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Development and Validation of Science Bilingual Workbook Supporting the Transition from Mother Tongue to English Medium of Instruction,

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ABSTRACT

This study meticulously addresses the challenges inherent in the transition from Mother Tongue-Based Multilingual Education (MTB-MLE) to English-medium instruction within the Philippine educational system. The research is specifically focused on Flora District, Apayao, a region characterized by the prevalence of Ilocano and Isnag languages. The MTB-MLE policy mandates the use of mother tongue instruction in the crucial early grades (Kindergarten to Grade 3). However, a significant linguistic and academic gap is consistently observed when learners are required to shift to English as the medium of instruction in Grade 4. This abrupt transition often leaves students underprepared, hindering their comprehension, engagement, and overall academic performance. To mitigate these challenges, this study aims to develop and validate a contextually relevant bilingual workbook. This workbook will be carefully aligned with the specific linguistic and cultural contexts of learners in Flora District, Apayao. The instructional material seeks to reinforce foundational concepts in both the mother tongue (Ilocano and Isnag) and English. By providing this dual-language support, the workbook aims to facilitate a smoother pedagogical transition and enhance instructional effectiveness for teachers. Ultimately, the development of this workbook is intended to address the identified need for localized, bilingual support materials, thereby boosting learner confidence and improving their achievement in English-medium classrooms.

Introduction

In an increasingly globalized world, proficiency in the English language has become a critical factor in accessing wider educational opportunities, fostering international communication, and enhancing competitiveness in the global workforce. As such, many countries have adopted English as either a primary or secondary medium of instruction to equip students with globally relevant linguistic skills [1]. However, the transition to English-medium education, particularly in early primary levels, poses significant challenges in multilingual societies where children begin their schooling in their native tongues [2].

International studies have shown that children learn best when taught in their first language during the early years of schooling. The UNESCO reiterates that Mother Tongue-Based Multilingual Education (MTB-MLE) supports cognitive development, enhances learning outcomes, and encourages active participation in classroom activities [3]. However, as learners shift from the use of the mother tongue to English in later grades, many encounter a linguistic and academic gap [4]. This transitional phase, if not

carefully scaffolded, can hinder comprehension, lower student engagement, and ultimately affect academic performance.

In the Philippines, the Department of Education institutionalized the MTB-MLE policy through the K to 12 Basic Education Curriculum, mandating the use of the mother tongue as the primary medium of instruction from Kindergarten to Grade 3, and a transition to English starting Grade 4 [5]. While this policy is rooted in sound educational theory, its implementation remains fraught with challenges. One major concern is the abrupt shift from mother tongue to English instruction, often leaving learners unprepared linguistically and academically [6]. Many pupils, especially those in linguistically marginalized and geographically isolated areas such as the rural parts of Apayao, struggle to cope with this sudden change, which may result in low performance and reduced classroom participation.

Locally, DepEd elementary schools of Flora District in Flora, Apayao, where Ilocano and Isnag languages are widely spoken, schools face a unique challenge in balancing the benefits of MTB-MLE with the demands of transitioning to English instruction. Observations and preliminary classroom-based assessments indicate that learners often display limited proficiency in English vocabulary, reading comprehension, and oral communication upon entering Grade 4. Teachers also express concern about the lack of structured and culturally responsive instructional materials that can bridge this gap effectively [5}. The issues mentioned earlier were also experienced by the elementary teachers of Flora District. Hence, the absence of localized, bilingual support materials tailored to the linguistic realities of the learners in Apayao hinders a smooth pedagogical transition and affects learner confidence and achievement.

Given these gaps, there is a pressing need to develop and validate instructional materials that can facilitate a smoother transition from mother tongue to English. A bilingual workbook is designed to reinforce concepts in both the mother tongue and English that can serve as a vital tool to ease this shift. By anchoring learning in the familiar while introducing new language structures and vocabulary in English, such a workbook can support learners in building the foundational skills necessary for academic success in an English-medium classroom [7].

