REPUBLIC OF THE PHILIPPINES
UNIVERSITY OF THE SOUTHERN MINDANAO
KABACAN, COTABATO

College of Science and Mathematics

BACHELOR OF SCIENCE IN APPLIED MATHEMATICS

LEVEL I
OCTOBER 26 - 30, 2026



AREA VI
Extension and Community Involvement

SYSTEM-INPUTS AND PROCESSES

S.1. The extension agenda is in consonance of local, regional and national development thrusts and priorities.

1.3 RDE Agenda (BOR Resolution No. 69, series 2021)

In support to the national agenda and in consultations with stakeholders, the RDE themes are as follows:

RDE Themes	RDE Priority Areas
Quality Learning, Skills Development, and Literacy	Innovative teaching strategies; development and evaluation of functional education materials and modalities, and teaching strategies/approaches, motivation, and engagement; school climate; school and knowledge management; special education; remedial education; curriculum development and implementation; alternative learning system; assessment studies; soft skills; practical skills; adult education; language literacy; numerical literacy; data literacy; computer literacy; international studies; tracer studies; livelihood programs;; capacity building; capability building
Social Development, and Strong Institutions	Gender and development GAD; peace initiatives; community development; human security; justice; public policy and legislations; social rehabilitation; governance; organizational studies; behavioral studies; social institutions; ethics and public accountability; programs/project assessment; community needs assessment and interventions; partnerships and linkages; technology adoption; Institutional development; upgrading of laboratory and lecture facilities
Preservation of Culture	Multicultural studies; educational materials for IPs; indigenous knowledge systems and practices; development of materials for cultural knowledge and promotion; arts; language and literature studies; traditional dance, sports and music; halal studies
Environmental Protection, Conservation, and Risk Reduction	Environment rehabilitation studies; biodiversity; climate change adaptation; risk, hazard and mitigation; biosafety; natural resources conservation and management; bioremediation; flood control; waste management; ecological preservation and care; environmental impact assessment; tourism; agroecology; natural farming
Food Security and Poverty Reduction	Agricultural and fisheries research; biotechnology; innovations; quality food product development; technology development; halal food production; sustainable production; responsible consumption; organic agriculture; food testing; smart agriculture; precision farming; farm machineries; post-harvest facilities; vertical farming; indigenous food; food tourism; development of new breeds and varieties

PARAMETER A: PRIORITIES AND RELEVANCE

RDE Themes	RDE Priority Areas
Good Health and Wellbeing	Nutrition; nutraceuticals; sports, physical education; physical fitness; sports psychology; health resiliency; psycho-social health; medical and medicinal studies; hygiene and sanitation; functional foods; food and water quality and safety; mental and emotional health; therapy; coping mechanism; preventive measures; emerging diseases; health management; traditional and alternative medicine; community health; risk assessment and mitigation; health informatics, regenerative medicine, emergency response medicine
Innovations in Science, Engineering, and Technology	Innovations and futures thinking; product and technology development; energy; materials science; nanotechnologies; robotics; artificial intelligence; internet of things; Science, Engineering, Communication, and Technologies (SECT) 4.0; biotechnology and OMIC technologies; inventions and discoveries; basic research; information technologies; electronics; drug discovery; mathematics; emerging technologies; fabrication; transport system; waste management; infrastructure; water systems; simulation studies; industrial and allied technology, Data Science and Analytics, GIS, Remote sensing, machine learning; quantum technology; smart cities
Sustainable Entrepreneurship and Management	Economics; micro and macro scale business; product development; marketing; commercialization; networking; franchising; financial management; business feasibility studies; risk and opportunities; value adding; value chain analysis; organizational management; quality service assessment; human resource management; production management; sustainable cooperative studies; Entrepreneurial studies

**RDE Agenda extracted from USM RDE Manual 2024, Section 1.3, pages 10 – 11

PARAMETER A: PRIORITIES AND RELEVANCE

Approved Extension Project 2023 (Approval sheet, Notice to Proceed, & Basic Information)

Tel. No. (064) 572-2638
e-mail address: vprde@usm.edu.ph

CERTIFIED www.bvr.com ID 9100634167

OFFICE OF THE VICE PRESIDENT FOR RESEARCH, DEVELOPMENT AND EXTENSION

UNIVERSITY RESEARCH DEVELOPMENT & EXTENSION COMMITTEE

APPROVAL SHEET

I. **BASIC INFORMATION**

URDEC No.:_____
___ Program
___ Project
___ Study
___ Others

Project Title: Strengthening mother-tongue based education of elementary teachers in Dep-Ed Cotabato/MBHTE BARMM through instructional materials development and validation

Project Leader:	Philip Lester Benjamin
Duration/ Period of Conduct:	January 2023- December 2023
Implementing Agency/Unit:	USM
Location/Research Station:	USM
Budget Detail:	P60,000.00 (Extension Fund-05)

II. ACTION TAKEN: ☑ Approved ☐ Disapproved Remarks: _____

Date of Implementation: January - December 2023

RESEARCH REVIEW COMMITTEE

LYDIA C. PASCUAL
Director, RDO

ABUBAKAR A. MURRAY
Director, PICRI

EFREN E. MAGULAMA
Director, USMARC

MARY JOY B. CAÑOLAS
Director, ESS

DEBBIE MARIE B. VERZOSA
Director, RPSO

_____
Statistical Pool

Approved by:

MA. TEODORA N. CABASAN
VP for RDE

II. REVIEWED BY:
Statistical Pool _____ Date Jan. 20, 2023 Remarks

III. FOR ISSUANCE OF:

✓ Notice to Proceed
✓ Special Order
___ Research Contract
___ Policy Guidelines (IPR, PNS, IACUC Permit, others _____)

IV. OUTPUTS:

___ Progress Report (Quarterly)
___ Financial Report
___ Completion Report
___ Last Quarter Honorarium released upon submission of terminal/publishable article
___ Terminal Report/Publishable Article Submitted

Recorded by: _____

USM-RES-F24-Rev.1.2020.02.18

CERTIFIED TRUE COPY:
MARGIE N. UTUAN-GALANG
Chief Administrative Officer
University of Southern Mindanao
Date: _____

PARAMETER A: PRIORITIES AND RELEVANCE

NOTICE TO PROCEED

NTP #: 2023-E009
January 26, 2023

PROF. PHILIP LESTER P. BENJAMIN
University of Southern Mindanao
Kabacan, Cotabato

Dear PROF. BENJAMIN,

Your extension project proposal had been approved by the URDEC for 2023 funding in the amount of Php 60,000.00 (Extension Fund-05) allocation. Notice is hereby given that the conduct of the project/study entitled **"Strengthening mother-tongue based education of elementary teachers in Dep-Ed Cotabato/MBHTE BARMM through instructional materials development and validation"** may commence not later than 7 days after the receipt of this notice up to December 2023.

As Project Leader, you shall be responsible for ensuring the completion of the extension project in accordance with the approved work and financial plan. Furthermore, you have to submit a quarterly progress report and news feature article about your activities. Make oral presentation during the University Research, Development and Extension In-House Reviews. Upon completion of the project, you have to submit six (6) copies of the terminal report not later than March 2024. Acknowledge ESO in all reports, articles and media releases related to the project. By virtue of this designation, you shall be entitled to corresponding honorarium subject to existing laws or policy on this matter.

In the event that you discontinue the extension project without justifiable reasons or deliberately avoid your responsibilities stated above, you have to refund/return to the management the total amount you have actually spent.

Please acknowledge receipt and acceptance of this NOTICE by signing both copies in the space provided below.

Very truly yours,

MARY JOY S. CAÑOLAS, PhD
Director for Extension

Recommending approval:

MA. TEODORA N. CABASAN, PhD
Vice Pres. for Res., Dev't. & Ext'n. and
Vice-Chairman, URDEC

Approved by:

FRANCISCO G. N. GARCIA, PhD
SUC President IV, USM and
Chairman, URDEC

Conforme:

PHILIP LESTER P. BENJAMIN
Project Leader

CERTIFIED TRUE COPY:
MARGIE N. [illegible]TUAN-GALANG
Chief Administrative Officer
University of Southern Mindanao
Date:_____

PARAMETER A: PRIORITIES AND RELEVANCE

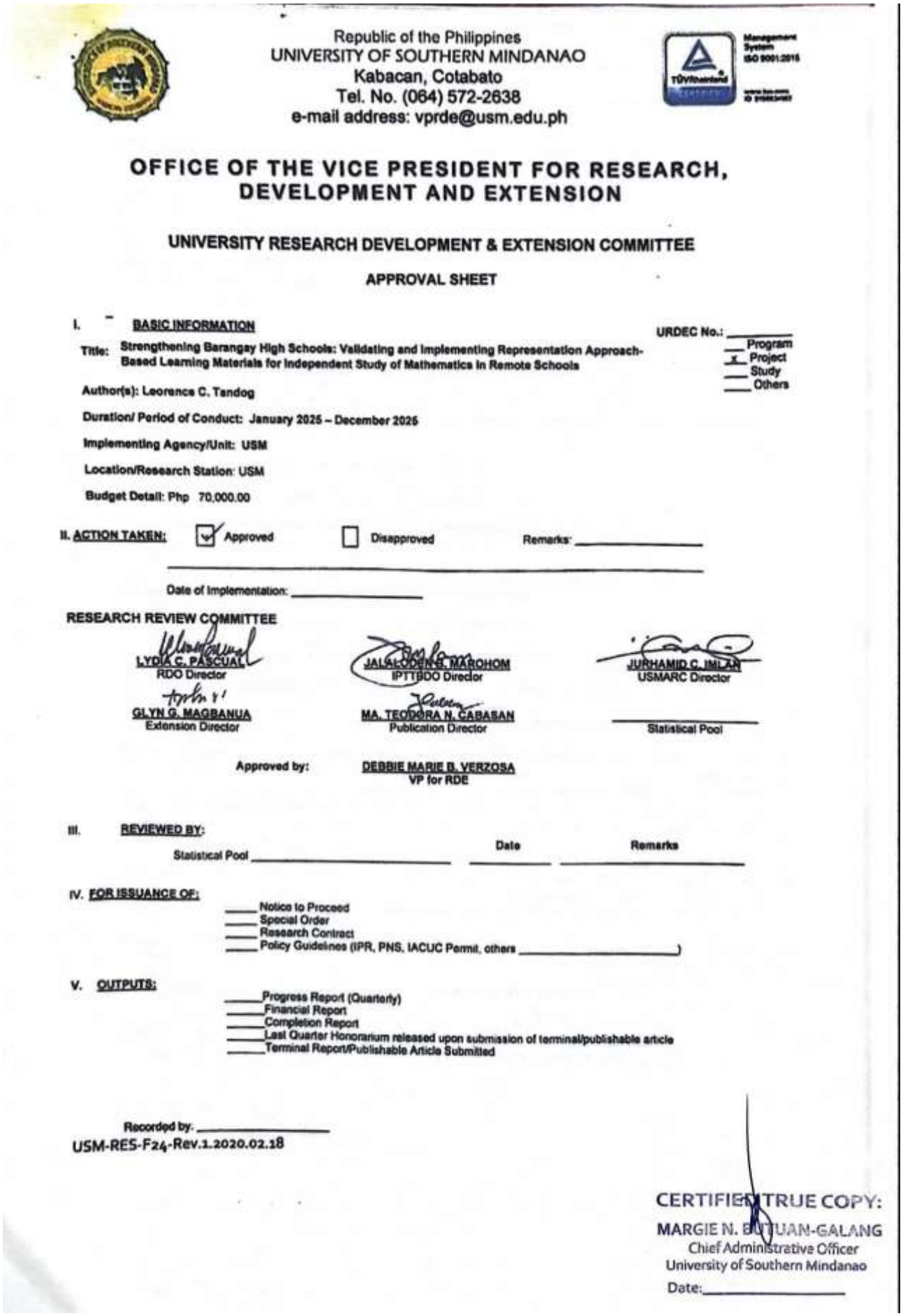
UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Philippines

NARRATIVE REPORT

A. BASIC INFORMATION	
1. **Title**	Strengthening Mother-tongue based Education of Elementary Teachers in DepEd Cotabato through Instructional Materials Development and Validation
2. **Status**	☒ Ongoing ☐ Completed
3. **Project Leader** **Study Leader** (Indicate College/Unit)	**Philip Lester P. Benjamin, Ph.D.** **Sandra A. Nanding** College of Science and Mathematics
Email Address	plbenj@usm.edu.ph
Contact Number	09338245352
4. **Lead Unit/College**	**USM Graduate School/ College of Science and Mathematics**
Collaborating Unit/College	**DepEd Cotabato**
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. **Project Duration**	**One year**
9. **Project Location**	Cotabato
10. **Total Budget Requested (Php)**	60,000

PARAMETER A: PRIORITIES AND RELEVANCE

Approved Extension Project 2025 (Approval sheet, Notice to Proceed, & Basic Information)



Republic of the Philippines
UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Tel. No. (064) 572-2638
e-mail address: vprde@usm.edu.ph

Management System ISO 9001:2015

OFFICE OF THE VICE PRESIDENT FOR RESEARCH, DEVELOPMENT AND EXTENSION

UNIVERSITY RESEARCH DEVELOPMENT & EXTENSION COMMITTEE

APPROVAL SHEET

I. BASIC INFORMATION

URDEC No.: _____
___ Program
_x_ Project
___ Study
___ Others

Title: Strengthening Barangay High Schools: Validating and Implementing Representation Approach-Based Learning Materials for Independent Study of Mathematics in Remote Schools

Author(s): Leorence C. Tandog

Duration/ Period of Conduct: January 2025 – December 2025

Implementing Agency/Unit: USM

Location/Research Station: USM

Budget Detail: Php 70,000.00

II. ACTION TAKEN: ☑ Approved ☐ Disapproved Remarks: _____

Date of Implementation: _____

RESEARCH REVIEW COMMITTEE

LYDIA C. PASCUAL
RDO Director

JALALODDIN S. MAROHOM
IPTTBDO Director

JURHAMID C. IMLAN
USMARC Director

GLYN G. MAGBANUA
Extension Director

MA. TEODORA N. CABASAN
Publication Director

_____
Statistical Pool

Approved by:
DEBBIE MARIE B. VERZOSA
VP for RDE

III. REVIEWED BY:

	Date	Remarks
Statistical Pool		

IV. FOR ISSUANCE OF:

___ Notice to Proceed
___ Special Order
___ Research Contract
___ Policy Guidelines (IPR, PNS, IACUC Permit, others _____)

V. OUTPUTS:

___ Progress Report (Quarterly)
___ Financial Report
___ Completion Report
___ Last Quarter Honorarium released upon submission of terminal/publishable article
___ Terminal Report/Publishable Article Submitted

Recorded by: _____

USM-RES-F24-Rev.1.2020.02.18

CERTIFIED TRUE COPY:
MARGIE N. BUTUAN-GALANG
Chief Administrative Officer
University of Southern Mindanao
Date: _____

PARAMETER A: PRIORITIES AND RELEVANCE

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Philippines

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	
Email Address	lctandog@usm.edu.ph	
Contact Number	09466115568	
4. Lead Unit/College	College of Science and Mathematics	
Collaborating Unit/College	DepEd Cotabato Division	
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 ☐ Industry Innovation & Infrastructure	☐ 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
9. Project Duration	One year	
10. Project Location	Matalam, Cotabato	
11. Total Budget	PhP 60,000	

CERTIFIED TRUE COPY:
MARGIE M. BUTUAN-GALANG
Chief Administrative Officer
University of Southern Mindanao
Date:_____

PARAMETER A: PRIORITIES AND RELEVANCE

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

NOTICE TO PROCEED

NTP #: 2025-____
Date: November 26, 2024

PROF. LEORENCE C. TANDOG
PROF. LEONARD M. PALETA
PROF. DEBBIE MARIE B. VERZOSA
PROF. PHILIP LESTER BENJAMIN
PROF. JUPITER G. PILONGO
University of Southern Mindanao
Kabacan, Cotabato

Dear Mesdames and Sirs:

Your extension proposal has been approved by the URDEC for 2025 funding in the amount of **Php 60,000.00** charged to Fund 101. Notice is hereby given that the conduct of the study entitled **"Strengthening Barangay High Schools: Validating and Implementing Representation Approach-Based Learning Materials for Independent Study of Mathematics in Remote Schools"** may commence not later than 7 days after the receipt of this notice up to December 2025.

This Study has the following components leaders and incentive:

Project Leader: ***Prof. Leorence C. Tandog,*** with honorarium

Component 1. **Building Capacity of Teachers in Instructional Development**
Component Leader: ***Prof. Leonard Paleta*** with honorarium;

Component 2. **Building Capacity of Teachers in the Conduct of Action Research**
Component Leader: ***Prof. Debbie Marie B. Verzosa*** with honorarium;

Component 3. **Development and Validation of Representation Approach-Based Learning Materials for Independent Learning of Mathematics**
Component Leader: ***Prof. Leorence C. Tandog,*** with honorarium and;

Component 4. **Implementation of Representation Approach- Based Learning Materials for Improved Learning of Mathematics**
Component Leader: ***Prof. Philip Lester Benjamin; Prof. Jupiter Pilongo,*** with honorarium

You shall be responsible for ensuring the completion of the extension project in accordance with the approved work and financial plan. Furthermore, you have to submit a quarterly progress report and make an oral presentation during the Midyear and Year-End University Research Development and Extension In-House Review. Upon completion of the study, you have to submit the terminal report and your outputs (IEC/s in both hard and e-copy) of extension results before you can claim your incentive as program/project/component leader.

In the event that you discontinue the project without justifiable reasons, you have to refund/return to the management the total amount you have actually spent; prior to the time you discontinue the project. In addition, you are required to submit the necessary output during the period you conducted the project.

Please acknowledge receipt and acceptance of this NOTICE by signing both copies in the space provided below.

Very truly yours,

GLYN G. MAGBANUA, PhD
Director, ESO

Recommending approval:

DEBBIE MARIE B. VERZOSA, PhD
Vice Pres. for Res., Dev't. & Ext'n.

Approved by:

FRANCISCO GIL N. GARCIA, RPAE, PhD
SUC President IV, USM

USM-RES-FoB-Rev.1.2020.02.18

CERTIFIED TRUE COPY:
MARGIE N. BUTUAN-GALANG
Chief Administrative Officer
University of Southern Mindanao
Date:_____

S.2. The College/Academic Unit of Mathematics/ Applied Mathematics has a benchmark survey of the problems, needs priorities and resources of the community.

4.6 Training Development and Implementation

The University Extension Services Office provides training programs designed to give the trainees the knowledge, skills, and attitude to perform their job or duties to the best of their abilities. The training may take a couple of days or weeks, depending on the skills. Once there is an indication of certainty in offering a training course, the Training Management Group (TMG) or training coordinator is created or appointed to implement and adequately manage the training course. By then, all training plans and activities should be finalized and formalized.

Figure 5 shows the training development and implementation flowchart.

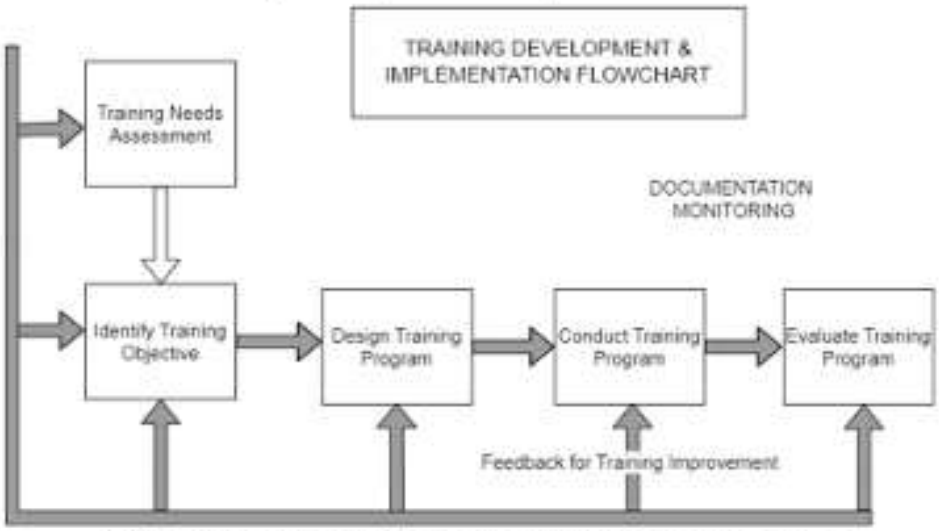


Figure 5. Training development and implementation flowchart

Training Needs Assessment

A training program is organized with a particular purpose in mind. Two questions need to be answered: (1) who are to be trained (2) for what purpose are they to be trained? One must know who to be trained and why they need the training to have a basis for the formulation of specific training objectives, subject matter content, and training methods.

Identify Training Objectives

Training objectives must be explicitly stated. What is expected of the participant as a result of the training?

Consider what is to be taught with the intended behavioral outcome. Each training objective should describe a particular output to be attained. The more specific the statement of objectives, the greater the clarity of the statement of the intended behavioral outcome, and it can be evaluated.

Design Training Program

Determine what is to be taught. The bases for determining what is to be taught are the program or organizational needs and expressed needs of the trainees.

The final training design is essentially a teaching plan. A well-organized training design consists of the following:

1. Statement of the coverage of the subject matter to be taught

2. Objectives of the training activity
3. Teaching aids, equipment, and other tools
4. A brief explanation of how the trainee participates in the training activity
5. Identification of the people who are to be involved in the training
6. Methods of teaching
7. A list of learning activities that are to be assigned to the trainees
8. Provision for evaluation of the learner before, during, and after the training, and a follow-up after the trainee has been home for some time.

Conduct Training Program

The implementation of the training activities may be assigned to various working committees. A central contact person who provides leadership in coordinating the working committees should be assigned. In implementing the training program, one may see specific weaknesses or faults in the training plan. Such observations should be attended immediately, and alternative means of correcting them should be adopted. This is the flexibility that a written program provides.

Evaluation and Follow-up

Provisions should be made to evaluate the trainees during and after training. A benchmark evaluation may be administered at the start of the training to determine the level of knowledge, skills, or attitudes that they possess. The trainees' reactions to the training session or activities should be solicited. Encourage suggestions or comments from them and make revisions or adjustments, if necessary, in the training program.

Evaluate the training in terms of the specific objectives of the training. The trainees should know the result of the evaluation.

A program of following up with trainees in their work situations should be made to find out the applicability of what trainees had learned in their training to their jobs. Follow-up or post evaluation of the trainees will enable training program planners to obtain information on which to base decisions for improving future training programs.

Monitoring Training Programs

The office of the Director for Extension Services (ODES) is responsible for undertaking the monitoring function. The TMG or the Training Coordinator is responsible for providing the ODES with information regarding the Training course for which he/she is responsible. Different forms are provided by the ODES for such purposes.

**Extracted from USM RDE Manual 2024, page 47

Community Needs Assessment Summary

The Department of Mathematics and Statistics, in partnership with USM Graduate School has conducted a benchmark survey to identify the problems, needs, priorities, and resources of the target community.

Survey Questionnaire Used:

Survey Questionnaire 1: Assesses elementary teachers' needs, challenges, and confidence in teaching Math using Mother Tongue-Based instruction.



