fractions	For Implementation	
Proportional Reasoning		-Percents	For Implementation	
Relational Thinking	Sets	-Sets and Set Operations	October, November	Grade 8,10
Data Sense Making/ Quantita-tive Reasoning	-Descriptive Statistics	-Data Presentation -Average & spread	October, November	Grade 9
Predicting/Inductive Reasoning	Patterns and Sequences	-Number Sequence	October, November	Grades 11-12
		-Arithmetic/ Geometric Seq	For Implementation	
Spatial Reasoning	Geometry	-Polygons	For Implementation	
		-Areas and Perimeter		
Logical Reasoning	Mathematical Logic	- Conditional Statements	For Implementation	
Probabilistic Thinking	Combinatorics	-Counting Techniques	For Implementation	
		-Combination -Permutation	For Implementation	
	Probability	-Simple Probability	For Implementation	
Symbolic Thinking	Algebra	-Alg. Expressions	For Implementation	
Problem Solving		-Linear Equation	For Implementation	
Measuring	Measurement		For Implementation	

Of the 11 targeted mathematical thinking skills, only four were fully implemented. The start of implementation was delayed by one month due to the extended validation and revision of the LMs and pretests, which took longer than anticipated. Additional factors also contributed to the partial implementation of the developed LMs, including class suspension due to school district's scheduled activities, cancellation of classes following an earthquake, and shortened class periods due to armed conflict in a neighboring area.

Figure 16. Extensionists Ensuring Student Safety During the October 10 Earthquake

The deployment of the learning materials was halted in November due to a land conflict in a nearby barangay and a killing incident on December 2, 2025, along the road leading to Salvacion. This decision was made to ensure that the safety of the graduate students and faculty members actively participating in the extension program was not compromised. As such many of the developed materials are still for implementation as shown in Table 2.

Figure 17. Newsclips of incidents that affected project implementation

Aside from the deployment of learning materials (LMs), a review in preparation for college admission examinations was conducted for senior high school students. The Department of Mathematics and Statistics provided review sessions on mathematics and quantitative reasoning, aiming to improve students' problem-solving skills and test-taking strategies. Other test components, such as English and Science, were delegated to the school as it has available teachers to handle these subjects. This collaborative effort provided a comprehensive review experience and helped enhance students' readiness and confidence for college admission examinations.

Figure 17. USM conducting a review for college admission tests

The school also requested assistance from the Mathematics and Statistics faculty extensionists in training selected students for the Damath competitions, further strengthening the collaboration between the university and the partner school while providing students with opportunities to develop their mathematical and strategic skills. This support helped enhance students' computational skills, and strategic decision-making, which are essential in mathematical problem-solving and competitive events.

Figure 17. USM coaching student contestants for DAMATH competition

Outcomes of the Project

The targeted major outcome of this project is the enhancement of numerical literacy and mathematics performance and among barangay high school students through the implementation of the developed LMs

1. **Improved** overall performance of the target school and increase the chances of its senior high school (SHS) students being admitted to the University of Southern Mindanao (USM).
    - Improved numeracy