Therefore, this study sought to develop and validate a bilingual workbook that aligns with the linguistic and cultural contexts of learners in Dep Ed Schools of Flora District in Flora, Apayao. This material aims not only to address the linguistic challenges associated with the language transition but also to support teachers in delivering inclusive and effective instruction.

Statement of the Problem

The study aims to develop and validate science bilingual workbook to support Grade 4 teachers in effectively facilitating the transition from mother tongue to English as the medium of instruction particularly the Dep Ed elementary schools of Flora District in Flora, Apayao.

Specifically, it seeks to answer the following questions:

1. What are the Science competencies to be selected?
2. What are the features in science bilingual workbook that supports learners transitioning from mother tongue to English instruction?
3. What is the evaluation rating of teacher experts on the developed science bilingual workbook in terms of:

3.1.content,

3.2.activities,

3.3.instructional characteristics; and
3.4.language appropriateness.
Figure 1 presents the flowchart on how the research study being conducted.

Research Paradigm

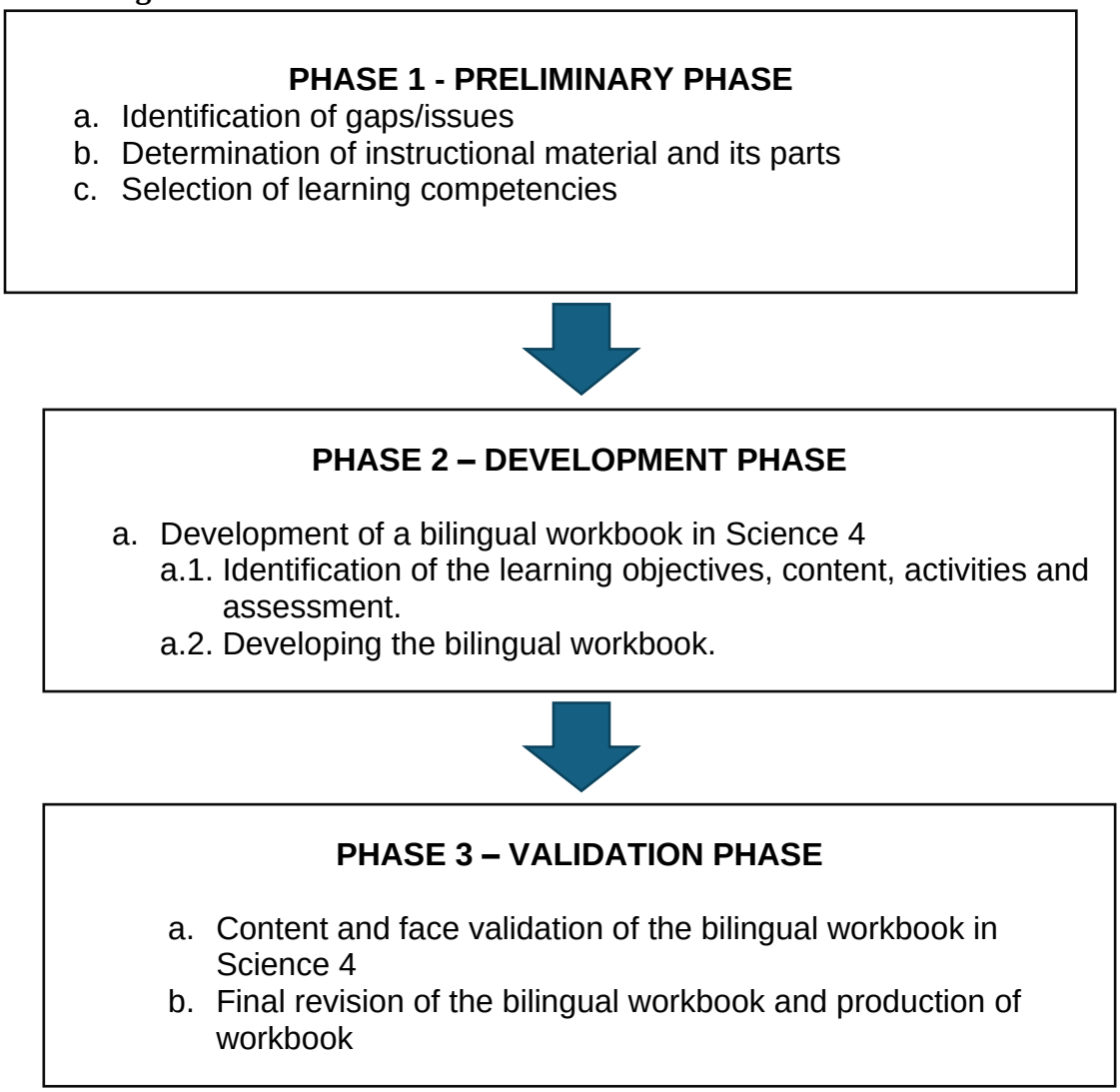


Figure 1 shows the flowchart of the study.

Respondents of the Study

This study involved one group of respondents, selected through **purposive sampling,** to ensure relevance and alignment with the development research process.

The group comprised **expert validators** who were engaged during the **validation phase**. A total of five (5) experts were selected based on their professional qualifications and experience in the areas of Science education, Mother Tongue-Based Multilingual Education (MTB-MLE), and instructional material development. Specifically, the expert validators include one (1) school head, one (1) master teacher and three classroom teachers which are expert in IMs development.

Research Instrument

The **workbook evaluation checklist** was used by the expert validators during the validation phase. This instrument followed a five-point Likert scale format, ranging from 1 (Not Valid at All) to 5 (Very Highly Valid), and was divided into four key domains: content, activities, instructional characteristics, and language appropriateness. The instrument was adopted from Sribek NK, Adiwijaya PA, Wedayanthi LM . The checklist allowed the experts to systematically assess each component of the workbook and provide both quantitative ratings and qualitative suggestions.

Table 2. Likert's Scale

Scale	Descriptive Rating