Survey Questionnaire 1

Respondent Information

Name (Optional): _____
School Name: _____ District/Division: _____

Grade Level Taught:
☐ Grade 1 ☐ Grade 4
☐ Grade 2 ☐ Grade 5
☐ Grade 3 ☐ Grade 6

Years of Teaching Experience:
☐ 0–3 ☐ 8–10
☐ 4–7 ☐ 11+

Mother Tongue Used in Teaching: _____

Teaching Needs in Mother-Tongue Based Mathematics Instruction

1. How confident are you in teaching fractions in Mathematics using the mother tongue?
   ☐ Very Confident
   ☐ Confident
   ☐ Somewhat Confident
   ☐ Not Confident
2. What challenges do you face when teaching fractions in the mother tongue? (Check all that apply)
   ☐ Lack of instructional materials
   ☐ Difficulty in translating math concepts
   ☐ Students' limited vocabulary
   ☐ No standardized terms in mother tongue
   ☐ Others: ___
3. How often do you use localized or culturally-relevant examples when teaching math?
   ☐ Always
   ☐ Often
   ☐ Sometimes
   ☐ Never

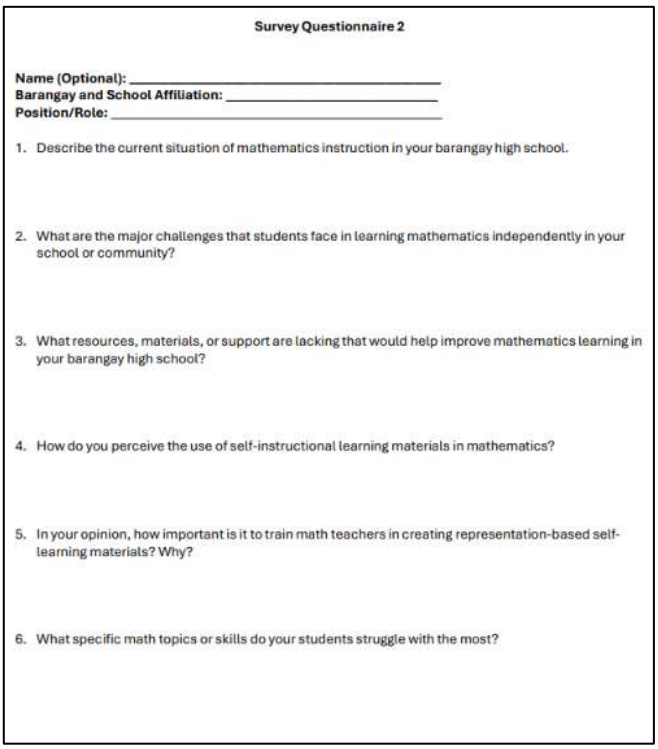


4. How helpful would it be to have visual, contextualized materials (e.g., posters, story problems, games) when teaching fractions?
   ☐ Very Helpful
   ☐ Helpful
   ☐ Somewhat Helpful
   ☐ Not Helpful

Professional Development and Collaboration

5. Do you feel the need for training or workshops to improve your MTB-MLE strategies in math teaching?
   ☐ Yes
   ☐ No
6. What topics would you like to learn more about in such training? (Check all that apply)
   ☐ Developing mother-tongue based materials
   ☐ Strategies for teaching fractions
   ☐ Language integration in math
   ☐ Student engagement techniques
   ☐ Assessment using MTB-MLE
   ☐ Others: ___
7. How often do you collaborate or share materials with other teachers?
   ☐ Regularly
   ☐ Sometimes
   ☐ Rarely
   ☐ Never
8. What suggestions do you have for making math instruction using the mother tongue more effective?
   _____
   _____
9. Are there any local cultural elements (games, stories, objects) you think can be used to teach fractions?
   _____
   _____

Survey Questionnaire 2: Assesses high school and community needs regarding math learning materials, student challenges, and teacher training.



Survey Questionnaire 2

Name (Optional): _____
Barangay and School Affiliation: _____
Position/Role: _____

1. Describe the current situation of mathematics instruction in your barangay high school.
2. What are the major challenges that students face in learning mathematics independently in your school or community?
3. What resources, materials, or support are lacking that would help improve mathematics learning in your barangay high school?
4. How do you perceive the use of self-instructional learning materials in mathematics?
5. In your opinion, how important is it to train math teachers in creating representation-based self-learning materials? Why?
6. What specific math topics or skills do your students struggle with the most?

PARAMETER A: PRIORITIES AND RELEVANCE

Result:

During our visit to Nangaan Elementary School to conduct a needs assessment, several needs were identified among the educators:

1. They need more materials to help teach fractions better.
2. They want easier ways to explain fractions to students.
3. They think it's important to use the students' own language and culture when teaching math.
4. Teachers want training to improve how they teach math, especially fractions.
5. They believe sharing ideas and materials with other teachers is important for improving teaching.

Attachment

Inception meeting and conduct of needs assessment







S.3. The extension program reflects the VMGO.

Section 1.1 - USM RDE Vision, Mission, and Goals (extracted from USM RDE Manual, page 8)

1.1 USM RDE Vision, Mission, and Goals

Vision

USM envisions upholding its status of excellence in Research, Development and Extension by continuing to be the pioneer source of technology and information that are on track towards poverty reduction, food security, and global competitiveness for cohesive and sustainable development among its multi-socio-cultural clientele.

Mission

To put into operation a system to undertake a multi-disciplinary approach for RDE activities to ensure that technologies and information generated can address the prevailing concerns and issues in the local, regional and national levels for sustainable development.

Goals

- improve the system with scientific excellence through collaborative and interdisciplinary RDE activities that are anchored on the University's vision/mission;
- conduct research and generate technologies that could provide solutions and address the local, regional and national concerns and issues;
- provide a mechanism to ensure that research results be effectively and efficiently delivered to the clients for utilization and commercialization; and
- build up resource generation facilities for continuous and sustainable RDE programs that are geared towards ensuring food security, global competitiveness, socio-cultural responsiveness that eventually improve the quality of life of the clientele.

Section 4.2.a - extracted from USM RDE Manual 2024, page 44

4.2.a Community Engagement Project (CEP)

The Community Engagement Project (CEP) is composed of several components in which each component has a series of activities to attain specific objectives. The scope of CEP is within the approved budget and defined time-period.

Partners in the engagement are bound through a Memorandum of Understanding or Agreement. In this document, parties are committed to perform their respective duties and responsibilities to the best of their abilities to carry out the planned activities stipulated in the project proposal. Stipulated also in the MOU/MOA is the willingness of each partner to provide resources as counterpart in the implementation of the CEP.

The CEP should be aligned with the University RDE Agenda, Unibersidad and Komunidad "UniK" Extension Program of the ESO, and Sustainable Development Goals of the United Nations.

PARAMETER A: PRIORITIES AND RELEVANCE

Appendix 4. RDE Capsule Proposal Format

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Philippines

CAPSULE PROPOSAL FORMAT

A. BASIC INFORMATION	
1. Category	☐ Program ☐ Project ☐ Study
2. Title	
3. Proponent/s Indicate Name Designation, Office	
3.1. Email Address	
3.2. Contact Number	
4. Lead Unit/College	
4.1. Collaborating Unit/College	
5. Classification a. Research ☐ Basic ☐ Applied	b. Development ☐ Pilot Testing ☐ Prototype Development ☐ Tech. Promotion/ Commercialization
6. Thematic Area	☐ Quality Learning Skills Development and Literacy ☐ Food Security and Poverty Reduction ☐ Social Development, and Strong Institutions ☐ Good Health and Well-being ☐ Preservation of Culture ☐ Innovations in Science, Engineering, and Technology ☐ Environmental Protection, Conservation, and Risk Reduction ☐ Sustainable Entrepreneurship and Management
7. Sector/Commodity/Discipline	
8. Project Duration	
9. Project Location	
10. Total Budget Requested (Php)	

S.4. There is a pool of consultants/experts from various disciplines to serve in extension projects and activities.



Profile of the Research and Extension Personnel

Name	Designation	Educational Qualification	Picture
Debbie Marie B. Verzosa	Vice President for Research Development and Extension	PhD in Education	
Glyn G. Magbanua	Director, Extension Services	PhD in Applied Lignuistics	
Ritchel O. Torres	Training Specialist II	MS in Animal Science	
Arnabie A. Murray	Extension Project Staff	BS in Islamic Studies	
Diether M. Barro	Extension Assistant	BS in Development Management	

DIETHER M. BARRO

Extension Assistant
University of Southern Mindanao
Kabacan, Cotabato
Mobile: 09070826201
Email: **dmbarro@usm.edu.ph**



PERSONAL DATA

Age: 25
Date of Birth: February 13, 2000
Place of Birth: Natipakan, Latagan, Matalam, Cotabato
Gender: Male
Religion: Roman Catholic
Civil Status: Single
Height: 5'6'
Weight: 60 kg
Nationality:
Filipino
Language Spoken: Ilonggo, Cebuano, Tagalog, English

EDUCATIONAL BACKGROUND

College:

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Bachelor of Science in Development Management Cum Laude, Class 2022

Senior High School:

KIBIA SENIOR HIGH SCHOOL
Purok 4, Kibia, Matalam, Cotabato
HUMSS
2016-2018

Junior High School:

KIBIA HIGH SCHOOL
Purok 4, Kibia, Matalam, Cotabato
2012-2016

Elementary:

NATIPAKAN ELEMENTARY SCHOOL
Natipakan, Latagan, Matalam, Cotabato
2006-2012

WORK EXPERIENCE

Extension Assistant
Extension Services Office
University of Southern Mindanao
2022-Present

QUALIFICATION AND SKILLS

- Proficient in Microsoft Office (Word, PowerPoint, Excel, Publisher)
- Communication Skills
- Leadership & Management skills
- Driving and cooking skills

ELIGIBILITY:

- Civil Service: Career Service Professional Eligible

SEMINARS/ TRAININGS ATTENDED

- Attended the Seminar on Financial Management at USM Extension Conference Room on December 2022.
- Attended the Training on Community Organizing at USM Extension Conference Room on March 2022.
- Training on Standard First Aid, Basic Life Support and Disaster Risk Reduction Management (Earthquake, Fire and Water Safety Drill) on April 2018.
- Attended the Training-Workshop on Training Management at USM Extension Conference Room on February 2022.
- Attended the Seminar-Workshop on Developing Effective Print-Based Information, Education and Communication (IEC) Materials at USM Extension Conference Room on March 2022.

- Attended the Training on Community Engagement at USM Extension Conference Room on March 2022.

- Attended the Training-Workshop on Communicating Research Results with Various Audience at USM Extension Conference Room on March 2022.

- Attended the Training "BLOOM APP USER'S TRAINING WORKSHOP" at USM, Commercial Building on March 19-21, 2025.

REFERENCES

GLYN G. MAGBANUA, PhD
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RAHIMA A. CABUNTO
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PERSONAL DATA

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Place of Birth: Oring, Buldon, Maguindanao
Gender: Female
Religion: Islam
Civil Status: Single
Height: 5'0'
Weight: 50 kg
Nationality:
Filipino
Language Spoken: Iranun, Tagalog, English

EDUCATIONAL BACKGROUND

College:

University of Southern Mindanao-Main Campus
Bachelor of Arts in English Language
Cum Laude, Class 2024

Junior High School:

Parang National High School
Poblacion 1, Parang, Maguindanao
2013-2017

Senior High School:

Notre Dame of Parang Inc.
Poblacion 1, Parang, Maguindanao
HUMSS
2017-2019

Elementary:

Edbul Elementary School
Brgy. Edcor, Buldon, Maguindanao Del Norte
2007-2013

WORK EXPERIENCE

Education Program Specialist I
University of Southern Mindanao
2024-Present

ESO Editor and Staff
University of Southern Mindanao
2024

QUALIFICATION AND SKILLS

- Proficient in Microsoft Office (Word, PowerPoint, Excel, Publisher)
- Communication Skills
- Writing Skills
- Interpersonal and collaboration skills

ELIGIBILITY:

- Civil Service: Career Service Professional Eligible

SEMINARS/ TRAININGS ATTENDED

- Training on Preparing Powerpoint Presentation (USM Format), (2024)
- Impact Assessment and Research Proposal Development (2024)
- Literary Arts Innovation Workshop (2024)
- Workshop on Project on PRC Investments: Exploring Chinese Investments and Narratives in the Philippines (2024)
- Public Information Training Workshop (2024)
- Training on Creating and Engaging Extension Proposals (2024)
- Design Thinking and Pitching Workshop (2023)
- Course of Language and Culture of Indonesia (CULTURA) 2023
- 2nd CASS In-House Review 2023

REFERENCES

GLYN G. MAGBANUA, PhD
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ANAMARIE B. UYANGURIN, MAEd
CASS Faculty
Contact No. 09171488747

LYN B. GABANO-MAGBANUA, Ph.D.



Current Rank

November 2024 – present **Associate Professor IV**
Department of English Language and Literature

PARAMETER A: PRIORITIES AND RELEVANCE

Education

Certificate in English Medium Education
University of Southampton
United Kingdom
Graduated: 2022

Ph.D. in Education major in Applied Linguistics
Immaculate Conception University
Davao City, Philippines
Graduated: 2013

Certificate of Proficiency in Special Education
Holy Cross of Davao College
Davao City, Philippines
Graduated: 2009

Master of Arts in English
Notre Dame of Kidapawan College
Cotabato, Philippines
Graduated: 2006

Bachelor in Secondary Education major in English
Mountain View College
Bukidnon, Philippines
Graduated: 1998

Current Designations (University of Southern Mindanao)

Director
Extension Services Office, USM

Program Head
PhD in Applied Linguistics, Graduate School - USM

Head, Secretariat
Performance Management Team (PMT), USM

Funded Research and Extension Engagements

Kasunayan Rising: A UniK (Unibersidad and Komunidad) Initiative for Sustainable Development and Indigenous Empowerment (2024)
Gender Research and Capability Building in Extension Projects: Exploring Engagement, Opportunities and Entry Points (2022)
From Research to Practice: Practical Applications of English for Specific Purposes in the Workplace (2022)
Development of E-learning Materials Towards Improving the Communicative Competence of ESL Learners (2019)
Health, Environment/Education, Agriculture and Livelihood Skills (HEALS) for Sustainable Development (2019)

Publications

Proficiency, Anxiety and Corrective Feedback Preferences Among ESL Learners
Modern Journal of Studies in English Language Teaching and Literature
June 2023

PARAMETER A: PRIORITIES AND RELEVANCE

Education

Certificate in English Medium Education
University of Southampton
United Kingdom
Graduated: 2022

Ph.D. in Education major in Applied Linguistics
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Davao City, Philippines
Graduated: 2013

Certificate of Proficiency in Special Education
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Mountain View College
Bukidnon, Philippines
Graduated: 1998

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Extension Services Office, USM

Program Head
PhD in Applied Linguistics, Graduate School - USM

Head, Secretariat
Performance Management Team (PMT), USM

Funded Research and Extension Engagements

Kasunayan Rising: A UniK (Unibersidad and Komunidad) Initiative for Sustainable Development and Indigenous Empowerment (2024)
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From Research to Practice: Practical Applications of English for Specific Purposes in the Workplace (2022)
Development of E-learning Materials Towards Improving the Communicative Competence of ESL Learners (2019)
Health, Environment/Education, Agriculture and Livelihood Skills (HEALS) for Sustainable Development (2019)

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Proficiency, Anxiety and Corrective Feedback Preferences Among ESL Learners
Modern Journal of Studies in English Language Teaching and Literature
June 2023

PARAMETER A: PRIORITIES AND RELEVANCE

Developing Word Recognition Skills of Dyslexic Students Through a Strategy and Phonological Training
Philippine ESL Journal
July 2015

Two Peas in a Pod – Grammar and Short Stories in the Language Classroom
Conference Proceedings
The ELT Professionals Network 2016 Conference
February 2016

Errors in Written Discourse of Omani EFL Learners
Conference Proceedings
14- Annual International TESOL Conference
August 21-23, 2015

A Phonological Strategy to Develop Word Recognition Skills of Dyslexic Students
Conference Proceedings
BUC 2- International Multidisciplinary Conference: English Language, Literature and Information Technology
May 2-3, 2015

Developing Linguistic Competence through Short Stories (with Prof. ZN Patil)
Conference Handbook
Oman 15th International ELT Conference
April 23-24, 2015

Recent Workshops, Trainings and Conferences Attended

Training on Financial Analysis
July 14-18, 2025
Baguio City

Fundamental Methods for Impact Assessment of R&D and Technology Transfer Programs in Agriculture, Aquatic and Natural Resources
Tagaytay City
June 23-27, 2025

3- Agri-Ecotourism Congress
Kalibo, Aklan
June 9-11, 2025

Training Workshop on Project Design and Evaluation for Extension Projects
University of Southern Mindanao
May 26-28, 2025

Joint IDIL and IMLD Conference
Sorsogon State University
March 26-28, 2025

Cultivating a Growth Mindset in English Language Classrooms: Strategies for Effective Teaching and Learning
Delivered by Teaching English Asia
October 22, 2024

Language, power and education – five principles for a critical language pedagogy

PARAMETER A: PRIORITIES AND RELEVANCE

Delivered by Teaching English Asia
October 22, 2024

FO1: Farm Tourism Basic and Business Opportunities Training
International School of Sustainable Tourism
Silang, Cavite
July 31 – August 2, 2024

7th National Coalition on Indigenous People's Higher Education Conference
Baguio City
March 5-6, 2024

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Weight: 68 kg
Nationality: Filipino
Language Spoken: Bagobo-Tagabawa, Ilonggo, Cebuano, Tagalog, English

EDUCATIONAL BACKGROUND

Post Graduate:

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UNIVERSITY OF SOUTHERN MINDANAO
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Master of Science in Animal Science
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College:

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Bachelor of Science in Agriculture
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High School:

BASAK HIGH SCHOOL
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2024-Present

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2023

QUALIFICATION AND SKILLS

- Proficient in Microsoft Office (Word, PowerPoint, Excel)
- Communication Skills
- Interpersonal and collaboration skills

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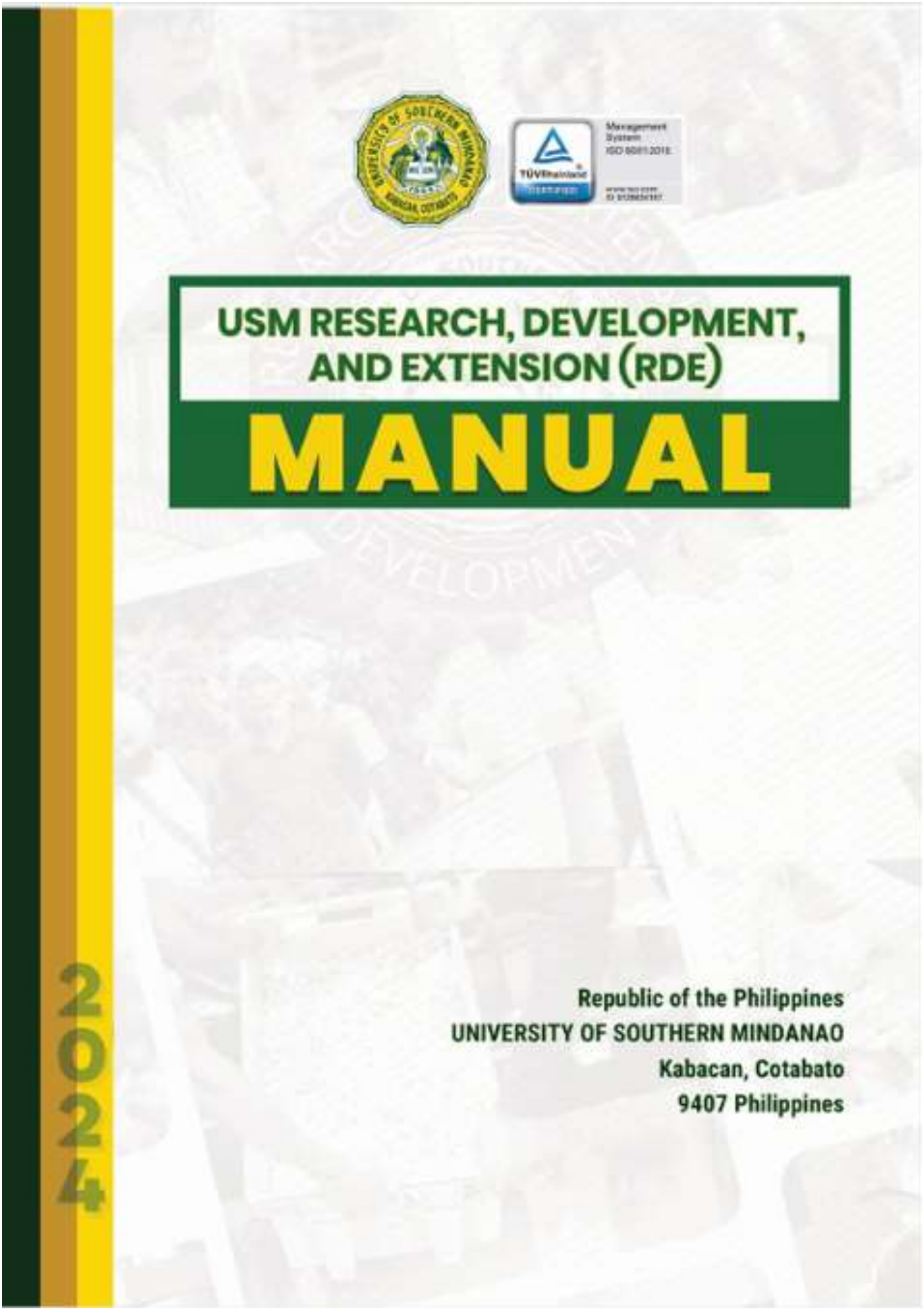
- LEADING WITH PURPOSE: EFFECTIVE PROJECT MANAGEMENT IN VOLUNTEERISM (2024)
- OK sa OA: ONLINE KWENTUHAN SA ORGANIC AGRICULTURE (ORGANIC AQUACULTURE PRODUCTION), (2024)
- 61ST PSAS SCIENTIFIC MEETING AND ANNUAL CONVENTION, (2024)
- FACILITATOR DURING THE 3RD RDE TECHNO- FORUM, (2024)
- SCHOLARS PRESENTING ADVANCED RESEARCH KNOWLEDGE SERIES, (2024)
- MOLECULAR DETECTION OF TRYSONOMA EVANSI AND OTHER BLOOD PARASITE IN TABANIDS, (2024)
- TRAINING ON MONITORINEVALUATION, (2024)
- FACILITATOR DURING THE TRAINING ON CLIMATE RESI IN AGRO-ECOSYSTEMS: ADDRESSING THE CHALLENGES POSED BY CLIMATE CHANGE AND IDENTIFYING OPPORTUNITIES TO BUILD RESILIENCE IN AGRICULTURAL SYSTEMS IN SOUTHERN MINDANAO, (2024)
- SHARER DURING LIRIP 7: PANDAIGDIGANG KUMPERENSIYA SA FILIPINO, (2023)
- STATE OF THE NATION'S ANIMAL INDUSTRY: A SITUATIONER ON THE CURRENT FOOD AND FEED INFLATION IN THE PHILIPPINES, (2022)
- THE CURRENT FOOD AND FEED INFLATION IN THE PHILIPPINES, (2022)
- TRAINING- WORKSHOP ON SOIL AND NUTRIENT MANAGEMENT, (2022)

REFERENCES

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S.5. The institution has an approved and copyrighted Extension Manual.



The USM Research, Development and Extension (RDE) Manual
Revised 2024

Approved by the USM Board of Regents (BOR) by virtue of Resolution No. 106, s. 2023
Revisions approved by the USM Board of Regents by virtue of Resolution No. 119, s. 2024

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IMPLEMENTATION

I.1. The extension projects and activities implemented are based on the results of the benchmark survey.

Extension Project 2023

1. Approved Detailed Proposal

University of Southern Mindanao
EXTENSION SERVICES OFFICE
Kabacan, North Cotabato

DETAILED PROPOSAL

A. BASIC INFORMATION

1. **Title of the Project:** Strengthening mother-tongue based education of elementary teachers in DepEd Cotabato/MBHTE BARMM through instructional materials development and validation.
2. **Proponents(s)**
   Component 1: Development of high-quality mother-tongue based instructional materials in elementary mathematics that effectively engage and educate students.
   2.1 Name: PHILIP LESTER P. BENJAMIN
   2.2 Designation: Component 1 Leader
   2.3 Component 1 members: Leorence Tandog, Debbie Marie Verzosa, Florie Jane Tamon, Rowel Madio, Roel Valenton, Anna Jean Garcia, Leonard Paleta
   2.4 College/ Unit: Graduate School/College of Science and Mathematics
   2.5 Address: Osias, Kabacan, Cotabato
   2.6 Telephone Number (s): 09338245352
   2.7 Fax Number: none
   2.8 Email Address: plbenj@usm.edu.ph

   Component 2: Validation of mother-tongue based instructional materials developed for elementary mathematics through feedback from teachers, students, and parents.
   2.9 Name: SANDRA A. NANDING
   2.10 Designation: Component 2 Leader
   2.11 Component 2 members: Merian Rubio, Jeaneth Licaros, Daryl Mae Mamon, Jonald Pimentel, Jennifer Pama, Honey Vincent Valle
   2.12 College/ Unit: College of Science and Mathematics
   2.13 Address: Mercado Street, Kabacan, Cotabato
   2.14 Telephone Number (s): 09169284643
   2.15 Fax Number: none
   2.16 Email Address: nsnanding@usm.edu.ph

3. **Implementing Agency**
   a. Lead Agency: USM Graduate School/College of Science and Mathematics
   b. Collaborating Agency (s): Deped Cotabato/MBHTE BARMM
4. **Project Duration:** One year
5. **Project Location:** Cotabato/BARMM

6. **Total Budget Requirement**
   6.1. Budget Requested: P60,000
   6.2. Agency Counterpart

B. TECHNICAL DESCRIPTION

1. **Rationale**

The United Nations has declared the period between 2022 and 2032 as the International Decade of Indigenous Languages to bring attention to the endangered status of many indigenous languages and to mobilize resources for their preservation, revitalization, and promotion. In the Philippines, Republic Act No. 10533, known as the Basic Education Act, emphasizes the importance of using languages understood by learners, and the curriculum is based on the principles of Mother Tongue-Based Multilingual Education. The Department of Education also promotes the use of indigenous languages through its Indigenous Peoples Education Program, but requires a working orthography, primer guide to literacy, vocabulary in various domains, a grammar sketch, and learning materials before it can be officially recognized and used as a medium of instruction in schools.