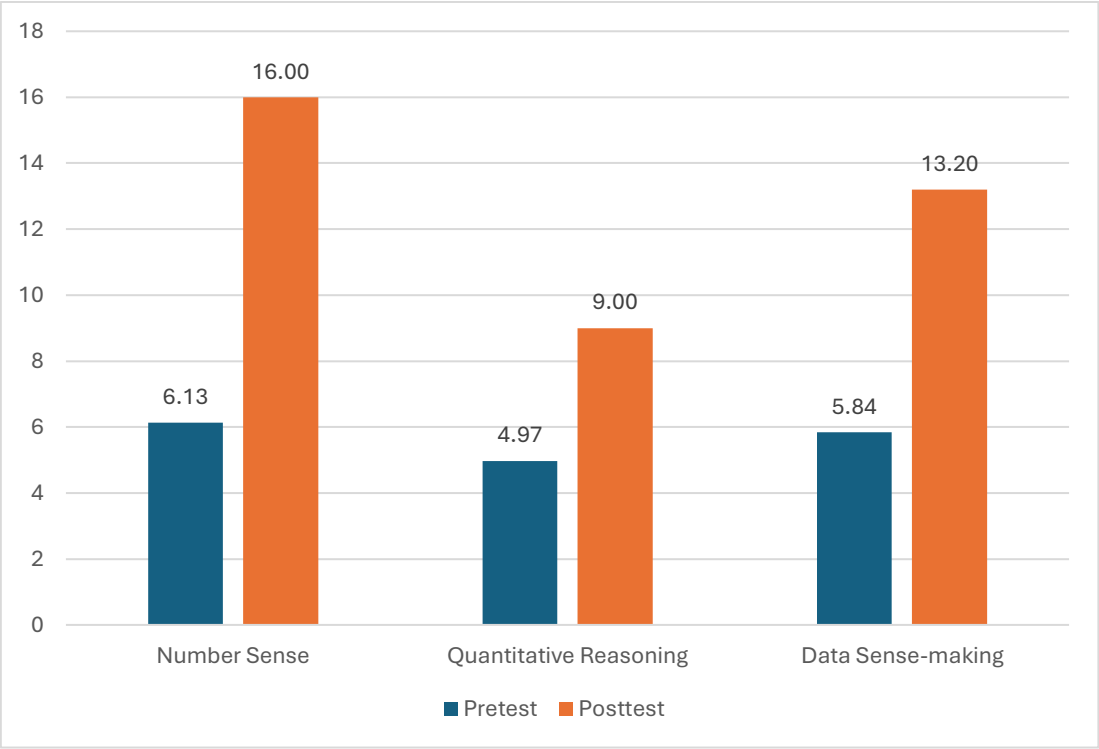
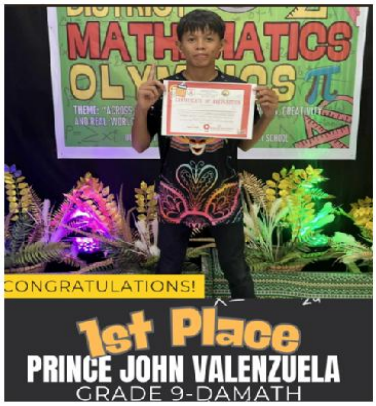


Figure 18. Pretest and Posttest performance of students

2. **Improved** ranking in mathematics competitions



3. Enhanced potential for college admission

Data	SY 2024-25		SY 2025-26	
	f	%	f	%
Grade 12 Grad	23		19	
Took the Exam	5	21.7	6	31.6
Passed USM CEE	2	40	6	100.0
Admitted to BS Program	2			
Admitted to Associate Program	1			

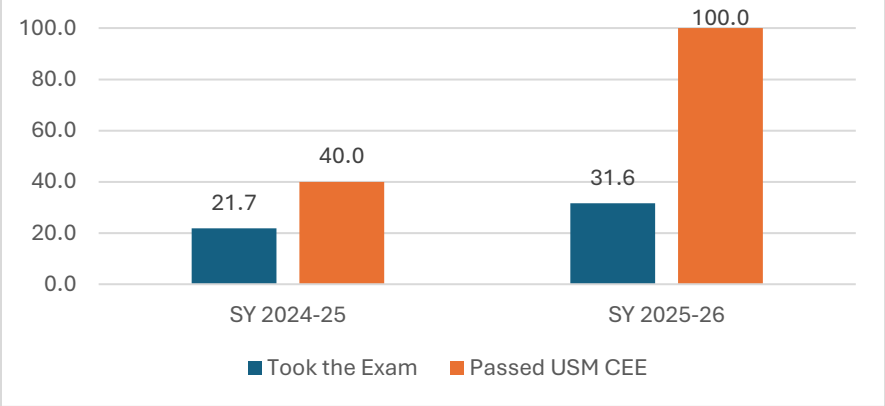


Figure 19. Comparative performance of Senior HS students in USMCEE

Extension Project Outputs

This project has produced the following outputs:

1. Developed and validated learning materials on at least ten topics
2. Three completed action research
3. One research article ready for journal publication submission

Improving Students' Quantitative Reasoning and Data Sense-Making through Microlearning-Based Gradual Release Scaffolding

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Abstract

Developing quantitative reasoning and data-sense making skills among students are two essential goals of statistics education. However, students face difficulties in understanding statistical concepts, choosing appropriate graphs for representing and organizing data and drawing conclusions. Microlearning was known for its effectiveness in enhancing retention and reducing cognitive load, but there is limited literature that examines its application in improving students' statistical skills. Moreover, the integration of the Gradual Release of Responsibility (GRR) model as a form of scaffolding in microlearning has not yet been fully explored. Hence, this study aimed to determine the effectiveness of microlearning based gradual release scaffolding in improving students' quantitative reasoning and data sense making. Using a one-group pretest and posttest design, 32 students from Salvacion High School answered a validated two-part test. Part I was a 20-item multiple choice test that measured their ability to understand and compute measures of central tendency and to read and interpret graphs. Part II measured their ability to construct graphs from a given set of data. Results revealed that after the two-week intervention using the researcher-made microlearning material, there was a significant difference in the pretest and posttest scores of students in quantitative reasoning and data sense making where both of their p-values were less than 0.01 and lower than the 0.05 level of significance. Moreover, it was found that the said instructional approach has a large effect in the improvement of students' quantitative reasoning (effect-size r=0.63) and data-sense making (effect-size r=0.73). This implies that microlearning based gradual release scaffolding is effective in the development of students' ability to understand statistical concepts and to interpret and present data in graphs meaningfully. Researchers recommended conducting studies using larger samples, different grade levels and subject areas and investigating long-term retention to further validate its effectiveness.

Statistics provides tools and methods in everyday decision making. It enables people to see patterns, relationships and trends that are usually hidden in raw data. In the field of education, statistics is not only about computations but also about quantitative reasoning and data sense-making. Developing these skills are the two essential goals of statistics in mathematics education. Quantitative reasoning focuses on using mathematical concepts to logically reason quantities and relationships (Herbert & Pierce, 2023). In that sense, teachers encourage students to read, interpret, draw conclusions and make predictions in the collected data. On the other hand, data sense- making involves interpreting, analyzing, and drawing conclusions in sets of data without using formal analytical tools as well as constructing different representations of data such as graphs and tables (Langen et al., 2022; Estrella et al., 2021).

However, many students struggle with these skills due to difficulties in connecting mathematical procedures with conceptual understanding that limits their ability to apply statistics in real life situations (Chan et al., 2016; Saidi and Siew, 2019; Ng & Chew, 2023). In the Philippine educational context, assessments have shown that Filipino students continue to encounter difficulties in understanding statistical concepts, specifically using constructing and simplifying data, choosing appropriate graphs in representing and organizing data, drawing conclusions from graphing and tabular data and even solving and interpreting measures of central tendency (Ruz, 2020; Jensen et al., 2023; Chang et al., 2024). Given the challenges faced by students, it is essential to explore different instructional strategies that can strengthen their skills in statistics and mathematics in general.

Microlearning has gained attention as a strategy that can improve engagement, retention and understanding by reducing cognitive overload and allowing learners to focus on specific objectives (Lai & Lee, 2016; Mostrady, 2025). Research suggests that students learn more effectively when complex concepts are broken down into smaller and manageable segments that allows them to process the information gradually (Sweller et al., 2017; Sathiyaseelan et al., 2024). Supporting microlearning with gradual release of responsibility (GRR) as a form of scaffolding offers an effective instruction in improving students' quantitative reasoning and data sense-making. In this approach, students first observe interpretation of graphs and computational procedures, then complete partially guided tasks, and finally construct graphs or solve problems independently while making the content into short and manageable segments. This ensures that students are provided enough time to answer guided practice with feedback, and gradually releases responsibility as they develop independence in computing and constructing

Figure 20. Research article from extension project for journal publication

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