5	Very Highly Valid
4	Highly Valid
3	Valid
2	Less Valid
1	Not Valid At All

Data Gathering Procedure

This study followed the Developmental research which involves a systematic process of designing, developing, and validating educational materials. The study was divided into three major phases: The Preliminary Phase, the Development Phase, and the Validation Phase.

Phase 1: Preliminary Phase

The phase began with an extensive bibliographic review of relevant literature, scholarly research, and educational policy documents. The review covered a range of topics including bilingual education, science instruction in multilingual contexts, language transition strategies, and instructional material development. From this review, the gaps and issues in existing instructional materials and practices were identified. In particular, challenges related to the transition from Mother Tongue-Based instruction to English as a medium of instruction were evident. Several studies pointed to learners' difficulties in comprehension, limited vocabulary, and teachers' struggle to bridge content learning with language proficiency. These findings underscored the need for instructional materials that could facilitate gradual language transition without compromising science learning.

Phase 2: Development Phase

The second phase focused on the actual development of the bilingual workbook for Grade 4 Science, guided by the insights gathered from the
preliminary phase.

The process began with the identification of learning objectives, core content, activities, and assessment tools. Each element was crafted to support dual-language learning, aiming to help learners gradually transition from understanding scientific concepts in their mother tongue to expressing and applying these concepts in English. The materials integrated scaffolding strategies, such as side-by-side translations, visual cues, and concept reinforcement through simplified language.

Phase 3: Validation Phase

The final phase of the study involved the validation of the developed workbook to ensure its quality, relevance, and effectiveness. A panel of expert validators which composed of experienced Science educators, language specialists, and curriculum supervisors—was invited to conduct both content and face

validation of the draft workbook. They used a structured evaluation tool to assess the material in terms of: a. Alignment of content with curriculum standards; b. Instructional quality and appropriateness of bilingual strategies; c. Language clarity, accuracy, and readability; and d. Cultural relevance and sensitivity to the learners' background.