Additionally, the Department of Education also provides training to teachers to effectively teach in an indigenous language and provide support for the development of instructional materials. The use of indigenous languages in education has been shown to be effective in improving learning outcomes, particularly in reading and writing, and in promoting cultural identity and self-esteem among indigenous learners.

However, the implementation of these programs faces challenges such as lack of resources and expertise in developing materials and training teachers in indigenous languages. It is important that the government and other stakeholders continue to invest in and support the preservation, revitalization, and promotion of indigenous languages to ensure their survival and to empower indigenous communities.

It is also important to engage with the indigenous communities and involve them in the development and implementation of programs related to their languages. This includes consulting with them on the development of orthography, primer guides, vocabulary, grammar sketches and learning materials, as well as involving them in teacher training and curriculum development.

Furthermore, promoting and preserving indigenous languages should not be limited to education, it should be integrated in all aspects of life. The government and other stakeholders should also promote the use of indigenous languages in media, government services, and other areas of public life. This can be done by providing translation and interpretation services, creating media content in indigenous languages, and encouraging the use of indigenous languages in government and other public service settings.

Overall, the International Decade of Indigenous Languages and the efforts of the Philippines government to promote the use of indigenous languages in education provide an opportunity to address the critical situation of many indigenous languages and to empower indigenous communities. However, it is important to sustain these efforts and to involve indigenous communities in the development and implementation of programs to ensure their success and long-term impact.

PARAMETER A: PRIORITIES AND RELEVANCE

It's also worth noting that preserving indigenous languages is not only important for the communities that speak to them, but also for linguistic and cultural diversity as a whole. Indigenous languages often contain unique knowledge and perspectives that can contribute to the global understanding of history, culture, and the environment. Additionally, the loss of an indigenous language can also mean the loss of traditional practices, stories, and other cultural heritage that are passed down through generations.

Moreover, it is important to recognize that language preservation and revitalization is not a one-time effort, but a continuous process. It requires ongoing commitment and resources from government, organizations, and communities. This can include funding for language documentation and archiving, language revitalization programs and workshops, and community-based language programs. Furthermore, community-based language programs are particularly effective in revitalizing endangered languages as they are often led by local speakers and have community support.

In conclusion, preserving and promoting indigenous languages is a critical effort that requires the collaboration of government, organizations, and communities. It is essential to involve indigenous communities in the development and implementation of programs, provide ongoing support and resources, and recognize the importance of indigenous languages for linguistic and cultural diversity, and for the preservation of traditional practices and cultural heritage.

The rationale behind this extension project to strengthen mother-tongue based education through instructional materials development and capacity building for elementary teachers in the DepEd Cotabato Division is rooted in several key considerations:

1. Promoting linguistic and cultural diversity: The use of mother-tongue as the medium of instruction in the early years of education has been recognized as an effective way to promote linguistic and cultural diversity. By providing students with the opportunity to learn in their mother-tongue, the project can help to preserve and promote the linguistic and cultural heritage of the students in the DepEd Cotabato Division.

2. Improving student learning outcomes: Research has shown that students who learn in their mother-tongue have better academic outcomes compared to students who learn in a language that is not their mother-tongue. This project aims to improve student learning outcomes by providing students with instructional materials that are tailored to their linguistic and cultural background, and by building the capacity of teachers to effectively teach in the students' mother-tongue.

3. Addressing the needs of students: This project aims to address the specific language and cultural needs of students in the DepEd Cotabato Division by developing instructional materials that are tailored to their needs and by providing teacher training that is aligned with the curriculum and the needs of the students.

Overall, this extension project aims to enhance mother-tongue based education in the Deped Cotabato/MBHTE BARMM Division by providing students with instructional materials that are tailored to their linguistic and cultural background and by building the capacity of teachers to effectively teach in the students' mother-tongue. This can help to improve student learning outcomes and promote linguistic and cultural diversity in the region.

PARAMETER A: PRIORITIES AND RELEVANCE

2. Objectives

General objective: To improve mother-tongue based education of elementary school teachers in Deped Cotabato/MBHTE BARMM by developing and validating instructional materials.

Specific objectives:

1. To develop high-quality mother-tongue based instructional materials in elementary mathematics that effectively engage and educate students.
2. To validate mother-tongue based instructional materials developed for elementary mathematics through data analysis and feedback from teachers, students, and parents.

At the end of the extension activity, it is expected that:

a. educational resources in mathematics are created that are tailored to the students' mother tongue, which will help to make learning more meaningful and effective. The materials will be developed are based on the curriculum and will be validated through testing and feedback from teachers and students.
b. validated instructional materials will be used to support classroom instruction and will be evaluated for their effectiveness in improving student learning outcomes.

3. Methodology

The methodology for implementing this project will be divided into three main phases: development, implementation, and evaluation.

Pre-implementation/Development Phase (Social Preparation):

- ✓ Finalization of methodology, ethics, and permission protocols, MOA
- ✓ Conduct profiling or needs assessment within DepEd Cotabato/MBHTE BARMM to identify the specific language and cultural context of the students.

Implementation Phase:

- ✓ Develop and refine existing instructional materials based on the curriculum and the identified needs of the teachers.
- ✓ Validate the instructional materials through pilot testing with teachers, students, and parents.

To do this, we have the following.

PRE-IMPLEMENTATION/Development Phase:

a. Methodology, ethics, MOA, and permission protocols will be finalized.

Ethics:

- Obtain informed consent from participants.
- Ensure confidentiality and anonymity of participants.
- Follow ethical principles and guidelines for research involving human subjects.

Permission protocols:

- Obtain necessary permissions and approvals from relevant authorities such as DepEd Cotabato/MBHTE BARMM and the school where the extension project will be implemented.
- Establish a Memorandum of Agreement (MOA) outlining the roles and responsibilities of all parties involved in the project.

b. Needs assessment

A profiling or needs assessment will be conducted to identify the specific language and cultural context of the students, which can be used in the development of materials that are tailored to their needs. A needs assessment will also be conducted to identify the main difficulties in students in learning math. This will be done through surveys, informal interviews, or online meetings.

IMPLEMENTATION Phase

a. Develop and refine existing instructional materials based on the curriculum and the identified needs of the teachers.

i. Curriculum Alignment: A thorough review of the elementary mathematics curriculum and standards will be conducted to ensure that the instructional materials align with the curriculum. Additionally, the identified needs of the teachers will be taken into consideration during the development and refinement process.

ii. Materials Development: A team of experts in mathematics education and instructional design will be assembled to develop the instructional materials.

iii. Review and Feedback: The instructional materials will be reviewed by the team and feedback will be solicited from teachers and other experts in the field to ensure that the materials are of high quality and effectively meet the needs of the students.

iv. Revisions: Based on the feedback received, revisions will be made to the instructional materials as necessary. This will ensure that the materials are accurate, up-to-date, and aligned with the curriculum.

v. Formatting and Production: The instructional materials will be formatted and produced in a professional manner, using appropriate design and layout techniques to make them visually appealing and easy to use.

vi. Quality Control: Quality control measures will be in place to ensure that the instructional materials are free of errors and meet the standards of excellence.

vii. Pilot Testing: The instructional materials will be pilot tested with a small group of teachers, students, and parents to assess their effectiveness and gather feedback for revisions.

viii. Revisions and Improvements: Based on the feedback, revisions and improvements will be made to the instructional materials as necessary.

b. Validate the instructional materials through pilot testing with teachers, students, and parents.

i. Selection of Pilot Testing Participants: A representative sample of teachers, students, and parents will be selected to participate in the pilot testing of the instructional materials. This sample will be chosen based on the specific language and cultural context of the students and the needs of the teachers.

ii. Preparation: The pilot testing participants will be provided with an overview of the

instructional materials.

iii. Data Collection: Data will be collected through a variety of methods such as observation, interviews, surveys, and assessments. The data will be collected from teachers, students, and parents.

iv. Feedback and Revisions: Feedback from the pilot testing participants will be used to make revisions and improvements to the instructional materials as necessary.

4. Revision and writing the final form

   An online meeting will be regularly scheduled between USM extensionists, and DepEd Cotabato/MBHTE BARMM teachers/representatives to discuss revisions of supplementary materials of topics which are about to be covered in DepEd regular schedule. The materials will be written in manner that can be best understood by the students.

5. The extension project will produce refined versions of supplementary materials in coordination with DepEd Cotabato/MBHTE BARMM teachers, students, and parents.

6. The process will continue until supplementary materials of good quality is produced and uploaded in the page. Enhanced quality of learning in the basic education is expected from this extension project. This project targets wide subscription of teachers.

VALUES EDUCATION/REORIENTATION

Values education and re-orientation can be an important aspect of this extension project to strengthen mother-tongue based education through instructional materials development and capacity building for elementary teachers in the DepEd Cotabato Division.

Values education can be incorporated into the instructional materials and teacher training program to help students develop positive attitudes, beliefs, and behaviors that align with the school's mission and vision. This could include topics such as respect, responsibility, honesty, and cooperation.

Re-orientation can be an important aspect of the project, as it can help to shift the focus of education from a traditional emphasis on rote learning to a more holistic approach that prioritizes the development of critical thinking, problem-solving, and communication skills. This can be achieved through the development of instructional materials that are aligned with the needs of the students and the curriculum and by providing teacher training that focuses on effective teaching strategies, assessment, and curriculum development.

Additionally, involving community members and other relevant stakeholders in the project can help to promote a shared understanding of the importance of mother-tongue based education and the role it plays in preserving linguistic and cultural diversity. This can help to build support for the project and ensure that it is sustainable in the long term.

REPORT WRITING

The final report will have the following methodology.

i. Data Collection: Gather all the data collected during the project including feedback from participants, and any other relevant information.

ii. Report Outline: Develop a clear and concise outline for the report, including the introduction, methodology, results, discussion, conclusion, and recommendations sections.

iii. Writing the Report: Write the report in a clear and concise manner, using appropriate language and formatting. Use tables, figures, and appendices as needed to present the data and results effectively.

iv. Review and Editing: Review the report multiple times to ensure that it is free of errors and that the information is presented clearly and accurately. Have others review the report for feedback and make revisions as necessary.

v. Final Review: Conduct a final review of the report to ensure that all the necessary information is included and that the report is ready for submission.

7. Work Plan

Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Pre-Implementation												
Finalization of methodology, ethics, and permission protocols, MOA												
Conduct profiling or needs assessment												
IMPLEMENTATION												
Development and refining of existing IMs												
Validation of the instructional materials												
REPORT WRITING												
Writing the final report												

Results Framework

Outputs	Outcome	Impact
Developed and validated mathematics instructional materials for mother-tongue based education.	Improved proficiency in the mother tongue among students. Increased use of mother-tongue as a medium of instruction in mathematics classrooms.	Improved mathematics academic performance and learning outcomes for students. Increased cultural pride and self-esteem among students. Stronger linguistic and cultural identity among students. Improved quality of education in the area.

2. Attendance sheet

University of Southern Mindanao
EXTENSION SERVICES CENTER
Kabacan, Cotabato
ATTENDANCE SHEET

ACTIVITY: strengthening mother-tongue based education of elementary teacher in pdpcl Cotabato through instructional materials development and validation
VENUE: GS Hall, USM DATE: APRIL 23, 2024
SPONSORS:

No.	Name	Gender	Designation/ Affiliation	Office/ Unit/ Organization	Mobile Number/ Email Address	Signature
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2.	Sandra A. Nonding	F		Dept of Math/CSM	09206AA2397	
3.	Rhed N. Fernan	M	BSEM - Student	Dept. of CBDEM /ETO	0963[illegible]	
4.	Jeiel C. Dorego	F	BSEM Student	Dept. of CBDEM/ESO	0994 373 4388	
5.	Saquira M. Abdullah	F	BSEM Student	CBDEM /ESO	09463178NR	
6.	Langalen, Princess M.	F	BSEM Student	Dept. of CBDEM /ESO	09381115655	
7.	PAWETA, LEONARDO M.	M	MATH-CSM-USM			
8.	RIOEL S. VALENTON	M	Math - Csm - usm	Math & Stat Dept	09497750905	
9.	Daryl Mae Hamm	F	Math	Math	09506463259	
10.	Fatima M. Afad	F	Teacher-I	MBHTE- BARMM	09105824949	
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13.	BANUHNE L SALAMUAN	F	Teacher -I	MBHTE -BARMM	09064857998	
14.	Muhaimina M. Pakpakan	F	T-III	MBHTE - BARMM	09858411398	
15.	NOOR L. AMON	F	T-I	MBHTE- BARMM	09465782546	

USM-EXT-F02-Rev.3.2021.01.26

CERTIFIED TRUE COPY:
MARGIE N. MOTUAN-GALANG
Chief Administrative Officer
University of Southern Mindanao
Date:

University of Southern Mindanao
EXTENSION SERVICES CENTER
Kabacan, Cotabato
ATTENDANCE SHEET

ACTIVITY:
VENUE: DATE:
SPONSORS:

No.	Name	Gender	Designation/ Affiliation	Office/ Unit/ Organization	Mobile Number/ Email Address	Signature
16.	MIKKO ANGELA M. ELIVAS	F	T-I	MBHTE - BARMM	09853[illegible]947	
17.	JOHANNAE P. TOPINES	F	T-I	MBHTE - BARMM	09178[illegible]947	
18.	ROSHAIDA W. KARENEA	F	T-I	MBHTE - BARMM	09263[illegible]88	
19.	SARAHJEAN A SALAMUAN	F	T-III/TIC	MBHTE - BARMM	09128[illegible]594	
20.	AMELANDA B. VASAN	F	T-I	MBHTE- BARMM	09105040514	
21.	JEZIL ETH R. LICAROS	F	Assoc Prof	Math & Stat Dept./CSM	09120821356	
22.	AIMA JEAN S. GARCIA	F	Assoc Prof	Math & Stat Dept/CSM	09328412468	
23.	JEFFALIE MAE M. GRAU	F	DU	CBDEM/ESO	09477823420	
24.	Lawrence Tandog	M	Prof VI	GS/CSM		
25.	Jonald L. Pimentel	M	Prof VI	Math & Stat.		
26.	MARGARICA J. MACALLON VII	M	ASSOC I	Math & Stat		
27.	Sarah B. Lusanbal					
28.	[illegible] B. [illegible]			MATH & STAT DEPT		
29.	ROLO MABIL	M	ASSO Prof 4	Math & Stat		
30.	[illegible]	M	ASSOC Prof 5	Math and Stat		

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3. Terminal/Narrative Report

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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
Jupiter G. Pilongo
Arnel B. Toledo
Honey Vicent Valle
Members

PARAMETER A: PRIORITIES AND RELEVANCE

University of Southern Mindanao
EXTENSION SERVICES OFFICE
Kabacan, North Cotabato

TERMINAL REPORT

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 April 23, 2024.

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	% Utilized
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%

PARAMETER A: PRIORITIES AND RELEVANCE

University of Southern Mindanao
EXTENSION SERVICES OFFICE
Kabacan, North Cotabato

TERMINAL REPORT

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 April 23, 2024, 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

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TERMINAL REPORT

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.

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University of Southern Mindanao
Date:_____

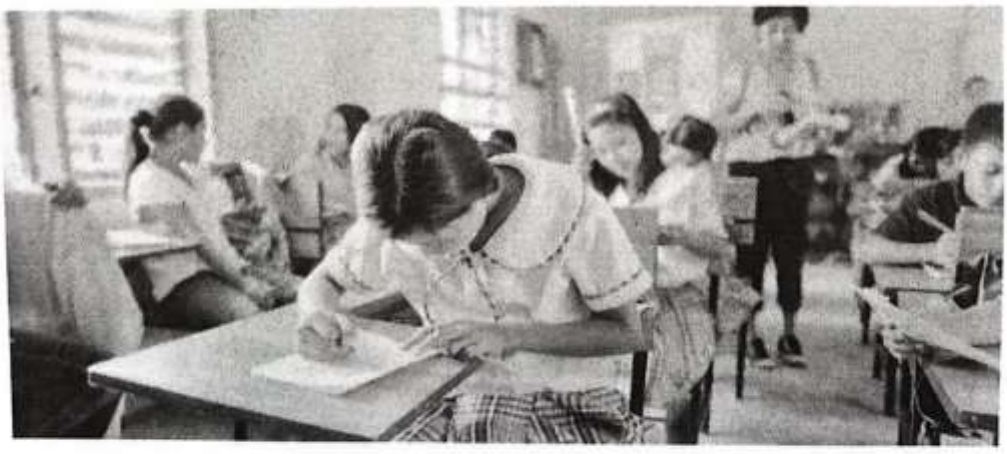
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TERMINAL REPORT

VII. Pictorials



Inception Meeting with Teachers of Nangaan Elementary School



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PARAMETER A: PRIORITIES AND RELEVANCE

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TERMINAL REPORT





Conduct of needs assessment and Pre-test





Visit at Nangaan Elementary School

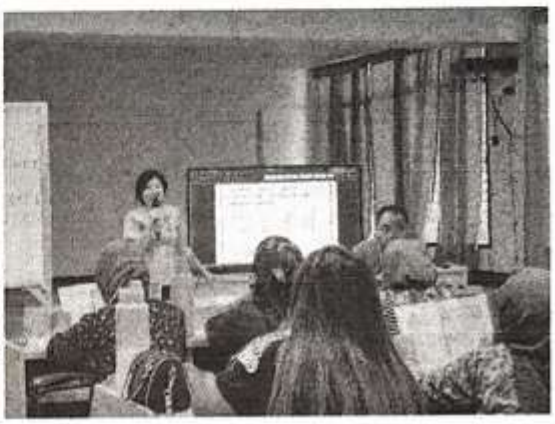
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Training on IM Development and Validation of IM with the resource person Dr. Verzosa.




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

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PARAMETER A: PRIORITIES AND RELEVANCE

Extension Project 2025

Detailed Proposal

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Kabacan, Cotabato
Philippines

EXTENSION SERVICES OFFICE

DETAILED PROPOSAL FOR EXTENSION

A. BASIC INFORMATION	
1. Project Title	Strengthening Barangay High Schools: Validating and Implementing Representation Approach-Based Learning Materials for Independent Study of Mathematics in Remote Schools
Component 1	Component 1. Building Capacity of Teachers in Instructional Development'
Component 2	Component 2. Building Capacity of Teachers in the Conduct of Action Research
Component 3	Component 3. Development and Validation of Representation Approach-Based Learning Materials for Independent Learning of Mathematics
Component 4	Component 4. Implementation of Representation Approach- Based Learning Materials for Improved Learning of Mathematics
2. Proponent/s Indicate Name Academic Rank, Office	Name: PROF. LEORENCE C. TANDOG Designation: Project Leader and Component Leader 3 College/ Unit: Department of Math & Stat/College of Science & Mathematics Name: PROF. LEONARD PALETA Designation: Component Leader College/ Unit: Department of Math & Stat/College of Science & Mathematics Name: PROF. DEBBIE MARIEB. VERZOSA Designation: Component Leader 2 College/ Unit: Department of Math & Stat/College of Science & Mathematics Name: PROF. PHILIP LESTER BENJAMIN & PROF. JUPITER PILONGO Designation: Component Leader 4 College/ Unit: Department of Math & Stat/College of Science & Mathematics
2.1. Email Address	lctandog@usm.edu.ph
2.2. Contact Number	09466115568
3. Lead Unit/College	Department of Math & Stat/CSM
3.1. Collaborating Unit/College	
3.2. Partner Agency	DepEd Cotabato
4. Thematic Area	☑ Quality Learning Skills Development and Literacy ☐ Food Security and Poverty Reduction ☐ Social Development, and Strong Institutions

PARAMETER A: PRIORITIES AND RELEVANCE

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Philippines

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DETAILED PROPOSAL FOR EXTENSION

	☐ Good Health and Well-being ☐ Preservation of Culture ☐ Innovations in Science, Engineering, and Technology ☐ Environmental Protection, Conservation and Risk Reduction ☐ Sustainable Entrepreneurship and Management	
5. **Sustainable Development Goal/s**	☐ No Poverty ☐ No Hunger ☐ Good Health ☑ Quality Education ☐ Gender Equality ☐ Clean Water and Sanitation ☐ Renewable Energy ☐ Good Jobs and Economic Growth ☐ Innovation and Infrastructure ☐ Reduced Inequalities ☐ Sustainable Cities and Communities ☐ Responsible Consumption ☐ Climate Change ☐ Life Below Water ☐ Life on Land ☐ Peace and Justice ☐ Partnership for the Goals	
6. **Sector/Discipline**		
7. **Project Duration**	Start Date: January 02, 2025	Completion Date: December 31, 2025
8. **Project Location / Service Area**	North Cotabato	
9. **Total Budget Requested (Php)**	Php 70,000.00	**Fund Source:** Fund 01

B. TECHNICAL DESCRIPTION
1. **Need-based Rationale** (State rationale based on current set-up, the need, your solution, and connect) Please refer to Magbanua, G.G. (n.d.) Writing a Need-based Rationale for Extension Proposal, *TeknoGiya* University of Southern Mindanao.

PARAMETER A: PRIORITIES AND RELEVANCE

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DETAILED PROPOSAL FOR EXTENSION

Rationale

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). The quality of education in barangay high schools could not be sufficiently maintained due to a lack of experienced teachers and funding (Ishida, 1995) resulting in a lack of quality material resources and infrastructures (Bai, 2023). However, due to the insistent demand of the local communities for secondary education and the pressing need to improve access to education in remote areas, barangay high schools continued to operate and increased in number.

Teacher shortage is a critical issue in many rural areas around the world. This shortage is magnified in barangay high schools which serve as entry employment for inexperienced teachers who at the same time are forced to teach out-of-field subjects due to teacher shortages or limited class sections to handle in remote schools. Covid 19 exposed the challenges of the digital divide and students in barangay high schools were further disadvantaged because they had no access to materials and tools needed for remote and independent learning (Gutierrez and Bilefsky, 2021). These challenges continue this post-pandemic as DepEd schools continued cancelation of face-to-face classes or shortened class periods during extreme weather conditions.

Self-regulated and independent study is vital in cases where teachers are not available to facilitate learning. Effective learning materials 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. 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).

The results of our study showed significant improvements in students' understanding of mathematics and science concepts. Anchoring from the positive outcome of the research project, the faculty and graduate students of PhD Ed and MST Mathematics programs engaged lesson study, produced research lessons and Learning Activity Pages (LAPs) that use various representation approaches. The learning resources are designed in a manner that students can learn essential concepts and skills with minimal support or even without the assistance of a teacher. The initiative established a structure for a Professional Learning

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DETAILED PROPOSAL FOR EXTENSION

Community (PLC) where teachers and experts work collaboratively for professional development and improved quality of learning. This endeavor provided a venue for sharing and transfer of pedagogies. The materials are now ready for validation and use by target students, thus this project.

The proposed implementation of representation approach-based learning materials for independent study of mathematics concepts aims to address the scarcity of quality teachers and other unique educational challenges faced by students in barangay schools and promote equitable access to quality education for all Filipino students regardless of geographic location. The rationale behind this extension project is rooted in several key considerations:

1. **Mitigating the effect of teacher scarcity/unavailability.** In the absence of quality teachers, students can utilize carefully designed self-instructional Learning Activity Pages (LAPs) to develop essential mathematics skills and concepts.
2. **Enhancing learning outcomes.** The learning material allows students to learn at their own pace ensuring the concept is fully grasped or the skill is learned before moving on to the next material. Students can fit their learning experience to their needs that could potentially lead to better learning commitment and engagement. It also encourages collaborative learning among students fostering a community where knowledge and skills are collectively constructed and shared.
3. **Promoting lifelong learning.** The materials do not focus only mathematics contents instead uses these contents as tools to develop important mathematics skills such as pattern recognition, measurement, number sense and problem solving; and soft skills such as critical thinking, and adaptability. Development of traits that allow students to learn new information and skills on their own is a key competency in our rapidly changing society. Self-guided study improves capabilities, enhances self-efficacy and unlocks student's full potential.
4. **Improving the status of education in barangay high schools.** Barangay high schools remain the least option for students. Most are underpopulated because the quality of instruction continues to be below par with municipal or national high schools. These schools serve the underprivileged and marginalized population and deserve all the support a university can extend. The learning materials can help improve the quality of mathematics learning in remote schools. Empowering barangay high schools will boost the image and credibility of this type of school as a provider of basic education. In the long term, an improved image of barangay high schools can offer a solution to the continuous overcrowding of municipal and national high schools.

Overall, this extension project aims to strengthen education in barangay high schools through the development of quality material resources for independent study of mathematics thereby improving access to quality education among marginalized communities.

2. **Objectives** (State specific objectives based on Knowledge, Skills, and Attitude/Practice (KSA/P)

General objective: This project aims 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 learning materials.

Specific objectives:

1. Strengthen math teachers' capability to develop representation-based self-instructional materials, and conduct action research
2. Engage teachers in collaborative work of developing and validating learning materials.
3. Enhance mathematics performance and numerical literacy among barangay high school students through implementation of developed learning materials
4. Determine if there is a significant improvement in students' performance and mathematics skills before and after use of developed instructional materials.

PARAMETER A: PRIORITIES AND RELEVANCE

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EXTENSION SERVICES OFFICE

DETAILED PROPOSAL FOR EXTENSION

3. **Expected Output/s** (State in quantifiable form)

At the end of the extension activity, it is expected that:

1. Teachers are empowered with knowledge and skills in designing and developing material resources that are effective for students' self-guided study, and in the conduct of action research
2. A professional learning community is sustained where teachers and experts will continue to work collaboratively and share pedagogies for improved learning quality.
3. Learning Activity Pages (LAPs) are created that are tailored to mathematical abilities and needs for independent study of target clients.
4. LAPs are validated, pilot-tested, and packaged and/or lesson exemplars are implemented for online uploading.
5. LAPs are used to supplement learning of important mathematics content and skills for improved numerical literacy among students in barangay high schools.
6. Students in barangay high schools improved in terms of mathematics performance and numerical literacy.
7. Final versions of LAPs are copyrighted.

4. **Review of Literature** (Present related research/projects/activities that have been conducted).

5. **Results Framework**

Implementation			Results	
Inputs (State the materials needed in the conduct of activities)	**Activities** (State the major activities of the project to attain the objectives)	**Outputs** (State the expected quantifiable outputs based on the activities conducted)	**Outcomes** (State the objectives of the project based on KSA/P of the partner-beneficiaries)	**Impact** (State the possible impact of the project either of the following: socio-economic, peace and order, environment, literacy and numeracy, etc.)

PARAMETER A: PRIORITIES AND RELEVANCE

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EXTENSION SERVICES OFFICE

DETAILED PROPOSAL FOR EXTENSION

6. **Methodology** (Brief description of how the project will be implemented to attain the objectives).

6.1. Pre-implementation (Social Preparation)

Development Phase:

1. **Baseline data**
   - current mathematics capabilities of students in Barangay High Schools.
   - existing materials/learning resources available in barangay high schools
   - performance of barangay high schools in division/nationwide evaluations from secondary sources.
   - number of school graduates who continued to the next level of education (ex. junior to senior HS) or admission rate of graduates to universities.
2. **Needs assessment**
   - specific needs of students that can be addressed through material development.
   - weaknesses of students that should be considered when designing the LAPs
   - contextual factors to learning.
3. **Brainstorming, initial planning and training**
   - Teacher-participant orientation
   - Brainstorming on topics, skills, and lesson design
   - Initial planning, topic assignment, and timelines
   - Training of teacher participants
4. **Development, validation, and Refinement of developed LAPs**
   - Validation of developed LAPs
   - Pilot-testing of developed materials
   - Refinement based on validation and pilot testing
   - Development of additional learning materials based on needs
5. **Packaging and reproduction of LAPs**
   - Final lay-out and graphic design
   - Printing and packaging of final version of LAPs
   - Reproduction of LAPs for implementation

PARAMETER A: PRIORITIES AND RELEVANCE

6.2. Implementation (Community Development)

Implementation Phase:

- Provide ongoing support to school heads and teacher participants during the implementation of the materials in the classroom.
- Immediate evaluation of students' outputs (answers in the LAPs) as basis of continuing learning support to students and lesson refinement
- Monitor and evaluate the implementation of the materials through teacher and student feedback.

Evaluation Phase:

- Assess the effectiveness of the extension project in improving student learning outcomes.
- Assess the effectiveness of the developed instructional materials in fostering lifelong learning.
- Analyze the impact of the developed materials in the school performance and in addressing some challenges of barangay high schools particularly in mitigating teacher scarcity

To do this, we have the following.

Development Phase:

1. **For baseline data we will**
   - Use researcher-made mathematics achievement test and standardized (if available) numerical literacy test to gather data on current mathematics capabilities of students in Barangay High Schools.
   - Conduct ocular visit and interview with teachers and school heads about existing materials/learning resources available in barangay high schools
   - Use available secondary sources to describe the performance of barangay high schools in division/nationwide evaluations.
   - Survey on the number of school graduates who continued to the next level of education (ex. junior to senior HS) or admission rate of graduates to universities.
2. **For needs assessment, we will**
   - Conduct diagnostic or pretest to identify specific needs of students that can be addressed through material development.
   - Interview teachers to identify weaknesses of students that should be considered when designing the LAPs.
   - Site visit to the target school and interview with school heads to identify other contextual factors that may be considered during project implementation.

PARAMETER A: PRIORITIES AND RELEVANCE

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WORK PLAN SCHEDULE

PROJECT TITLE:	Strengthening Barangay High Schools: Validating and Implementing Representation Approach-Based Learning Materials for Independent Study of Mathematics in Remote Schools						
COLLEGE/ DEPARTMENT/ UNIT:	CSM/Math & Stat Dept. in collaboration with GS/MST and PhD Ed Math Programs						
PROPONENT (S):	Leorence Tandog						
Total Duration (in months)	12 months	**Planned Start**	January 2025	**Planned End**	December 2025		
Activities	**Expected Outputs**	**Responsible Person**	**Schedule of Activities** 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	**Milestone (%)**
1. Building Capacity of Teachers in Instructional Material Development (one day)	-30 teachers capacitated in IM development -design and sample lay-out of IM	L Paleta (RS) DB Verzosa (RS) L Tandog (RS) J Pilongo (F) R Valenton (F) S Nanding (F) PL Benjamin (M)	• Seminar-workshop • Initial Planning • Brainstorming				10%
2. Development of Representation Approach-Based Learning Materials for Independent Learning of Mathematics (two months)	-20 Learning Mathematics Activity Pages (LMAPS) produced thru lesson study	L Tandog (RS) DB Verzosa (RS) L Paleta J Pilongo (F) R Madio (F) S Nanding (F) PL Benjamin (F) AJ Garcia (F) DM Mamon (F)	• Brainstorming • Lesson Study • Writing • Design and Lay-out of LMAPS				50%

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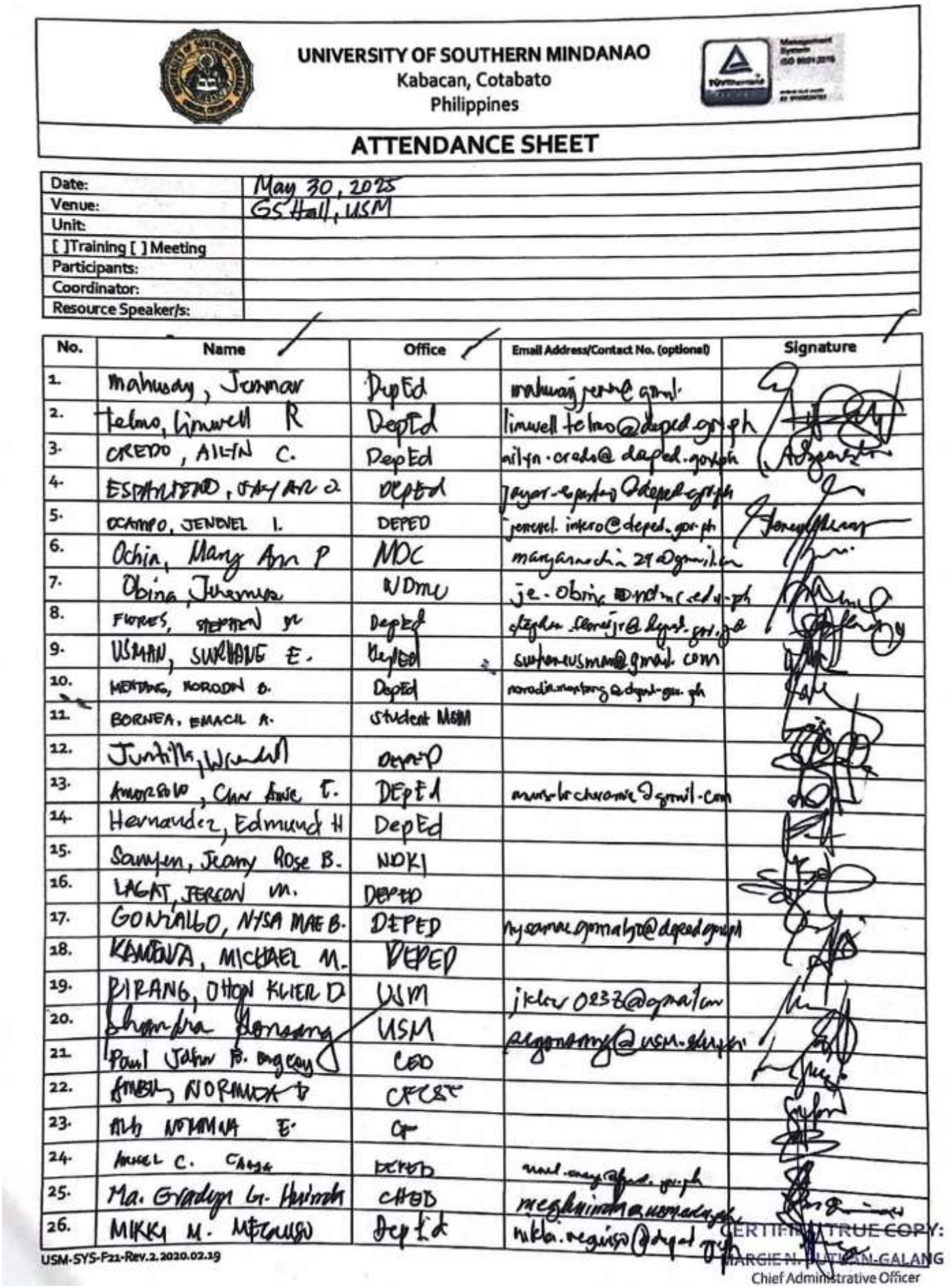
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WORK PLAN SCHEDULE

3. Validation and Packaging of Representation Approach-Based Learning Materials for Independent Learning of Mathematics (two months)	-20 validated and packaged LMAPS	J Pilongo (RS) L Tandog (RS) DB Verzosa (RS) L Paleta (F) R Valenton (F) S Nanding (F) AJ Garcia (F) DM Mamon (F) L Yabes (F)		• Validation & Pilot testing of LMAPS • Revision and Packaging of LMAPS			70%
Building Capacity of Teachers on Action Research (one day)	-10 partner teachers capacitated to implement action research using LMAPS	DB Verzosa (RS) L Tandog (RS) J Paleta (F) R Madio (F) R Valenton (M)		• Seminar-workshop • Initial Planning for action research			80%
Implementation of Representation Approach-Based Learning Materials for Improved Learning of General Mathematics (two months)		PL Benjamin (RS) L Tandog (F) DB Verzosa (F) J Pilongo (F) R Madio (F)			• Deployment & use of LMAPS by target beneficiaries • Pretest & Posttest	• Data analysis • Report writing & finalization	100%

PARAMETER A: PRIORITIES AND RELEVANCE

Attendance



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ATTENDANCE SHEET

Date:	May 30, 2025
Venue:	GS Hall, USM
Unit:	
[ ]Training [ ] Meeting	
Participants:	
Coordinator:	
Resource Speaker/s:	

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4.	ESPAÑOLETO, [illegible]	DEPED	[illegible]	
5.	OCAMPO, JENDIEL I.	DEPED	jendiel.intero@deped.gov.ph	
6.	Ochia, Mary Ann P	MDC	maryannochia29@gmail.com	
7.	Obina, Jhermina	WDMU	je.obina@[illegible]	
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11.	BORNEA, ISMAEL A.	Student MSM		
12.	Juntilla, [illegible]	DEPED		
13.	Amorado, Chin Anie T.	DEPED	anniebchinie@gmail.com	
14.	Hernandez, Edmund H	DepEd		
15.	Sanjen, Jeany Rose B.	NDKI		
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Kabacan, Cotabato
Philippines

ATTENDANCE SHEET

Date:	
Venue:	
Unit:	
[ ]Training [ ] Meeting	
Participants:	
Coordinator:	
Resource Speaker/s:	

No.	Name	Office	Email Address/Contact No. (optional)	Signature
27.	Ramirez, Mary LJ C.	DEPED		
28.	Taborada, Jamaica H.	DEPED		
29.	Valencia, Apple Mae R.	Deped		
30.	Besana, Leizl S.	Deped		
31.	BANUER, Hannah Faith S.	New Grad		
32.	HERRERA, DAVE MARK A.	STUDENT		
33.	FLORES, BRYAN JOHN C.	STUDENT		
34.	LAGAÑA, MARY ALETH D.	DEPED		
35.	JURADO, MARIA CHRYSOLITE V.	STUDENT		
36.	RECORTE, RESHYL	STUDENT		
37.	ADTO, ELAINE GRACE	U- STUDENT		
38.	BERNARDINO, RHEA CAINE	SPED SKSU		
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42.	KAMENSA, MICHAEL M.	DEPED		
43.	Pascua, Jenalyn D.	DEPED		
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45.	MARIA THERESA E. SERANTONE	DepEd		
46.	Maricel I. Torreja	Peped		
47.	Abo, Jehad H.	MSU-Mag.		
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Philippines

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Venue:	
Unit:	
[ ]Training [ ] Meeting	
Participants:	
Coordinator:	
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Narrative/Terminal Report

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

Project members: *Leorence Tandog, Sandra Nanding, Philip Lester Benjamin, Jupiter Pilongo, Rowel Madio, Lawton John Yabes, Dominic Carajay, Lidey Sultan, Debbie Marie Verzosa, Jonald Pimentel, Leonard Paleta, Anna Jean Garcia, Daryl Mae Mamon, Jeaneth Licaros, Roel Valenton, Jennifer Pama, Arnel Toledo, DOST-SEI Project Strand-N Scholars, MST and PhD Ed Math Students*

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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Kabacan, Philippines

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	
Email Address	lctandog@usm.edu.ph	
Contact Number	09466115568	
4. Lead Unit/College	College of Science and Mathematics	
Collaborating Unit/College	DepEd Cotabato Division	
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 ☐ Industry Innovation & Infrastructure	☐ 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
9. Project Duration	One year	
10. Project Location	Matalam, Cotabato	
11. Total Budget	PhP 60,000	

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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).

2. 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.

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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).

3. 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.

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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.

4. 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.

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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.

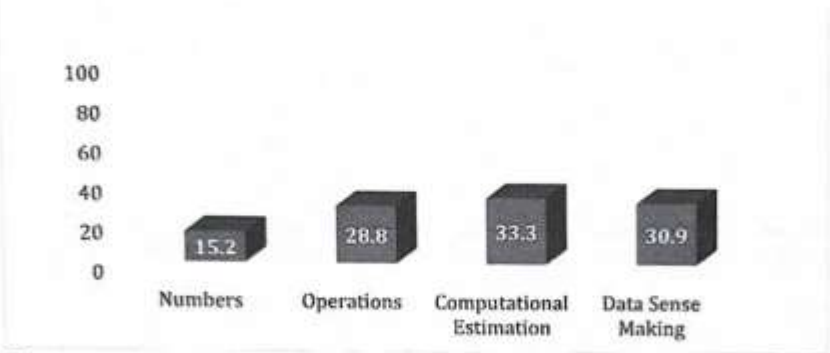


Figure 4. Average Percent Scores of Students in Diagnostic Test Items

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.

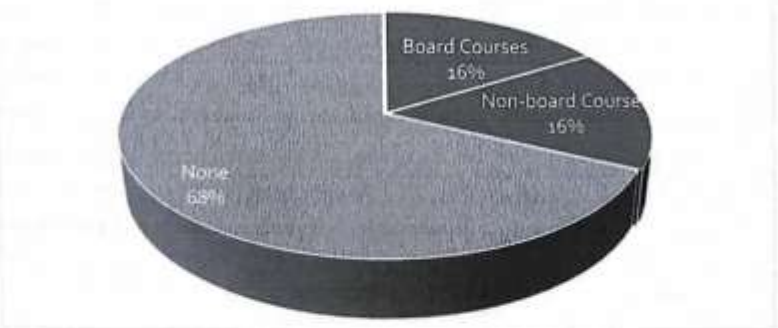


Figure 5. Percent Distribution of Respondents According to their Potential Performance in USM-CEE

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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.

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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.

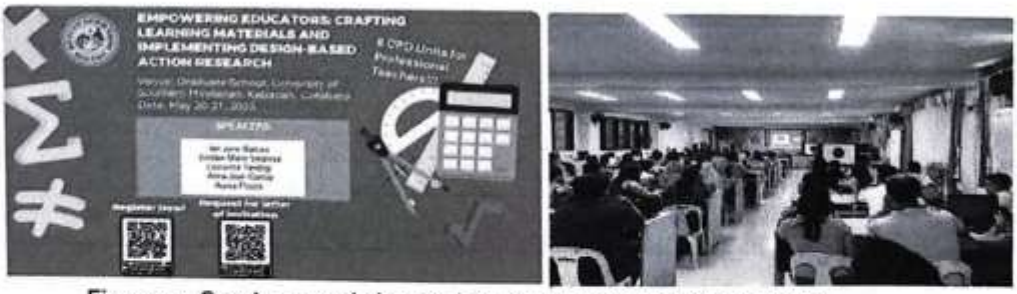


Figure 9. Seminar-workshop publication material and attendees

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.

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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

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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

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(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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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.

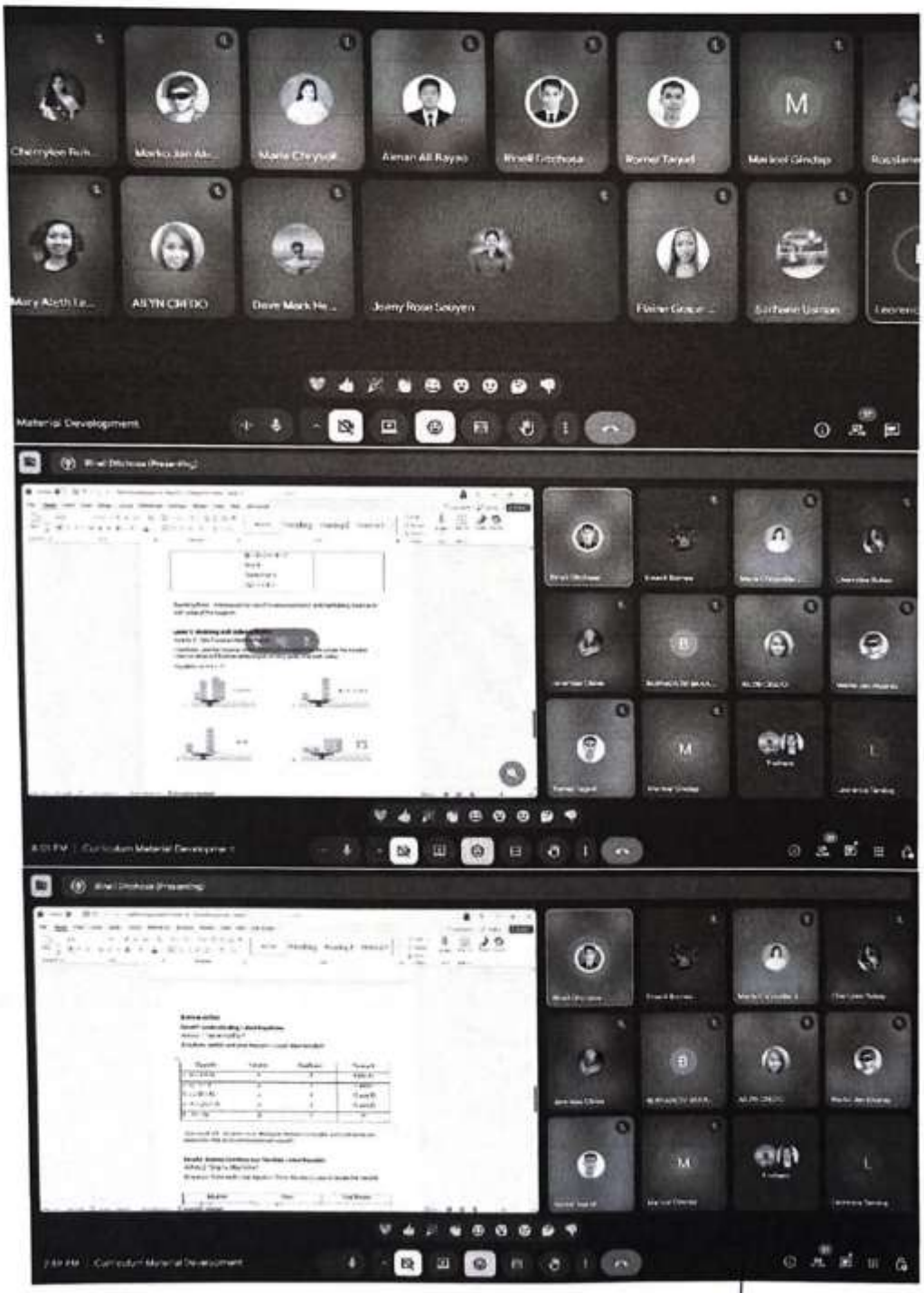


Figure 15. Online meetings and presentations of developed LMs

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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.



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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.

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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



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.