Analysis of Data

The data collected from this instrument were analyzed using quantitative techniques.

Quantitative data from the expert validators' evaluation checklists were analyzed using descriptive statistics. The mean was computed for each of the four domains. The interpretation of the mean scores followed a defined scale where 5.0 was descriptively rated as "very highly valid" and 4.0 as "highly valid" and so on. The results helped determine the overall acceptability of the workbook from an expert perspective.

All collected data were synthesized and used as the basis for revising and finalizing the workbook. This systematic approach ensured that the final product was acceptable, and contextually appropriate.

RESULTS, FINDINGS AND DISCUSSION

In view of the thorough analysis of data, the following findings emerged from this study:

Table 1. selected learning competencies in science with the developed instructional material.

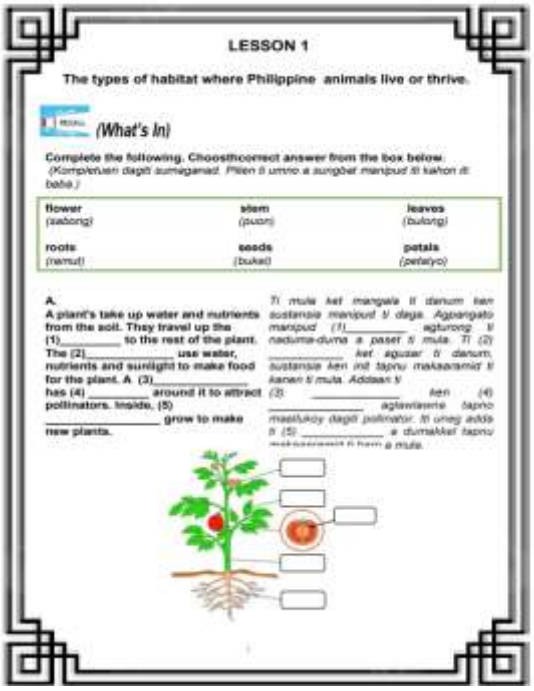
Learning competencies	Instructional Materials
1. Identify the types of habitat where Philippine animals live or thrive.	Bilingual Workbook
2. Identify the types of habitat where Philippine plants live or thrive.	Bilingual Workbook
3. List down examples of animals and more on terrestrial habitats, specifically gardens and rice fields and describe their ecological significance.	Bilingual Workbook
4. Explore more on aquatic habitats, specifically the seashore and mangrove swamp, describing their unique characteristics and ecological significance.	Bilingual Workbook

The selection of learning competencies in science, specifically those related to identifying habitats and their ecological significance, was driven by the need to foster a comprehensive understanding of the interconnectedness between organisms and their environments among students. The competencies outlined in Table 1, which include identifying types of habitats where Philippine animals and plants thrive, as well as listing examples of organisms in terrestrial and aquatic habitats while describing their ecological significance, are foundational for developing a robust ecological literacy.

B. Features of the Developed Science Bilingual Workbook

Figure 1. The developed Bilingual Workbook in Science 4

The bilingual workbook first feature is the **"Title Page"**, designed to capture the attention of young learners with its vibrant illustrations of relevant subject. The page introduces the core themes and provides a clear overview of the learning journey ahead. Specifically, it outlines the competencies to be developed, ensuring learners understand the knowledge and skills they will acquire."



The next feature, "**Let's Recall (What's In)**", offers a concise evaluation of previously learned concepts and skills, establishing a strong foundation for the new lesson. This section aims to solidify understanding and prepare students for more in-depth exploration.

(What's New)

Sing the song "Old MacDonald Had a Farm" using the pictures of animals given.