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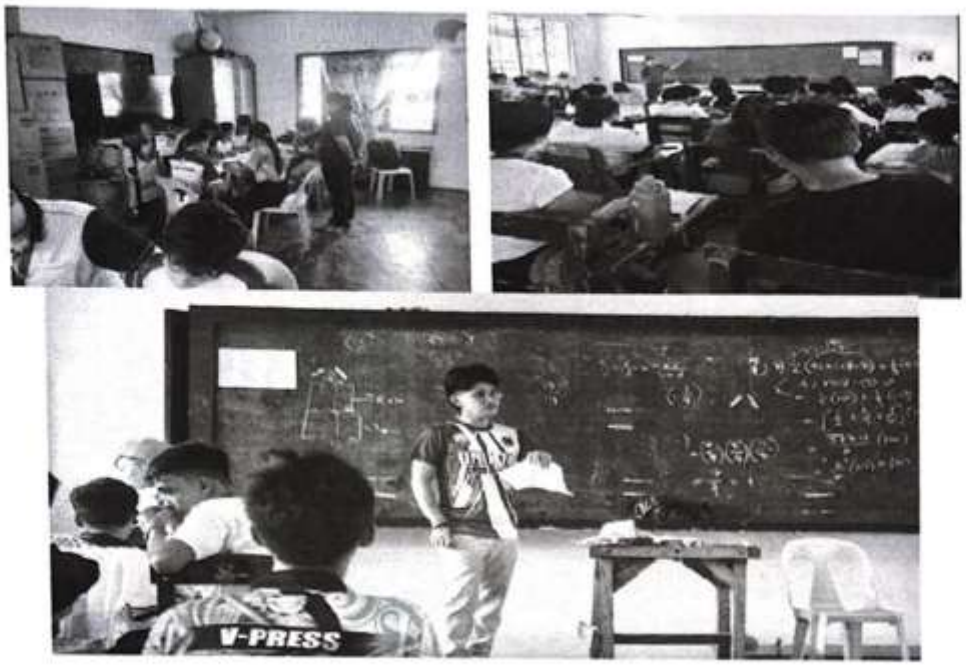


Figure 17. USM conducting a review for college admission tests

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

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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

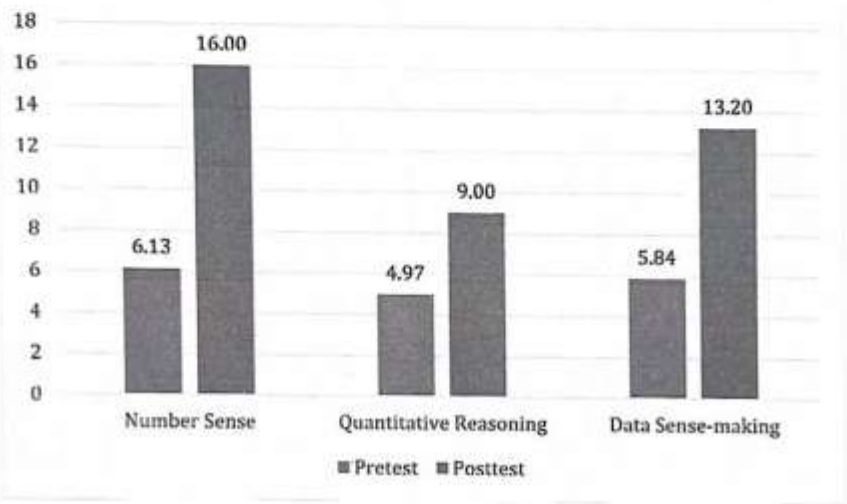
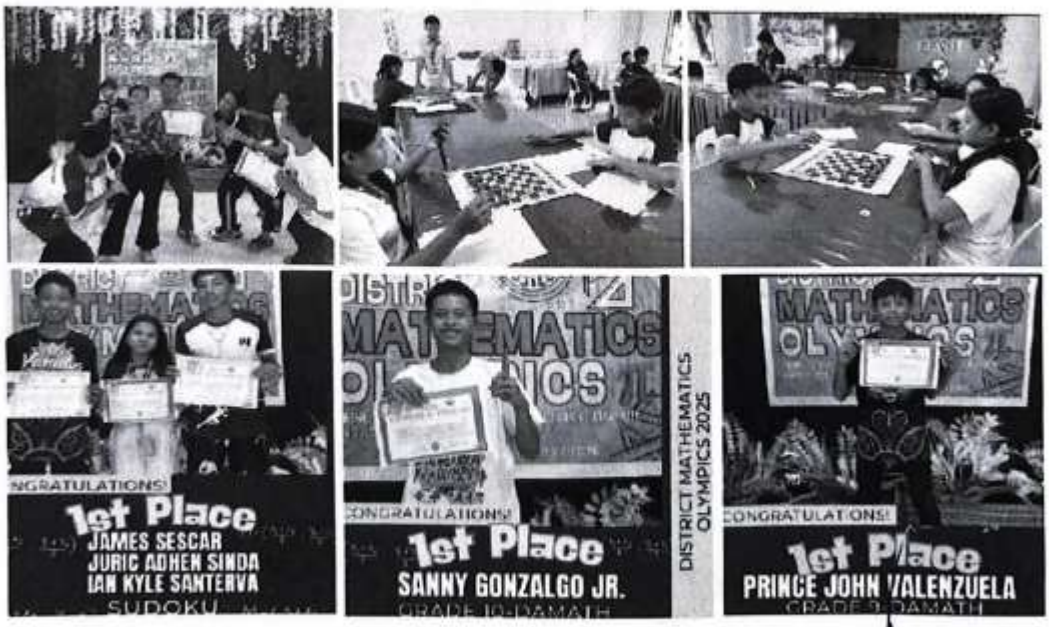


Figure 18. Pretest and Posttest performance of students

2. **Improved** ranking in mathematics competitions



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PARAMETER A: PRIORITIES AND RELEVANCE

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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Dave Mark A. Herrera
Ramasith I. Bañagos
Lourence C. Tandog
University of Southern Mindanao

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 assess 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 (Langrall 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., 2019; Sadi and Sebe, 2019; Ng & Chew, 2020). 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 (Paz, 2020; Jansen 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; Montrady, 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 (Seedler et al., 2017; Sathyanesan 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

Figure 20. Research article from extension project for journal publication

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Gutierrez, J., & Bilefsky, D. (2021). With schools closed, Covid-19 deepens a Philippine education crisis. Retrieved October 19, 2021, from https://www.nytimes.com/2021/09/13/world/asia/philippines-students-remote-covid.html

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TO WHOM IT MAY CONCERN:

THIS IS TO CERTIFY that the extension project titled **"Strengthening Barangay High Schools: Validation and Implementation of Representation-Based Learning Materials for Independent Study of Mathematics in Remote Schools (AY 2025-2026)"**, implemented by the University of Southern Mindanao at Salvacion High School, Matalam, Cotabato, has fully met and satisfied all the prescribed guidelines, standards, and requirements set forth under **JC3 CMO No. 18, Series of 2025.**

THIS IS FURTHER TO CERTIFY that, having successfully fulfilled the prerequisite monitoring and implementation compliance metrics under the aforementioned Joint Circular/CMO guidelines, the project was deemed **ELIGIBLE** for the conduct of the official Client Satisfaction Survey (CSS).

THIS LIKEWISE CERTIFIES that the **Terminal Report** for the project was officially completed, submitted, and duly received on time by the **Extension Services Office** in accordance with institutional schedules and project reporting timelines.

The project obtained a total of **87.2 points out of the maximum score of 100 points,** based on the results of the official Client Satisfaction Survey (CSS) conducted among the target beneficiaries.

Attached herewith is the official summary of the CSS Results conducted among the target beneficiaries.

GLYN B. GABANO-MAGBANUA

Director, Extension Services Office

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Chief Administrative Officer
University of Southern Mindanao
Date:_____

I.2. The extension projects and activities complement the curriculum of the Mathematics/ Applied Mathematics program under review.

❖ Curriculum

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

COLLEGE OF SCIENCE AND MATHEMATICS
Bachelor of Science in Applied Mathematics (BSAM)
Revised/New Curriculum c based on CMO No. 48 s.2017, CMO No. 20 s. 2013 and CMO No. 39 s. 2021
BOR Res. No. 67-D, Series of 2025
Effective AY 2025 - 2026

First Year – First Semester

Course Code	Course Title	Lec	Lab	Unit Credit	Pre-requisite
AMath01	Calculus 1	4	0	4	
AMath04	Fundamentals of Computing 1	2	3	3	
AMath07	Fundamental Concepts of Mathematics	1	0	1	
GE01	Understanding the Self	3	0	3	
GE02	Readings in Philippine History	3	0	3	
GE03	The Contemporary World	3	0	3	
GE04	Math in the Modern World	3	0	3	
PE01	PATHFit1: Movement Competency Training	2	0	2	
NSTP01	Civic Welfare Training Service 1/ Reserved Officers Training Corps 1	3	0	3	
	TOTAL	26	3	27	

First Year – Second Semester

Course Code	Course Title	Lec	Lab	Unit Credit	Pre-requisite
AMath02	Calculus 2	4	0	4	AMath01
AMath05	Fundamentals of Computing 2	2	3	3	AMath04
AMath06	Abstract Algebra	3	0	3	
AMath09	Linear Algebra	3	0	3	
PhySci01 Lec	General Physics 1	3	0	3	
PhySci01 Lab	General Physics Lab 1	0	3	1	
GEMST01	Environmental Science	3	0	3	
PE02	PATHFit2: Exercise-based Fitness Activities	2	0	2	PE01
NSTP02	Civic Welfare Training Service 2/ Reserved Officers Training Corps 2	3	0	3	NSTP01
	TOTAL	23	6	25	

First Year – Summer/Midyear

Course Code	Course Title	Lec	Lab	Unit Credit	Pre-requisite
AMath03	Calculus 3	4	0	4	AMath02
GEMST03	Living in the IT Era	3	0	3	
	TOTAL	7	0	7	

Second Year – First Semester

Course Code	Course Title	Lec	Lab	Unit Credit	Pre-requisite
AMath10	Probability	3	0	3	AMath03
AMath13	Discrete Mathematics	3	0	3	
AMath12	Advanced Calculus 1	3	0	3	AMath03
AMath15	Operations Research 1	3	0	3	AMath05, AMath09
GE05	Purposive Communication	3	0	3	
GE06	Art Appreciation	3	0	3	
GE07	Science, Technology and Society	3	0	3	
PE03	PATHFit3: Menu of Dance, Sports, Martial Arts, Group Exercises, Outdoor and Adventure Activities	2	0	2	PE02
	TOTAL	23	0	23	

Second Year – Second Semester

Course Code	Course Title	Lec	Lab	Unit Credit	Pre-requisite
AMath08	Differential Equations 1	3	0	3	AMath03
AMath17	Mathematical Modeling	3	0	3	AMath08
AMathElec05	Graph Theory and Applications	3	0	3	
AMathElec03	Time Series Analysis	3	0	3	AMath10
AMathElec04	Applied Multivariate Analysis	3	0	3	AMath10
AMathUT01	Undergraduate Thesis 1	2	0	2	
AMathChem01	General Chemistry 1	3	3	3	
GE09	The Life and Works of Rizal	3	0	3	
PE04	PATHFit4: Menu of Dance, Sports, Martial Arts, Group Exercises, Outdoor and Adventure Activities	2	0	2	PE03
	TOTAL	24	3	25	

Second Year – Summer/Midyear

Course Code	Course Title	Lec	Lab	Unit Credit	Pre-requisite
AMathElec06	Free Elective 1	3	0	3	AMath10
AMathBioSci01	General Biology	3	0	3	
GE08	Ethics	3	0	3	
	TOTAL	9	0	9	

PARAMETER A: PRIORITIES AND RELEVANCE

Third Year – First Semester

Course Code	Course Title	Lec Hours	Lab Hours	Unit Credit	Pre-requisite
AMath14	Numerical Analysis	3	0	3	AMath03, AMath05
AMathElec03	Real Analysis	3	0	3	AMath12
AMathElec07	Free Elective 2	3	0	3	
AMathUT02	Undergraduate Thesis 2	2	0	2	AMathUT01
GEAH02	Philippine Popular Culture	3	0	3	
	TOTAL	14	0	14	

Third Year – Second Semester

Course Code	Course Title	Lec Hours	Lab Hours	Unit Credit	Pre-requisite
AMath13	Statistical Theory	3	0	3	AMath10
AMath16	Theory of Interest	3	0	3	
AMathElec05	Mathematical Biology	3	0	3	AMath08
AMathUT03	Undergraduate Thesis 3	2	0	2	AMathUT02
	TOTAL	11	0	11	

SUMMARY		
CURRICULUM COMPONENT	CMO UNITS	USM UNITS
General Education Courses (including Life and Works of Rizal)	36	36
PE and NSTP Courses	14	14
Institutional GE Courses	-	-
Professional Courses	-	-
Elective Courses	21	21
Major Courses	51	54
Undergraduate Thesis	3	6
Non-math Foundational Courses	10	10
(Insert additional components as defined in the CMO)		
TOTAL UNITS	135	141

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USM President

Recommending Approval for Notation:

ENGR. JHAN JKEM B. FONTANILLA
Education Supervisor II

❖ Learning Materials Developed (Extension Project)

READING AND WRITING NUMBERS



Activity 1: Writing Big Numbers

1. The given numeral **9672185734** can be written in **Standard Form** as follows:
   a. Group the digits into periods of three digits from right to left, separated by a comma: **9,672,185,734**
   b. Each period can be separated by a space instead of a comma **9 672 185 734**
   c. **9 672 185 734** has four periods.
2. The numeral **755780986145** can be written in **Standard Form** as _____ or _____.



Activity 2: Reading Big Numbers

1. We read the numeral **9 672 185 734** by labeling each period and reading the digits with each period from left to right, followed by the name of the period.

Numeral		9	6	7	2	1	8	5	7	3	4
Period	Billion		Million			Thousand			Unit		

Therefore, **9 672 185 734** is read as **9 billion, 672 million, 185 thousand, 734**

2. We read the numeral **755 780 986 145** as _____.

Numeral	-	-	-	-	-	-	-	-	-	-	-	-
Period	Billion			Million			Thousand			Unit		

3. We read the numeral **98 768 335 369** as _____.



Activity 3: Let us practice writing and reading numerals.

Numeral	Standard Form	# of periods	Periods (from right to left)	How to read
185734	185 734	two	thousand, unit	185 thousand, 734
879252456				
	27 487 117			
		four		
				78 billion, 134 million, 62 thousand, 94

UNDERSTANDING PLACE VALUE



Activity 1: Filling the Gaps: Values of Digits

1. Look at the numeral given: **879 672 185 734**

Numeral	8	7	9	6	7	2	1	8	5	7	3	4
Place Value	Hundred	Ten	One	Hundred	Ten	One	Hundred	Ten	One	Hundred	Ten	One
Period	Billion			Million			Thousand			Unit		
Value of Digit	8 Hundred Billion or 800 000 000 000	7 Ten Billion or 70 000 000 000	9 One Billion or 9 000 000 000	6 Hundred Million or 600 000 000	7 Ten Million or 70 000 000	2 One Million or 2 000 000	1 Hundred Thousand or 100 000	8 Ten Thousand or 80 000	5 One Thousand or 5 000	7 Hund-red or 700	3 Tens or 30	4 Ones or 4

2. Match the given numeral **97 594 588 972** to its correct period and value of digit.

Numeral												
Place Value	Hundred	Ten	One	Hundred	Ten	One	Hundred	Ten	One	Hundred	Ten	One
Period	Billion			Million			Thousand			Unit		
Value of Digit												



Activity 2: Let us fill in the table by identifying the digits, their place values, and the value of each digit.

Numeral	Digit	Place Value of the Digit	Value of the Digit
1 982	**8**	**Tens**	**80**
4 269			9
16 943	6		
72 531		Hundreds	
269 836			200 000
743 291		Ten Thousands	
3 719 045	3		

Activity 3: Let us write the standard form of the following.

1. (9 x 10 000) + (8 x 1 000) + (6 x 100) + (4 x 10) + (1 x 1) = **98 641**
2. (_____) + (_____) + (_____) + (_____) = **59 406**
3. (8 x 100 000) + (_____) + (7 x 100) + (_____) + (3 x 1) = **810 763**
4. (1 x 1 000) + (_____) + (2 x 10) + (3 x 1 000 000) + (_____) = **3 291 010**
5. (3 x 100) + (7 x 10 000 000 000) + (4 x 100 000) + (7 x 1 000) + (7 x 10) = _____

Activity 4: Exploring Number Ranges

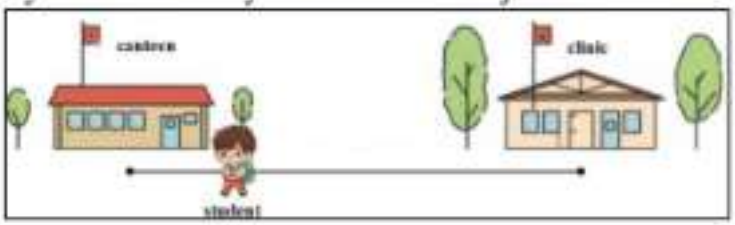
A. Let us complete the table by identifying the range in which each numeral belongs.

	RANGE			
Numerals	**Tens**	**Hundreds**	**Thousands**	**Ten Thousands**
13 859	13 850 – 13 860	13 800 – 13 900	13 000 – 14 000	10 000 – 20 000
21 193				
		34 600 – 34 700		
	49 340 – 49 350			
			58 000 – 59 000	

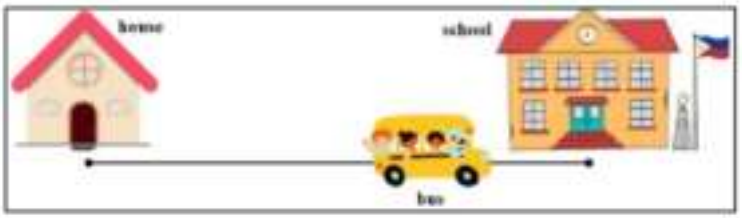
B. The possible range in ten thousands of the following numerals **1 235 025**; **1 237 659**; and **1 239 901** is _____

Activity 5: Closer to Which?

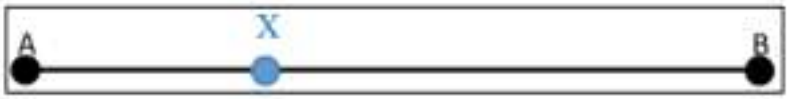
A. Let us identify which boundary is nearer to the object.



Answer: The student is nearer to the canteen.



Answer: The bus is _____.



Answer: _____

B. Let us round off each number to the nearest place value indicated in the underlined digit by identifying the left and right boundaries of the range and deciding which boundary is nearer to the number.

Number	Round off to the nearest	Left Boundary	Right Boundary	Nearer Boundary
3 784	**Tens**	**3 780**	**3 790**	**3 780**
15 729				
	Ten Thousands			10 000
		27 400		
			2450	

C. Let us round each number to the nearest ten, hundred, and thousand.

Number	Tens Nearest to Me	Hundreds Nearest to Me	Thousands Nearest to Me
1 562	**1 560**	**1 600**	**2 000**
32 854			
		25 900	
	8 260		
		13 600	
			1 522 000
	13 890 580		
		21 102 400	
			391 093 000

1. The number 370 is the result of rounding to the **nearest tens**. What is the original number?
   a. 363 b. 364 c. 369 d. 376

2. Which of the following is the **best estimate** for 11 936?
   a. 11 940 b. 11 900 c. 12 000 d. 10 000

3. The height of Mt. Apo is 9 692 ft. Which of the following is the **best estimate** for its height?
   a. 10 000 b. 9 700 c. 9 690 d. 9 600

4. Which of the following is the **best estimate** for 13 897 + 12 514?
   a. 14 000 + 13 000
   b. 13 900 + 12 500
   c. 13 900 + 12 510
   d. 13 800 + 12 500

5. Rounded to the nearest 100 kg, the weight of a cow was recorded as 500 kg. What might have been the **actual weight** of the cow?

   Answer: _____

PARAMETER A: PRIORITIES AND RELEVANCE

Activity 6: Estimating Products

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



A cat lives about 11 years

There are 365 days in a year, which is approximately 370 days.
11 × 370 = **4 070 days**

400 days	4 000 days	40 000 days	400 000 days

A cat lives for about 4 000 days



A chicken lives about 8 years

2 000 days	20 000 days	200 000 days	2 000 000 days



A dog lives about 14 years

50 days	500 days	5 000 days	50 000 days

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: _____

PARAMETER A: PRIORITIES AND RELEVANCE

ORDER OF OBJECTS

Activity 1: Identifying orders on the line

Let us identify order and how many are ahead, behind, and in between.

Order	1	2	3	4	5	6	7	8	9	10
Name	Sheldon	Howard	Juliet	Amy	John	James	Raj	Annie	Karen	Jane



A. The first in the line is **Sheldon**.
B. The fifth in the line is _____.
C. Annie is in _____ order on the line.
D. There are **two** students ahead of _____.
E. Sheldon and _____ are ahead of Amy.
F. There are **three** students behind of Raj.
G. There are _____ students behind of James.
H. Amy and Raj are _____ of Howard.
I. There are **two** students between Amy and Raj.
J. There are _____ students between John and Jane.
K. John is between Juliet and _____.
L. **Howard** is in second order on the line.
M. The last in the line is _____.
N. Karen is in _____ order on the line.
O. There are ___ students ahead of John.

Activity 2: What Comes Before and After?

Before	# of counts	After
670	**1 count**	**671**
11 999	1 count	
	1 count	**5 000 000 000**
13 299	5 counts	
	5 counts	**20 000**
19 297	5 counts	
	10 counts	**2 001 282 007**
11 991	10 counts	
	100 counts	**14 001**
3 000 002 901	100 counts	

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 smallest 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?



PARAMETER A: PRIORITIES AND RELEVANCE



Activity 3: Forming the Nearest Number

1. Let us use the given digits to create a number as close as possible to the target number.

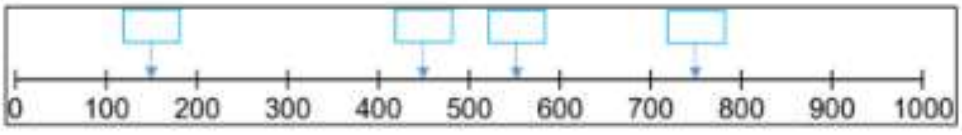
Given digits	Closest to 200	Closest to 1 000	Closest to 5 000
1, 5, 7, 3, 2, 9	197	975	5 123
1, 9, 6, 2, 8, 0			
2, 3, 1, 8, 5, 7			

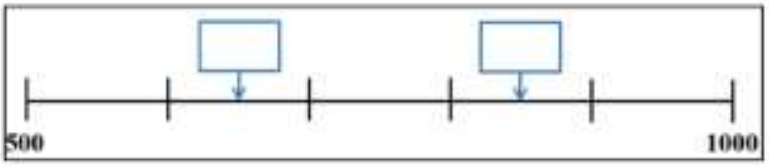
2. Swap a pair of digits in **17 235** to make it closer to **15 000**, which digit would you change and why?
   Answer: _____
3. Someone picked **9 357** instead of **9 753** as the closest number to **10 000**. How would you explain their mistake?
   Answer: _____

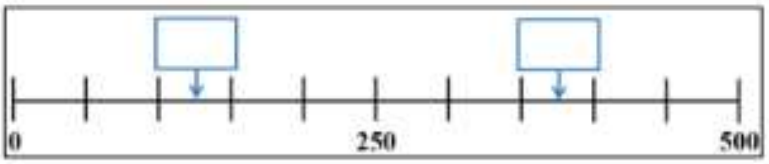
NUMBER LINE ESTIMATION

Activity 1: Estimating on the number line

1. Let us estimate the number that each arrow is pointing to.







2. Let us draw points to show an estimate of the position of each of the numbers in the number line.



Activity 2: Estimating Marked Points

1. Let us examine the marked points on the number line. Estimate their values based on the given labels.

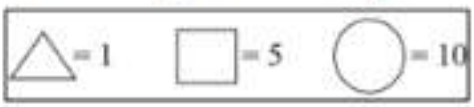


A. ____
B. ____
C. ____
D. ____
E. ____

NUMBER REPRESENTATION AND COMPUTATION

Activity 1: Number Blocks

I. Let us represent the following numbers using these different shapes.



8 = □△△△

14 = _____

27 = _____

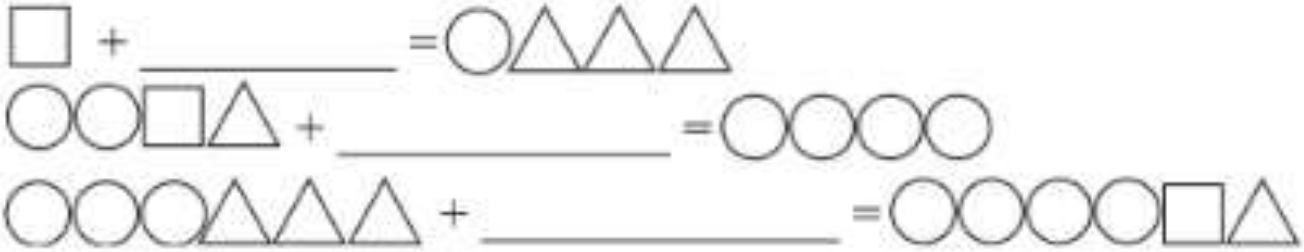
38 = _____

59 = _____

72 = _____

PARAMETER A: PRIORITIES AND RELEVANCE

II. Let us fill the blanks with appropriate shapes to make the equation true.





Activity 2: Identifying Numbers

Let us provide the corresponding values to make the solution correct.

6	1b	c1	106	16g
+ a	+ 9	+ 23	+ 5e	+ 1h9
13	21	7d	1f1	i21

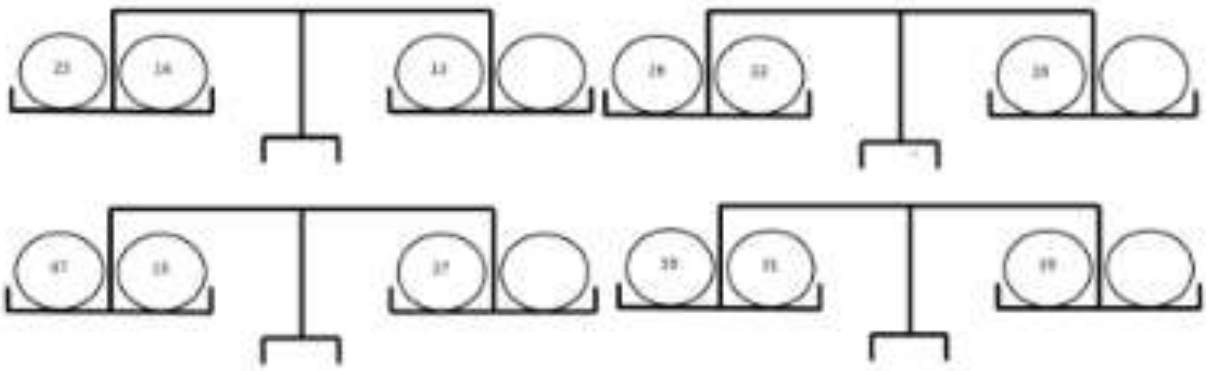
j	16	41	136	18p
- 6	- k	- 13	- 8n	- qr9
2	13	m2	o1	74

	Value
a	7
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	
l	
m	
n	
o	
p	
q	
r	



Activity 3: Scale Balancing

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



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Activity 4: Building Numbers by Tens

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



- There are _____ pieces of 10-peso coins.
- The total amount of the coins is ₱____.
- If four 10 peso-coins are added, then there would be a total of _____ 10-peso coins.
- ₱30 can be represented as 10 + 10 + 10, while ₱70 can be represented as _____.
- ₱50 can be represented as 5 x 10, while ₱90 can be represented as _____.

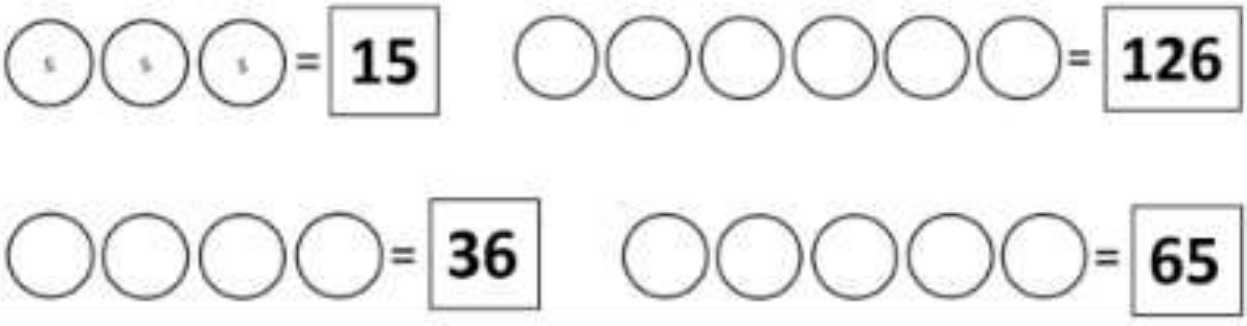
II. Let us identify the **maximum** number of 10-peso coins that can be present in the following numerals.

	10-peso coins	Leftover
28	2	8
73		
141		
1 227		
3 782		

- If ₱76 is doubled, there will be a total of _____ 10-peso coins
- After four 10-peso coins were added to ₱83, the total amount of the coins would be ₱____.
- If six 10-peso coins are removed from ₱289, there will be a total of _____ 10-peso coins left.

Activity 5: Number Representation

I. Let us fill in the circles with numbers that make the equation true.



II. Let us identify the number of groups and items per group for each target number

Target Number	Illustration	Classification	Multiplication Expression
16	8 8	Two groups of Eight	2 x 8
35			
56			
125			

Activity 6: Stacking Up

A pile of 10 books measures 30 inches. Each book has the same thickness.

A. The thickness of one book is _____.
B. The height of the pile after removing 1 book is _____.
C. The height of the pile after removing 3 books is _____.
D. The height of the pile after adding 3 more books is _____.
E. The number of books in the pile when it measures 21 inches is _____.





Activity 7: What's Next?

Let us fill in the missing repeated addition and answers using the pattern shown.

Multiplication Expression	Repeated Addition	Answer
3 x 53		
4 x 53		
5 x 53	(53 + 53 + 53 + 53 + 53 + 53) - 53	318 - 53
6 x 53	**53 + 53 + 53 + 53 + 53 + 53**	**318**
7 x 53	(53 + 53 + 53 + 53 + 53 + 53) + 53	318 + 53
8 x 53		
9 x 53		

- **6 x 53** is equal to **318**. How will you compute **5 x 53**?
  Answer: 265 **Solution: 318 – 53 = 265**

- **6 x 53** is equal to **318**. How will you compute **7 x 53**?
  Answer: _____ **Solution:** _____

- **6 x 53** is equal to **318**. How will you compute **8 x 53**?
  Answer: _____ **Solution:** _____

- **48 x 72** is equal to **3 456**. How will you to compute **49 x 72**?
  Answer: _____ **Solution:** _____

- **67 x 205** is equal to **13 735**. How will you compute **65 x 205**?
  Answer: _____ **Solution:** _____

I.3. A mutual exchange of resources and services between the College/Academic Unit and the community is evident.

❖ Training-Workshop on IM Development

2023





2025





❖ Implementation of IM

2023





PARAMETER A: PRIORITIES AND RELEVANCE

2025









PARAMETER A: PRIORITIES AND RELEVANCE

Certificates













Terminal Reports

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

Project members: *Leorence Tandog, Sandra Nanding, Philip Lester Benjamin, Jupiter Pilongo, Rowel Madio, Lawton John Yabes, Dominic Carajay, Lidey Sultan, Debbie Marie Verzosa, Jonald Pimentel, Leonard Paleta, Anna Jean Garcia, Daryl Mae Mamon, Jeaneth Licaros, Roel Valenton, Jennifer Pama, Arnel Toledo, DOST-SEI Project Strand-N Scholars, MST and PhD Ed Math Students*

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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UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Philippines

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	
Email Address	lctandog@usm.edu.ph	
Contact Number	09466115568	
4. Lead Unit/College	College of Science and Mathematics	
Collaborating Unit/College	DepEd Cotabato Division	
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 ☐ Industry Innovation & Infrastructure	☐ 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
9. Project Duration	One year	
10. Project Location	Matalam, Cotabato	
11. Total Budget	PhP 60,000	

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TERMINAL REPORT

B. TECHNICAL DESCRIPTION

1. Rationale / Significance

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

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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).

2. 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.

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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).

3. 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.

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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.

4. 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.

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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.

DepED MATATAG **RAPID MATHEMATICS ASSESSMENT(RMA) Grades 7 to 10**

SCHOOL NAME: SALVACION HIGH SCHOOL

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

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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.

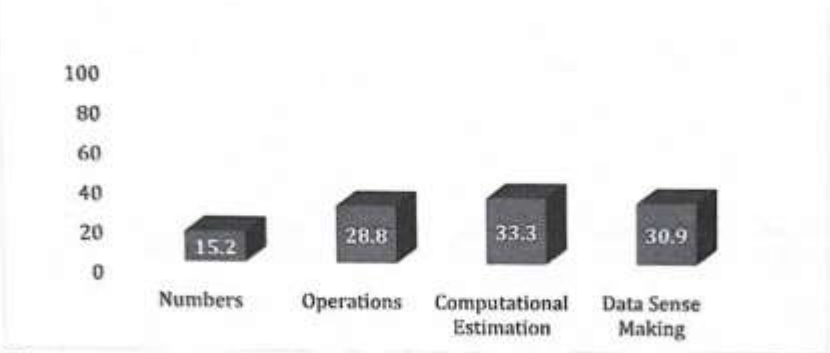


Figure 4. Average Percent Scores of Students in Diagnostic Test Items

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.

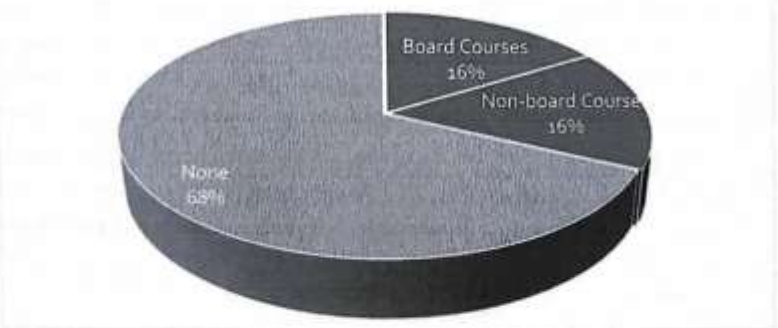


Figure 5. Percent Distribution of Respondents According to their Potential Performance in USM-CEE

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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.

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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.

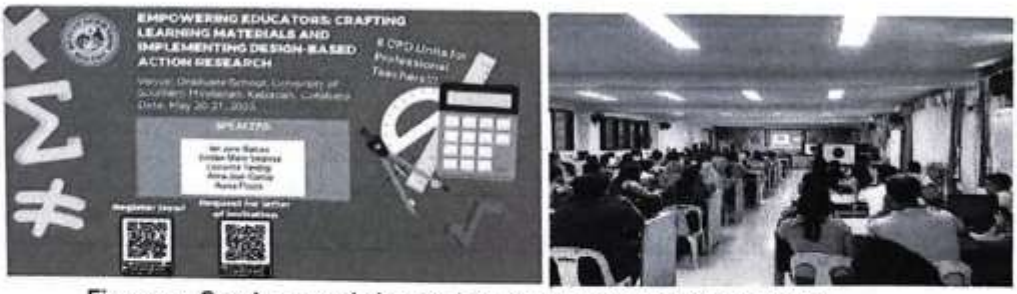


Figure 9. Seminar-workshop publication material and attendees

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.

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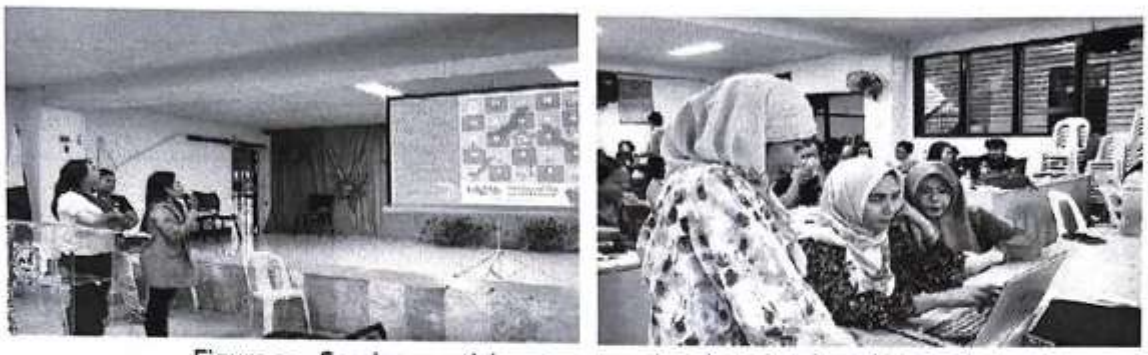


Figure 10. Seminar participants presenting their developed LM and collaborating for possible action research

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.

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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

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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

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(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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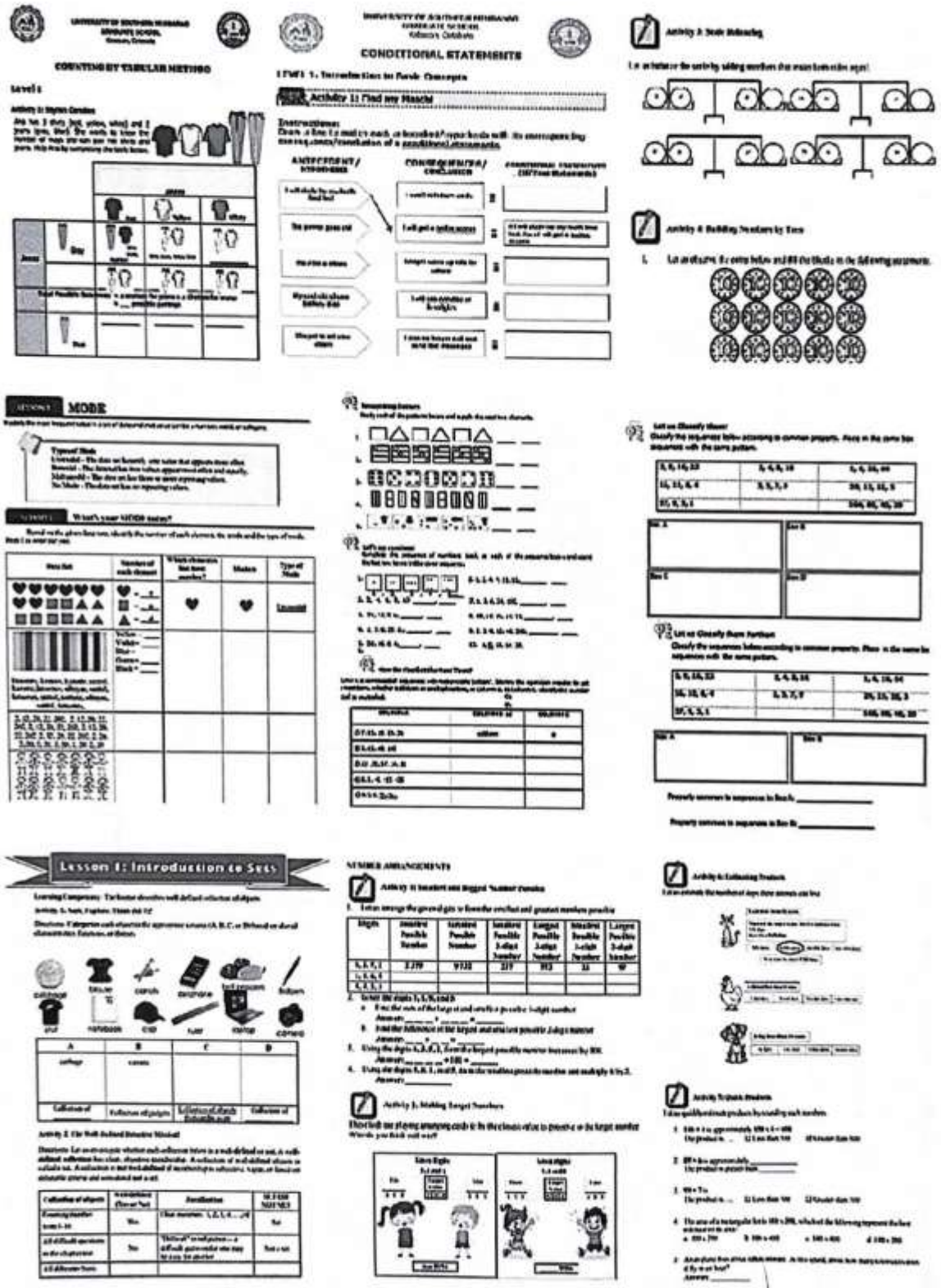


Figure 14. Samples of developed LMs

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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.

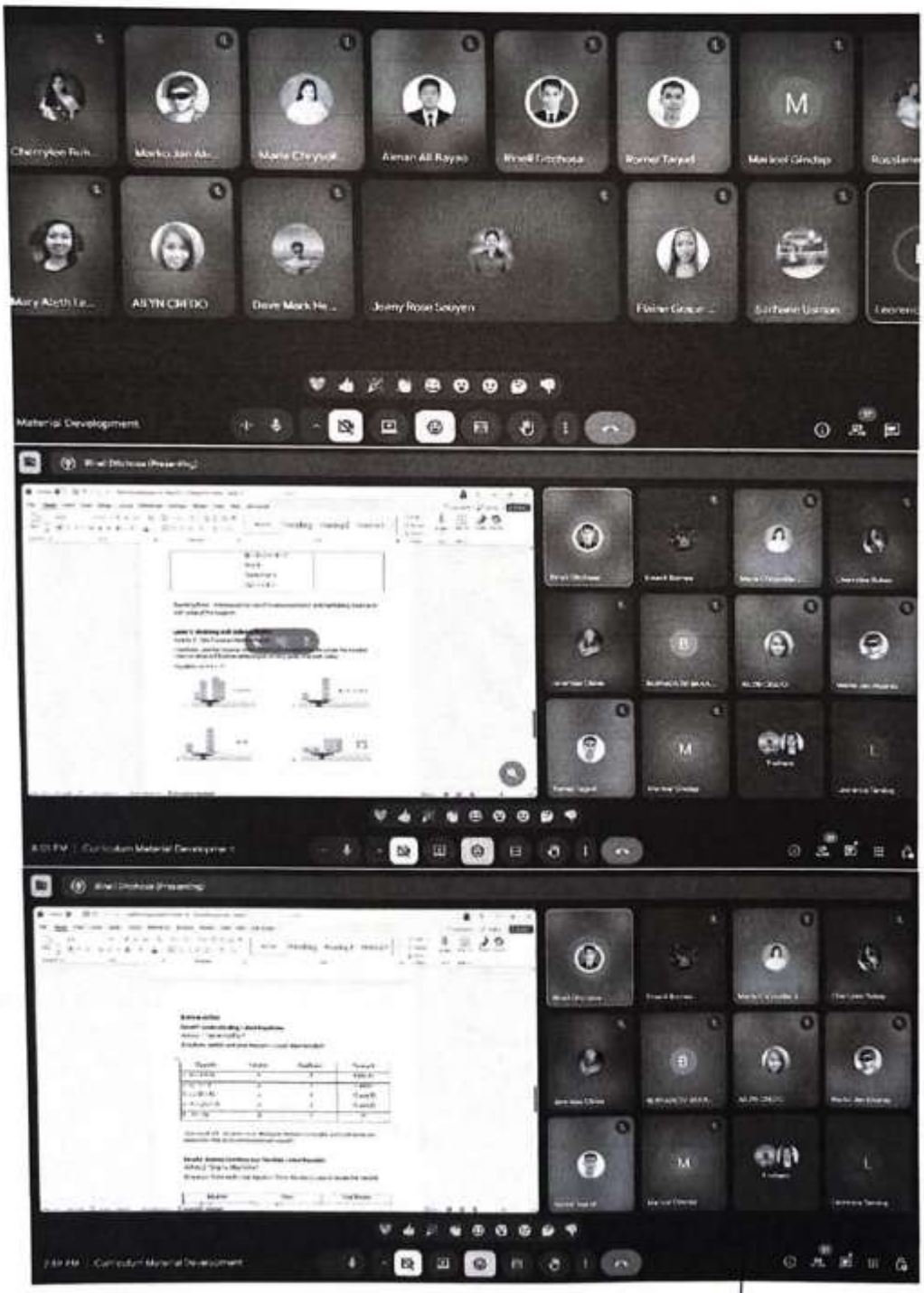


Figure 15. Online meetings and presentations of developed LMs

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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.



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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.

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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.

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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.

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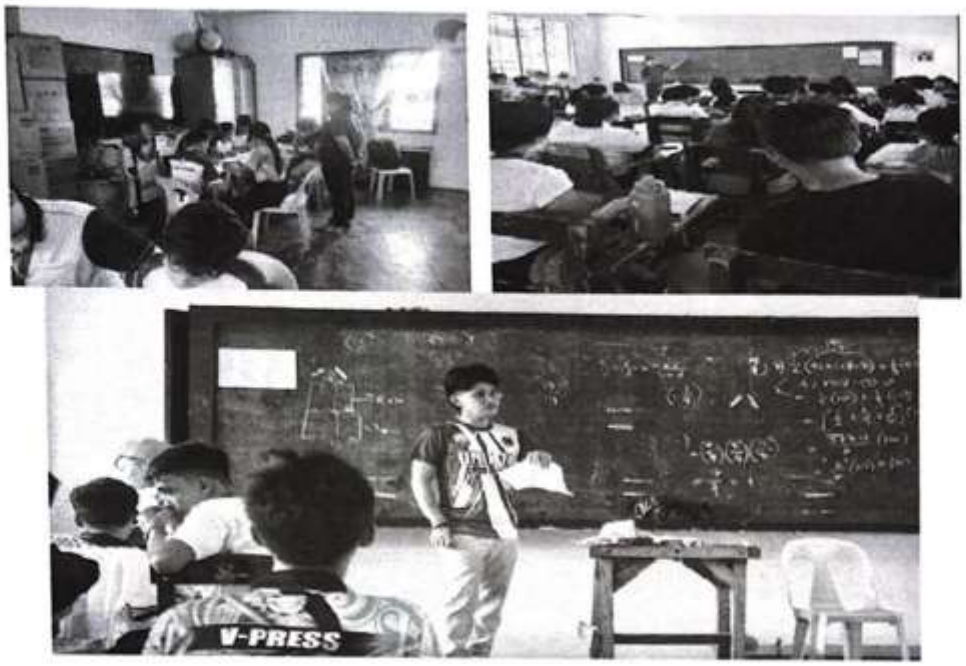


Figure 17. USM conducting a review for college admission tests

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

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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

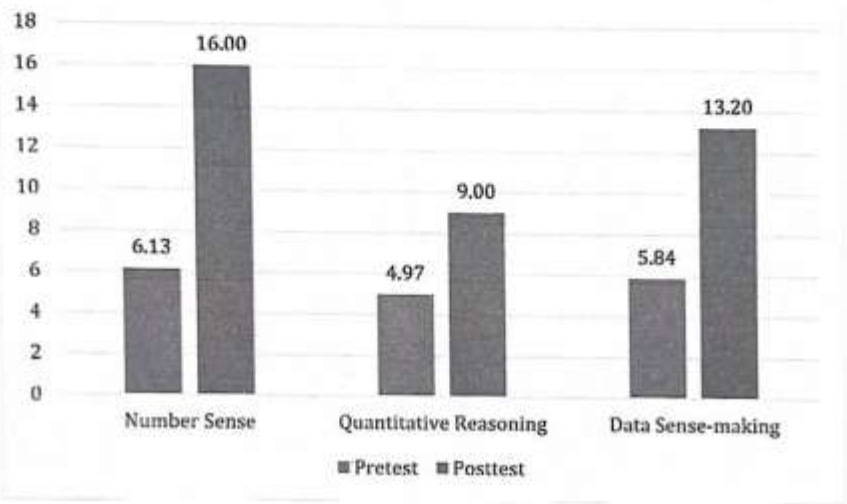
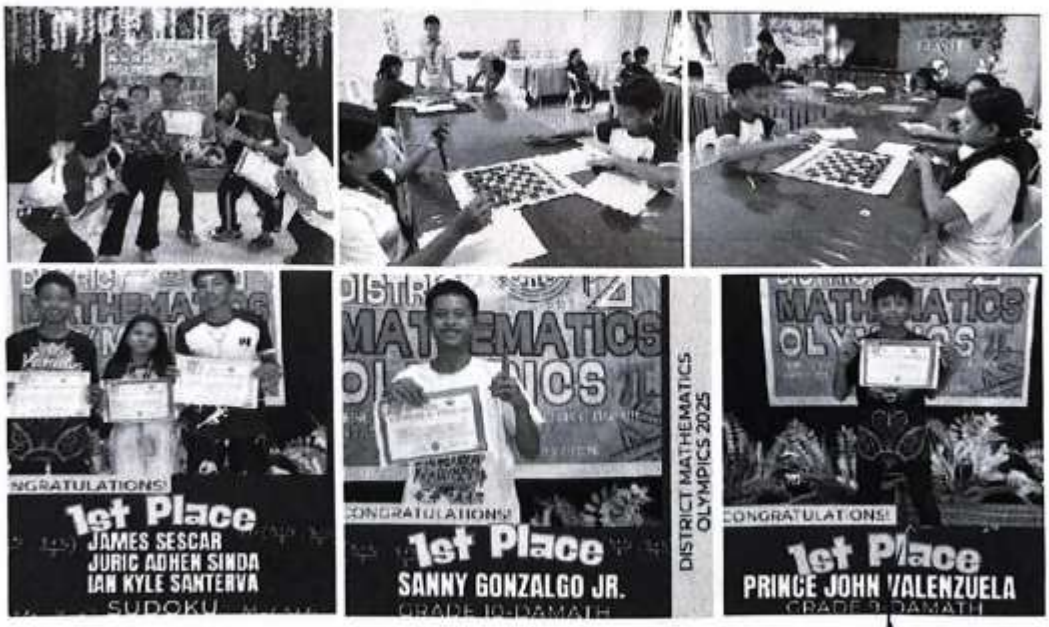


Figure 18. Pretest and Posttest performance of students

2. **Improved** ranking in mathematics competitions



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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			

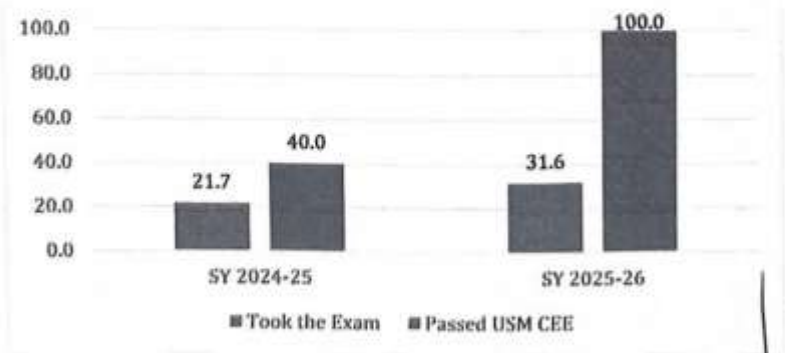


Figure 19. Comparative performance of Senior HS students in USMCEE

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PARAMETER A: PRIORITIES AND RELEVANCE

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

Karne Ramona Elpi L. Lanuza
Dave Mark A. Herrera
Ramasith I. Bañagos
Lourence C. Tandog
University of Southern Mindanao

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 assess 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 (Langrall 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., 2019; Sadi and Sebe, 2019; Ng & Chew, 2020). 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 (Paz, 2020; Jansen 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; Montrady, 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 (Seedler et al., 2017; Sathyanesan 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

Figure 20. Research article from extension project for journal publication

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Chief Administrative Officer
University of Southern Mindanao
Date:_____

TO WHOM IT MAY CONCERN:

THIS IS TO CERTIFY that the extension project titled **"Strengthening Barangay High Schools: Validation and Implementation of Representation-Based Learning Materials for Independent Study of Mathematics in Remote Schools (AY 2025-2026)"**, implemented by the University of Southern Mindanao at Salvacion High School, Matalam, Cotabato, has fully met and satisfied all the prescribed guidelines, standards, and requirements set forth under **JC3 CMO No. 18, Series of 2025.**

THIS IS FURTHER TO CERTIFY that, having successfully fulfilled the prerequisite monitoring and implementation compliance metrics under the aforementioned Joint Circular/CMO guidelines, the project was deemed **ELIGIBLE** for the conduct of the official Client Satisfaction Survey (CSS).

THIS LIKEWISE CERTIFIES that the **Terminal Report** for the project was officially completed, submitted, and duly received on time by the **Extension Services Office** in accordance with institutional schedules and project reporting timelines.

The project obtained a total of **87.2 points out of the maximum score of 100 points,** based on the results of the official Client Satisfaction Survey (CSS) conducted among the target beneficiaries.

Attached herewith is the official summary of the CSS Results conducted among the target beneficiaries.

GLYN B. GABANO-MAGBANUA

Director, Extension Services Office

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Chief Administrative Officer
University of Southern Mindanao
Date:_____

I.4. Linkages with local, national, foreign, and non-governmental agencies are institutionalized.



** https://www.usm.edu.ph/rde/vp/eso-who-we-are-what-we-do-our-services/#1668860211034-8ba42b7d-10a4

PARAMETER A: PRIORITIES AND RELEVANCE

University of Southern Mindanao – Extension Services Office Linkages

2025 | 2024 | 2023 | 2022

Year 2024

- Iranun Peace and Development Council Philippines (IPDC)
- Food and Agriculture Organization (FAO) of the United Nations (UN)
- National Police Training Services (PNPTS)
- Local Government Unit (LGU) of Kidapawan City
- International Committee of the Red Cross (ICRC)
- Cooperative Development Authority (CDA-XII)
- 10th Field Artillery (ROLLING THUNDER) Battalion
- Philippine Rural Reconstruction Movement (PRRM)
- Department of Trade and Industry (DTI-XII)
- Kabacan Moro Women Organization, Inc. (KMWOI)

2025 | 2024 | 2023 | 2022

Year 2025

- Carmen National High School- Senior High School
- Agriculture and Fisheries Resources Research Development and Extension Network (AFRRDEN)
- Inter-cultural Organization's Network for Solidarity and Peace (ICON-SP)
- Caritas Kasunayan Village
- Nagasat a Mannalon Irrigator's Association (NAM-IA)
- National Irrigation Administration – Kabacan River Irrigation System (NIA-KABRIS).
- Nangaan National High School
- SOCCSKSARGEN Agriculture, Aquatic and Natural Resources Research and Development Consortium
- Local Government Unit (LGU) of Kabacan.
- DepEd- Schools Division of Cotabato Province
- DepEd- Schools Division of Kidapawan City
- Malapatan Multi-purpose Cooperative (MMPC)
- Fundacion Accion Contra el Hambre- Action Against Hunger

PARAMETER A: PRIORITIES AND RELEVANCE

MEMORANDUM OF AGREEMENT

KNOW ALL MEN BY THESE PRESENTS:

This Memorandum of Agreement made and entered into by and between:

UNIVERSITY OF SOUTHERN MINDANAO (USM), a level IV state University, created and operating under Republic act No. 763, s. 1952, as amended and Presidential Decree No. 1312, s. 1978 with a principal office and postal address at Bai Matabay, Plang Avenue, Poblacion, Kabacan, Cotabato, represented herein by its President, **JONALD L. PIMENTEL, PhD,** hereinafter referred to as the **"USM-Kabacan";**

-and-

Schools Division Office of Cotabato (SDO-Cotabato), a DepEd division of schools, with principal office address at Cotabato Province Capitol Compound, Amas, Kidapawan City represented herein by **ROMELITO G. FLORES, CESO V, School Division Superintendent, Cotabato**, hereinafter referred to as **"SDO-Cotabato"**.

Jointly, the **USM** and the **SDO-Cotabato** herein referred to as **"PARTNERS"**.

WHEREAS, the **SDO-Cotabato**, supports schools and learning centers and enables them to deliver accessible and quality education to the community it serves, by implementing education plans and policies, monitoring implementation of curriculum standards and providing instructional supervision and/or technical assistance and building communities of good practices, ensuring equitable distribution and allocation of resources while establishing linkages among educational stakeholders;

WHEREAS, the **SDO-Cotabato** recognizes the importance of developing innovative approaches to support student learning, especially through independent study and localized instructional materials in mathematics;

WHEREAS, the **SDO-Cotabato** recognizes the need for self-learning instructional materials and capacity building in the development of instructional materials and action research;

WHEREAS, the **USM** is a government institution of higher learning established in 1952 by Bai Matabay Plang, a state University with four mandated functions, namely: instruction, research, extension, and production;

WHEREAS, the **USM** through its College of Science and Mathematics and the University Extension Services Center, aims to uplift education in underserved communities through research-based extension services;

WHEREAS, the **USM**, as an academic institution, through the Office of the University Extension Services Center, supports SDO-Cotabato through capacity-building, instructional material development, and research-based extension activities;

NOW THEREFORE, for and in consideration of the foregoing premises and strong commitment of **PARTNERS** to advance the quality of education in the region, **PARTNERS** hereby agree to collaborate in the planning implementation, and evaluation of the said extension project under the following provisions:

USM by:

JONALD L. PIMENTEL, PhD
President

SDO-Cotabato by:

ROMELITO G. FLORES, CESO V
Superintendent, DepEd Cotabato Division

Witness:

LEORENCE C. JANDOG, PhD
VPAA/Project Leader

DEBBIE MARIE B. VERSOZA, PhD.
VPRDE

GLYN G. MAGBANUA, PhD.
ESO, Director

PHILIP LESTER P. BENJAMIN, PhD.
CSM, Dean

MARY JOY D. BAUTISTA, PhD
EPS-Mathematics

JUVY B. TITURA, EdD.
EPS - LRMDS

Section 1. Scope of Work/Description of the Project

PARTNERS hereby undertake the implementation of Extension Project with the title **"Strengthening Barangay Schools: Validating and Implementing Representation Approach-Based Learning Materials for Independent Study of Mathematics in Remote Schools"** with an approved budget of PhP 60,000.00.

Section 2. Obligations of UNIVERSITY OF SOUTHERN MINDANAO
*The **USM shall:***

1. *Conduct extension activities with permission and proper consultation with concerned and target participants;*
2. *Conduct capacity-building activities and workshops for mathematics teachers of SDO-Cotabato;*
3. *Lead the development, validation, and pilot-testing of representation approach-based Learning Activity Pages (LAPs);*
4. *Provide technical and academic expertise in instructional material development and implementation;*
5. *Facilitate monitoring and documentation of the project outcomes and learning impact;*
6. *Share results of the implementation with relevant stakeholders and propose scaling strategies where applicable.*

Section 3. Obligations of the Schools Division Office of Cotabato
The **SDO-Cotabato shall:**

1. *Recommend beneficiary schools for the extension project.*
2. *Advise school heads to designate participating mathematics teachers and ensure their attendance in training and project-related activities.*
3. *Ensure that school heads provide the necessary venue and support for workshops, validation, and pilot-testing activities.*
4. *Encourage collaboration among teachers in developing and refining LAPs.*
5. *Provide feedback and reflections on the implementation to guide project refinement.*
6. *Ensure the dissemination and sustained use of validated materials within the school.*

Section 4. Amendments

No amendment or modification of any of the terms and conditions of this Agreement shall be valid unless evidenced by a written Agreement executed by the parties' respective authorized representatives.

Section 5. Arbitrary Clause

If any dispute or difference of any kind whatsoever shall arise between the parties in connection with the implementation of this Agreement, the parties shall make an effort to resolve such dispute or difference by mutual agreement. Accordingly, the parties may resort to court only after all efforts to settle the dispute amicably have been exhausted.

USM by:
JONALD L. PIMENTEL, PhD
President

SDO Cotabato by:
ROMELITO G. FLORES, CESO V
Superintendent, DepEd Cotabato Division

Witness:
LEORENCE C. TANDOG, PhD
VPAA/Project Leader

DEBBIE MARIE B. VERSOZA, PhD.
VPRDE

GLYN G. MAGBANUA, PhD.
ESO, Director

PHILIP LESTER P. BENJAMIN, PhD.
CSM, Dean

MARY JOY D. BAUTISTA, PhD
SPS-Mathematics

JUVY B. TURA, EdD.
EPS-LRMDS

Section 6. Binding Effect

This Agreement shall be effective immediately upon signing hereof and shall remain in full force and effect for the activities under this Agreement until 2026, unless sooner terminated in writing by either of the parties with written consent from the other party and subject to yearly evaluation.

IN WITNESS WHEREOF, the parties, through their respective representatives, have hereunto affixed their signature this _____ day of _____, 2025 at _____, Cotabato, Philippines.

SCHOOLS DIVISION OFFICE OF COTABATO (SDO-COTABATO)

ROMELITO G. FLORES, CESO V
Superintendent, DepEd Cotabato Division

UNIVERSITY OF SOUTHERN MINDANAO (USM)

JONALD L. PIMENTEL, PhD
President

SIGNED IN THE PRESENCE OF:

LEORENCE C. TANDOG, PhD
VPAA/Extension Project Leader

DEBBIE MARIE B. VERZOSA, PhD
VP RDE

PHILIP LESTER P. BENJAMIN, PhD
CSM Dean

GLYN MAGBANUA, PhD
ESO Director

MARY JOY D. BAUTISTA, PhD
EPS-Mathematics

JUVY B. NITURA , EdD
EPS – LRMDS

ACKNOWLEDGMENT

REPUBLIC OF THE PHILIPPINES)
Municipality of Kabacan, Cotabato)S. S.

BEFORE ME, a Notary Public, for and in the Municipality of Kabacan, Cotabato, this ____ day of APR 14 2026 2025, personally appeared:

	ID No.	Issued on/Issued at
ROMELITO G. FLORES, CESO V		
JONALD L. PIMENTEL, PhD	P13904608	JULY 01, 2016 / DFA DAVAO

Known to me are the same person(s) who executed the foregoing Memorandum of Understanding and they acknowledged to me that the same is of their own will and voluntary act and deed and that of the institutions they represent.

The foregoing instrument refers to a Memorandum of Understanding (MOU), consisting of three (4) pages, including the page in which this Acknowledgement is written, signed by the parties, including their instrumental witnesses on each and every page thereof and sealed with my Notarial Seal.

WITNESS MY HAND AND SEAL, on the date and place above written.

NOTARY PUBLIC

REGERICK L. BENITO
NOTARY Public for the Province of Cotabato
Valid Until December 31,2026
Notarial Commission No. 01-2025
PTR No. 4379824/01-07-26/ Amas, Kidapawan City
IBP O.R No. 563735/12-08-25/North Cotabato Chapte
Roll No. 46786

Doc. No. 98;
Page No. 78;
Book No. 41
Series of 2025.

REGERICK L. BENITO NOTARY PUBLIC

OUTCOME/S

O.1. Priority and relevant extension projects and activities are conducted.

1. Terminal Report

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

Project members: *Leorence Tandog, Sandra Nanding, Philip Lester Benjamin, Jupiter Pilongo, Rowel Madio, Lawton John Yabes, Dominic Carajay, Lidey Sultan, Debbie Marie Verzosa, Jonald Pimentel, Leonard Paleta, Anna Jean Garcia, Daryl Mae Mamon, Jeaneth Licaros, Roel Valenton, Jennifer Pama, Arnel Toledo, DOST-SEI Project Strand-N Scholars, MST and PhD Ed Math Students*

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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PARAMETER A: PRIORITIES AND RELEVANCE

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Philippines

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	
Email Address	lctandog@usm.edu.ph	
Contact Number	09466115568	
4. Lead Unit/College	College of Science and Mathematics	
Collaborating Unit/College	DepEd Cotabato Division	
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 ☐ Industry Innovation & Infrastructure	☐ 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
9. Project Duration	One year	
10. Project Location	Matalam, Cotabato	
11. Total Budget	PhP 60,000	

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TERMINAL REPORT

B. TECHNICAL DESCRIPTION

1. Rationale / Significance

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

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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).

2. 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.

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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).

3. 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.

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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.

4. 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.

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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.

DepED MATATAG **RAPID MATHEMATICS ASSESSMENT(RMA) Grades 7 to 10**

SCHOOL NAME: SALVACION HIGH SCHOOL

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

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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.

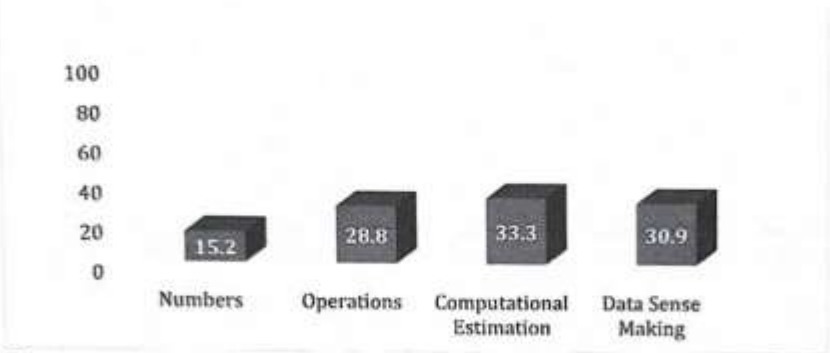


Figure 4. Average Percent Scores of Students in Diagnostic Test Items

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.

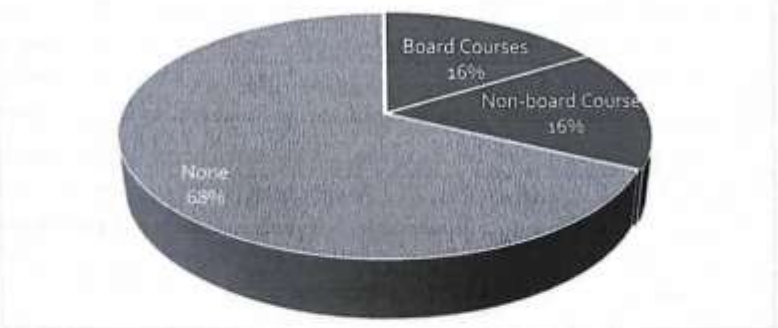


Figure 5. Percent Distribution of Respondents According to their Potential Performance in USM-CEE

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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.

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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.

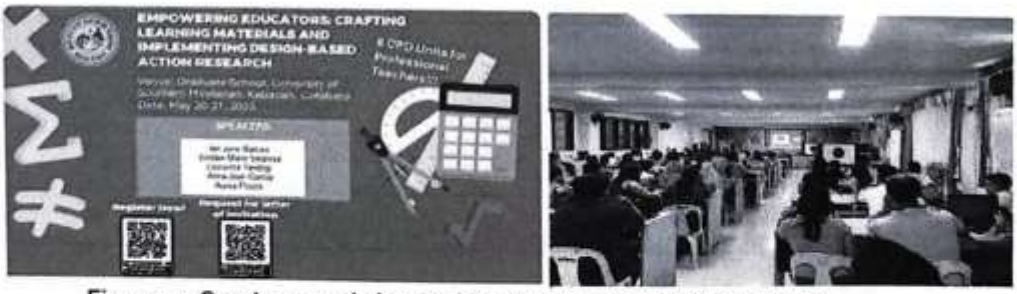


Figure 9. Seminar-workshop publication material and attendees

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.

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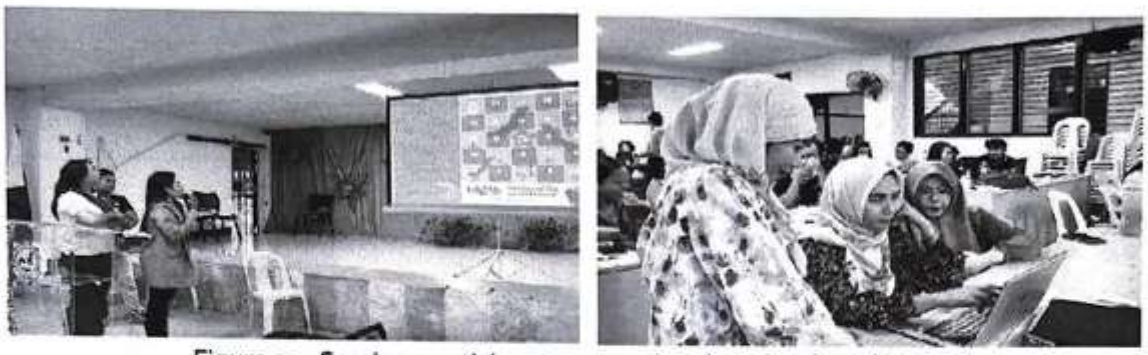


Figure 10. Seminar participants presenting their developed LM and collaborating for possible action research

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.

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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

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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

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(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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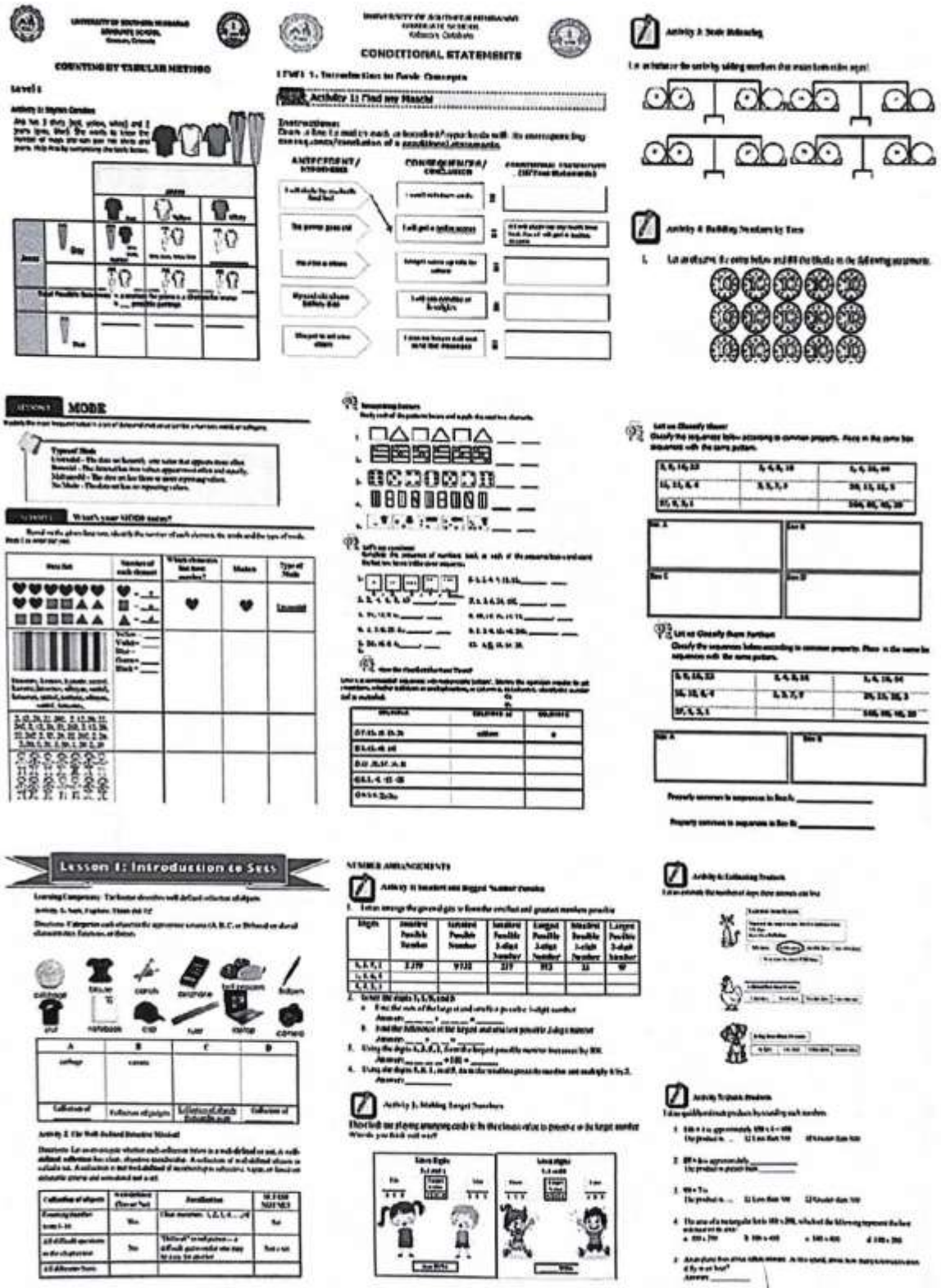


Figure 14. Samples of developed LMs

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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.

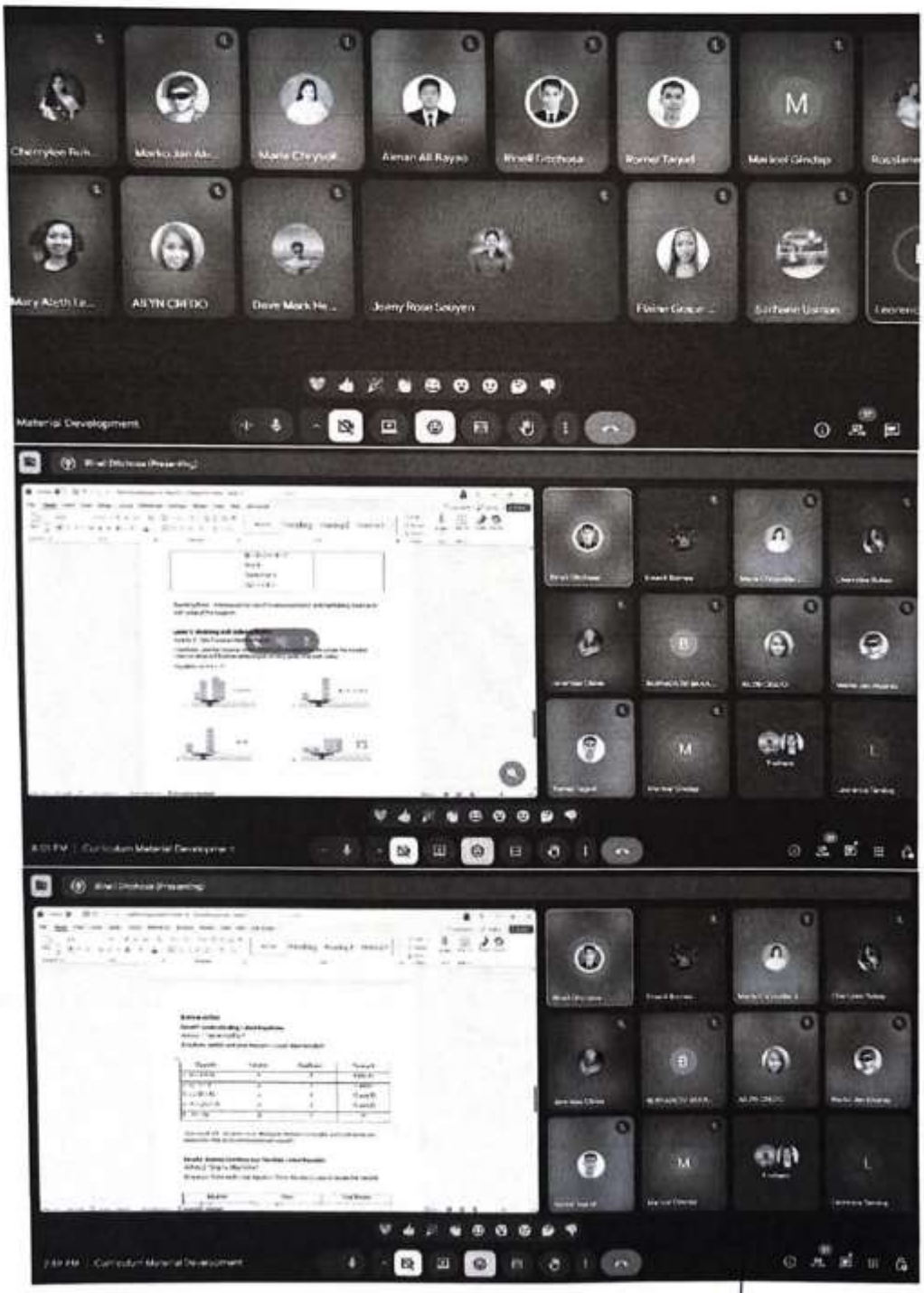


Figure 15. Online meetings and presentations of developed LMs

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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.



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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.

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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.

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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.

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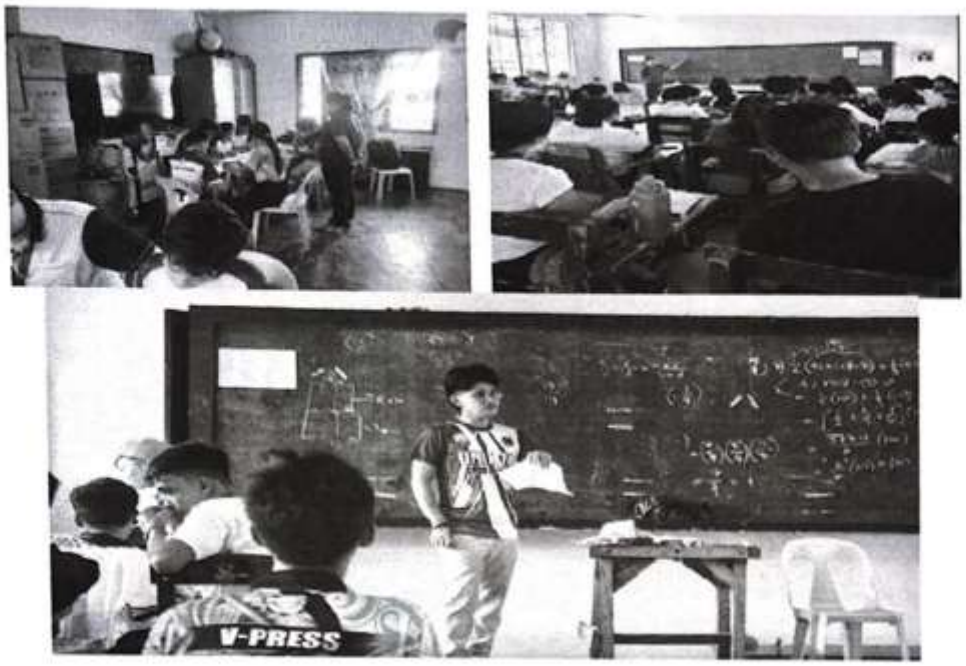


Figure 17. USM conducting a review for college admission tests

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

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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

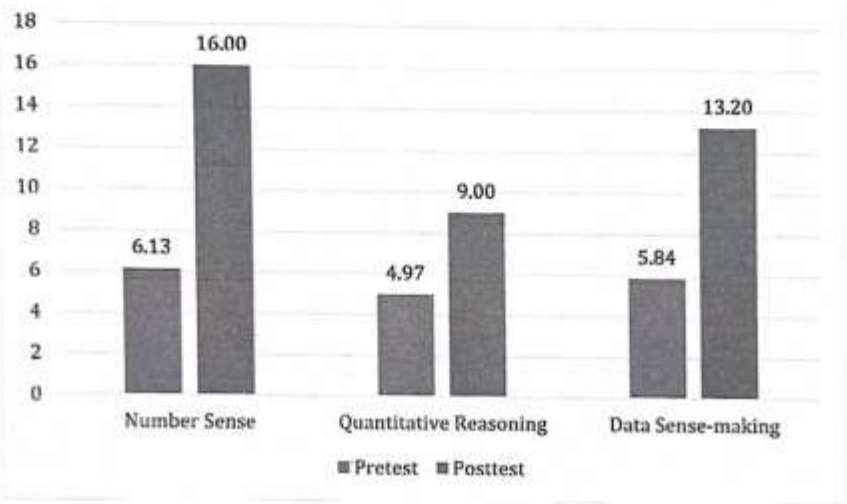
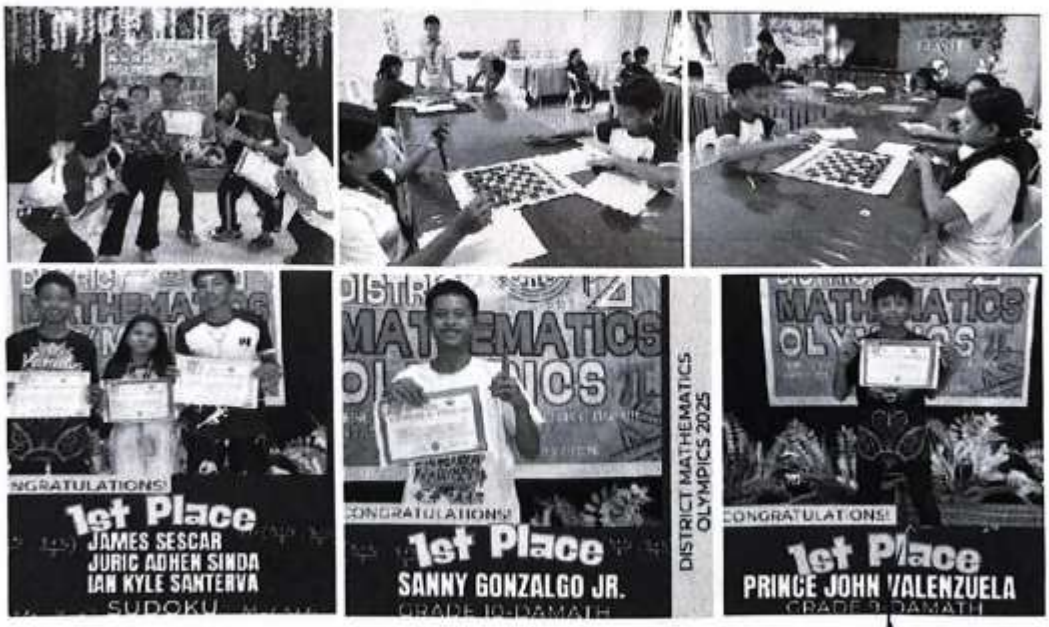


Figure 18. Pretest and Posttest performance of students

2. **Improved** ranking in mathematics competitions



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University of Southern Mindanao
Date:_____



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			

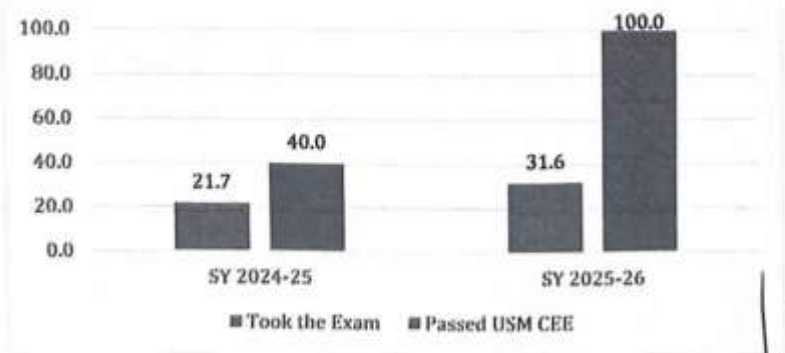


Figure 19. Comparative performance of Senior HS students in USMCEE

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Date:_____

PARAMETER A: PRIORITIES AND RELEVANCE

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

Karne Ramona Elpi L. Lanuza
Dave Mark A. Herrera
Ramasith I. Bañagos
Lourence C. Tandog
University of Southern Mindanao

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 assess 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 (Langrall 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., 2019; Sadi and Sebe, 2019; Ng & Chew, 2020). 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 (Paz, 2020; Jansen 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; Montrady, 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 (Seedler et al., 2017; Sathyanesan 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

Figure 20. Research article from extension project for journal publication

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University of Southern Mindanao
Date:_____

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Chief Administrative Officer
University of Southern Mindanao
Date:_____

TO WHOM IT MAY CONCERN:

THIS IS TO CERTIFY that the extension project titled **"Strengthening Barangay High Schools: Validation and Implementation of Representation-Based Learning Materials for Independent Study of Mathematics in Remote Schools (AY 2025-2026)"**, implemented by the University of Southern Mindanao at Salvacion High School, Matalam, Cotabato, has fully met and satisfied all the prescribed guidelines, standards, and requirements set forth under **JC3 CMO No. 18, Series of 2025.**

THIS IS FURTHER TO CERTIFY that, having successfully fulfilled the prerequisite monitoring and implementation compliance metrics under the aforementioned Joint Circular/CMO guidelines, the project was deemed **ELIGIBLE** for the conduct of the official Client Satisfaction Survey (CSS).

THIS LIKEWISE CERTIFIES that the **Terminal Report** for the project was officially completed, submitted, and duly received on time by the **Extension Services Office** in accordance with institutional schedules and project reporting timelines.

The project obtained a total of **87.2 points out of the maximum score of 100 points,** based on the results of the official Client Satisfaction Survey (CSS) conducted among the target beneficiaries.

Attached herewith is the official summary of the CSS Results conducted among the target beneficiaries.

GLYN B. GABANO-MAGBANUA

Director, Extension Services Office

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MARGIE N. PUTUAN-GALANG
Chief Administrative Officer
University of Southern Mindanao
Date:_____

2. Quarterly Accomplishment Reports

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

EXTENSION SERVICES OFFICE

QUARTERLY MONITORING AND EVALUATION REPORT FOR EXTENSION

Project Title:	**Strengthening Barangay High Schools: Validation and Implementation of Representation-Based Learning Materials for Independent Study of Mathematics in Remote Schools**	**Period Covered**	☒ 1st Quarter ☐ 3rd Quarter ☐ 2nd Quarter ☐ 4th Quarter
Proponent(s):	Leorence C. Tandog, Debbie Marie B. Verzosa, Jonald L. Pimentel, Philip Lester P. Benjamin, Leonard M. Paleta, Anna Jean S. Garcia, Jupiter G. Pilongo, Daryl Mae C. Mamon, Rowel P. Madio, Roel S. Valenton, Sandra A. Nanding, Lawton John A. Yabes	**Fund Source**	☒ Local ____Fund 101_____ ☐ External _____

Activities *Based on the Work Plan Schedule*	**Outputs**	**Accomplishments** Target (%) *Based on the Milestone in the Workplan*	**Accomplishments** Actual (%)	**(%) Completion (Cumulative)**	**Problems Encountered** *(if any)*	**Action Taken**	**Fund Utilization (%)**	**Remarks by Evaluator**
% Completion (Cumulative) from the previous quarter: 0%								
1. Building Capacity of Teachers in Instructional Material Development (one day)	Training design, workshop schedule and venue, committee in charge, processed COPD application	10%	0%	0%	Conflict of schedule, DepEd teachers and faculty were busy at the time, near semester end.	Training will be conducted together with the next capacity-building activity to allow more preparation time.	0%	
2. Development of Representation Approach-Based Learning Materials for Independent Learning of Mathematics	Diagnostic test result, some baseline information, PhD students identified topics for IM development and lesson study.	40%	0%	0%	Cannot proceed because the training on capacity must come first.	Activity postponed until capacity-building training is completed.	0%	

Prepared by:

LEORENCE C. TANDOG, PhD
Project Leader

Noted by:

CHERIE C. MANGAOANG, PhD
College Extension Coordinator

Evaluated by:

GLYN G. MAGBANUA, PhD
Director, Extension Services Office

Concurred by:

DEBBIE MARIE B. VERZOSA, PhD
Vice President for Research, Development and Extension

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

EXTENSION SERVICES OFFICE

QUARTERLY MONITORING AND EVALUATION REPORT FOR EXTENSION

Project Title:	**Strengthening Barangay High Schools: Validation and Implementation of Representation-Based Learning Materials for Independent Study of Mathematics in Remote Schools**	**Period Covered**	☒ 1st Quarter ☐ 3rd Quarter ☒ 2nd Quarter ☐ 4th Quarter
Proponent(s):	Leorence C. Tandog, Debbie Marie B. Verzosa, Jonald L. Pimentel, Philip Lester P. Benjamin, Leonard M. Paleta, Anna Jean S. Garcia, Jupiter G. Pilongo, Daryl Mae C. Mamon, Rowel P. Madio, Roel S. Valenton, Sandra A. Nanding, Lawton John A. Yabes	**Fund Source**	☒ Local ____Fund 101_____ ☐ External _____

Activities *Based on the Work Plan Schedule*	**Outputs**	**Accomplishments** Target (%) *Based on the Milestone in the Workplan*	**Accomplishments** Actual (%)	**(%) Completion (Cumulative)**	**Problems Encountered** *(if any)*	**Action Taken**	**Fund Utilization (%)**	**Remarks by Evaluator**
% Completion (Cumulative) from the previous quarter: 0 %								
1. Building Capacity of Teachers in Instructional Material Development (one day)	Training design, workshop schedule and venue, committee in charge, processed COPD application	10%	100%	10%	None	None	25.84%	
2. Development of Representation Approach-Based Learning Materials for Independent Learning of Mathematics (two months)	Diagnostic test result, some baseline information, PhD students identified topics for IM development and lesson study.	40%	100%	50%	None	None		
3. Validation and Packaging of Representation Approach-Based Learning Materials for Independent Learning of Mathematics (two months)	validated and packaged LMAPS	20%	100	70%	None	None		

PARAMETER A: PRIORITIES AND RELEVANCE

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

EXTENSION SERVICES OFFICE

QUARTERLY MONITORING AND EVALUATION REPORT FOR EXTENSION

Project Title:	**Strengthening Barangay High Schools: Validation and Implementation of Representation-Based Learning Materials for Independent Study of Mathematics in Remote Schools**	**Period Covered**	☒ 1st Quarter ☒ 3rd Quarter ☒ 2nd Quarter ☐ 4th Quarter
Proponent(s):	Leorence C. Tandog, Debbie Marie B. Verzosa, Jonald L. Pimentel, Philip Lester P. Benjamin, Leonard M. Paleta, Anna Jean S. Garcia, Jupiter G. Pilongo, Daryl Mae C. Mamon, Rowel P. Madio, Roel S. Valenton, Sandra A. Nanding, Lawton John A. Yabes	**Fund Source**	☒ Local ____ Fund 101 ☐ External _____

Activities *Based on the Work Plan Schedule*	**Outputs**	**Accomplishments**		**(%) Completion (Cumulative)**	**Problems Encountered** *(if any)*	**Action Taken**	**Fund Utilization (%)**	**Remarks by Evaluator**
		Target (%) *Based on the Milestone in the Workplan*	**Actual (%)**					
% Completion (Cumulative) from the previous quarter: 80%								
Implementation of Representation Approach-Based Learning Materials for Improved Learning of General Mathematics (two months)	Deployment & use of LMAPS by target beneficiaries	15%	100%	95%	None	None	40%	

Prepared by:
LEORENCE C. TANDOG, PhD
Project Leader

Noted by:
CHERIE C. MANGAOANG, PhD
College Extension Coordinator

Evaluated by:
GLYN G. MAGBANUA, PhD
Director, Extension Services Office

Concurred by:
DEBBIE MARIE B. VERZOSA, PhD
Vice President for Research, Development and Extension

3. Post-Activity Evaluation Reports

Overall Training/Activity Evaluation

Training Detail

Name of Training: Empowering Educators: Crafting Learning Materials and Design Implementing Design-Based Action Research

Venue: USM Graduate School

Date: May 30-31, 2025

Particulars	Weighted Mean	Verbal Description
Course Content and Structure		
The objective of the activity was clearly stated at the beginning of the session	4.96	Excellent
The sequence of the topics was easy to follow	4.84	Excellent
There was sufficient time allocated for each topic	4.52	Excellent
The content of the session was clear and easy to understand	4.88	Excellent
Training Activities		
There was sufficient activities in the session	4.93	Excellent
The activities increased my knowledge and understanding	4.95	Excellent
The group activities encouraged my participation	4.81	Excellent

PARAMETER A: PRIORITIES AND RELEVANCE

Methodology and Materials		
The instructional materials and presentation aids used helped me understand the topic better	4.62	Excellent
The delivery method (e.g. lecture training, FGD, forum) was suitable for the activity	4.72	Excellent
The delivery method assisted my learning and understanding	4.55	Excellent
Training Management Team, Facilities and Services		
The activity was well-organized and facilitated	4.43	Very Satisfactory
The secretariat was approachable and helpful	4.45	Very Satisfactory
The venue was conducive for the activity	4.51	Excellent

Rating Scale: 4.50-5.00 Excellent, 3.50-4.49 Very Satisfactory, 2.50-3.49 Satisfactory, 1.50-2.49 Fair, 1.00-1.49 Poor

4. Certificates









5. Training Completion Report

PARAMETER A: PRIORITIES AND RELEVANCE

University of Southern Mindanao
EXTENSION SERVICES OFFICE
Kabacan, North Cotabato

TRAINING COMPLETION REPORT

Report on non-degree training program (including seminars, conferences, workshops) conducted. This form should be submitted by the training coordinator to the monitoring office (OED) not later than 1 week after the completion of the training program.

Title	Strengthening Barangay High Schools: Validating and Implementing Representation Approach-Based Learning Materials for Independent Study of Mathematics in Remote Schools		
Budget	₱49,100.00	Fund Source	USM Extension Office/ Math Department
Start Date	May 30, 2025	End Date	May 31, 2025
Venue	Graduate School Hall, USM	No. of Beneficiaries/ Participants	70
Barangay	Poblacion	Municipality	Kabacan
Province	North Cotabato		

Training Team/ Facilitators
Faculty of Mathematics and Statistics Department, and PhD/MST USM students
Sponsor/s
College of Science and Mathematics/Graduate School, USM

Resource Speaker/s	Topic/s
Ms. Aurea Puyos	Lecture 1: Action Research
Dr. Ian June Garces	Lecture 2: Writing Good Math Problems
Dr. Debbie Marie Verzosa	Lecture 3: Development of Representation Approach – Learning Materials
Dr. Leorence Tandog Dr. Anna Jean Garcia	Lecture 4: Design – based Research

Training Objective/s

Upon completion of this training program, participants will be able to:

1. Strengthen math teachers' capability to develop representation-based self-instructional materials.
2. Engage teachers in collaborative work of developing research lessons and Learning Activity Pages (LAPs).
3. Validate, pilot-test, and refine LAPs to efficiently facilitate independent learning of mathematics concepts and skills.
4. Enhance mathematics performance and numerical literacy among barangay high school students through implementation of LAPs

PARAMETER A: PRIORITIES AND RELEVANCE

TRAINING HIGHLIGHTS

A two-day training-workshop was successfully conducted on May 30–31, 2025, as part of the extension project aimed at enhancing the capacity of mathematics educators in instructional material development. The event gathered over 70 participants from various DepEd schools across Cotabato, comprising both graduate students and invited high school teachers.

The training formally opened with an inspirational message from Dr. Jonald L. Pimentel, President of the University of Southern Mindanao (USM), who emphasized the university's commitment to community engagement and excellence in teacher development.

A total of four lectures and two hands-on workshops were delivered during the training. The first session featured Ms. Aurea Puyos of Notre Dame of Kidapawan College, who provided an in-depth discussion on Action Research and its practical application in the classroom. This was followed by Dr. Ian June Garces of De La Salle University – Manila, who joined online to conduct a session on Writing Good Math Problems, equipping participants with strategies to create engaging and thought-provoking assessment items.

The succeeding lectures were delivered by USM faculty members. Dr. Debbie Marie Verzosa presented the third lecture on the Development of Representation-Based Learning Materials, highlighting how visual and contextual strategies can support diverse learners. The final lecture, jointly presented by Dr. Leorence Tandog and Dr. Anna Jean Garcia, focused on Design-Based Research, emphasizing iterative processes for developing and refining instructional materials grounded in classroom realities.

Participants actively engaged in the interactive sessions and workshops, demonstrating enthusiasm and collaboration throughout the event. The workshops provided opportunities for them to apply the concepts discussed, particularly in developing draft Learning Activity Pages (LAPs) and research lesson components. Facilitation was led by the faculty of the USM Department of Mathematics and Statistics, supported by selected PhD and MST students, ensuring a guided and enriching learning experience.

The training served as a significant step forward in equipping local teachers with both theoretical knowledge and practical tools for improving mathematics instruction through research-based and student-centered learning materials.

PARAMETER A: PRIORITIES AND RELEVANCE

OVERALL COURSE DELIVERY

The table below highlights on the level of satisfaction as expressed by the participants on the overall course delivery

Item Code	Particulars	Weighted Mean	Verbal Description
a	The objective of the activity was clearly stated at the beginning of the session	4.96	Excellent
b	The sequence of the topics was easy to follow	4.84	Excellent
c	There was sufficient time allocated for each topic	4.52	Excellent
d	The content of the session was clear and easy to understand	4.88	Excellent
e	There was sufficient activities in the session	4.93	Excellent
f	The activities increased my knowledge and understanding	4.95	Excellent
g	The group activities encouraged my participation	4.81	Excellent
h	The instructional materials and presentation aids used helped me understand the topic better	4.62	Excellent
i	The delivery method (e.g. lecture training, FGD, forum) was suitable for the activity	4.72	Excellent
j	The delivery method assisted my learning and understanding	4.55	Excellent
k	The activity was well-organized and facilitated	4.43	VS
l	The secretariat was approachable and helpful	4.45	VS
m	The venue was conducive for the activity	4.51	Excellent
	Total Mean Rating	**4.71**	**Excellent**

SUMMARY OF RESOURCE PERSON/S' EVALUATION		Resource Person 1		Resource Person 2		Resource Person 3	
Item Code	Particulars	Weighted Mean	Verbal Description	Weighted Mean	Verbal Description	Weighted Mean	Verbal Description
1	The resource person displayed a thorough knowledge of the topic and was able to provide insights	4.76	Excellent	4.86	Excellent	5.00	Excellent
2	The resource person explained and processed the activities thoroughly	4.65	Excellent	4.79	Excellent	4.93	Excellent
3	The resource person sustained the attention of participants and encouraged their participation	4.43	VS	4.86	Excellent	5.00	Excellent
4	The resource person was able to create a good learning climate	4.62	Excellent	4.79	Excellent	4.97	Excellent
5	The resource person was able to manage their time well	4.73	Excellent	4.55	Excellent	4.93	Excellent
6	The resource person was sensitive to the participants' need	4.68	Excellent	4.83	Excellent	4.97	Excellent
	Total Mean Rating	4.65	Excellent	4.78	Excellent	4.97	Excellent

Rating Scale: 4.5 - 5.0 excellent **(E)**, 3.50-4.49 Very satisfactory **(VS)**, 2.50-3.49 Satisfactory **(S)**, 1.50 - 2.49 Fair **(F)**, 1.00-1.49 Poor **(P)**

TRAINING PARTICIPANTS' TESTIMONY

PARAMETER A: PRIORITIES AND RELEVANCE

Picture 1.	**Picture 2.**
	
Lecture on instructional design using representation approach by Dr. Verzosa	Participants collaborate actively during the hands-on workshop session
Picture 3.	**Picture 4.**
	
Workshop participants present their collaborative output to the group	Group photo with participants and training facilitators from USM

REMARKS/ PROBLEMS ENCOUNTERED/ ACTIONS TAKEN

Problems Encountered:

1. Unstable internet connection during the online session of Dr. Ian June Garces caused delays and interruptions.
2. Due to the extended lecture and the dense training schedule, the allotted time for workshop activities was insufficient for participants to complete their outputs.

Actions Taken:

1. The session was extended to accommodate the full lecture, which consequently led to a late lunch service. The organizing team adjusted the schedule accordingly to minimize further delays.
2. The submission deadline for the outputs was extended, and participants were encouraged to finalize their work after the training, with support from facilitators if needed.

PARAMETER A: PRIORITIES AND RELEVANCE

Prepared by:	PHILIP LESTER P. BENJAMIN	Reviewed by:	RITCHEL O. TORRES
Designation	Component Leader	Designation	Training Specialist II
Date signed	06 - 05 - 2025	Date signed	06 - 06 - 2025
Noted by:	GLYN G. MAGBANUA		
Designation	Director, Extension Services		
Date signed	06 - 05 - 2025		