(Kantaen ti kanta a "Old MacDonald Had a Farm" babaen ti panangusar kadagiti ladawan dagiti animal a naited.)

cow (baka)	pig (baboy)	bird (tumaytayab)	fish (lames)

Old MacDonald had a farm

Ee i ee i o
And on his farm he had some cows
Ee i ee i oh
With a moo-moo here
And a moo-moo there
Here a moo, there a moo
Everywhere a moo-moo
Old MacDonald had a farm
Ee i ee i o
Old MacDonald had a farm
Ee i ee i o

Ni Mang Pedro adda talon na

Ni Mang Pedro adda talon na
Ee i ee i o
Iday talon, adu ti baka na
Ee i ee i oh
Moo moo diay, moo moo iday
Ee i ee i oh
Ni Mang Pedro adda talon na
Ee i ee i o

pig/baboy: oink, onk
Bird/tumaytayab: tweet tweet
fish/lames:prrrt,prrrt

Questions/Saludsod:

1.Where are the animals in the song?
Ania dagiti ayup ti kanta?

2.Where does these animals live?
Sadinno ti pagnanaedan dagitoy nga ayup?

Another feature, the "**Let's Go (What's New)**" section, serves as a dynamic preliminary activity designed to actively engage learners and set the stage for the upcoming lesson. This section starts with a brief brainstorming session where students share their initial thoughts and observations on [specific aspect of the lesson]. By tapping into their curiosity and connecting the new material to real-world examples like [example], this activity aims to pique student interest and establish a clear context for understanding.



The next feature is "**Dig Deep**" s is the core of the lesson, where pupils explore the content through a combination of text, informative visuals, and interactive simulations. This section includes guided activities that allow students to actively construct their understanding of the lesson. This feature also incorporates opportunities for differentiated instruction, ensuring that all learners can successfully master the learning objectives.

The "**Let's Try (What's More)** feature offers a diverse series of engaging activities designed to reinforce learning and provide opportunities for practical application. This section includes activities. Through these activities, pupils will reinforce their understanding of key concepts and developing critical thinking, problem-solving, and collaborative skills.

The next feature is "**Wrap Up**", this section provides a concise summary of the key concepts covered in the lesson, including and explores their practical applications. To reinforce learning, this section also includes a brief review activity where students. By revisiting these core concepts and exploring their practical implications, this section aims to solidify student understanding and inspire further exploration.

The "**Evaluate**" feature serves as a comprehensive tool to measure learners' overall understanding and mastery of the content. This section includes a variety of assessment methods. The assessments directly align with the learning objectives of the lesson and the broader learning competencies. Learners will receive feedback on their performance, highlighting areas of strength and areas for improvement. To accommodate diverse learning needs, differentiated assessment options are provided.

A. Validity of the developed bilingual workbook in Science 4 in terms of content, activities instructional activities and language appropriateness, of the 5 experts who came from different schools in Flora District.

Table 2. Likert's Scale

Scale	Descriptive Rating
5	Very Highly Valid
4	Highly Valid
3	Valid
2	Less Valid
1	Not Valid at All

DOMAINS	MEAN
A. CONTENT	Mean
1. The content aligns with the Science 4 curriculum standards.	5.0
2.The concepts are scientifically accurate and updated.	4.20
3.The explanations provided are clear and understandable.	4.40
4.The Language used (Mother Tongue and English) is appropriate for the learner's level.	4.0
5.The bilingual presentation enhances student's comprehension.	5.0
6.The examples and illustrations are relevant to the topic.	4.80
7.The key terms are properly translated and defined.	5.0
8.The content promotes critical thinking and inquiry.	4.20
9.The information presented is free from bias and errors.	3.80
10.The topics are logically organized and sequenced.	4.80
MEAN	**4.52**
B. ACTIVITIES	
11.The activities are age-appropriate and aligned to the learning competencies	5.0
12. Instructions for each activity are clear and easy to follow.	4.60

13. Activities encourage the use of critical thinking and use of problem-solving skills.	4.60
14. Activities effectively reinforce the concepts presented.	3.60
15. Activities allow integration of Mother Tongue and English in a meaningful way.	4.20
16. There is a good balance of individual pair and group activity.	4.60
17. Activities are varied and prevent monotony.	3.60
18. Activities cater to different types of learners (visual, auditory and kinesthetic).	5.0
19. Activities promote real life application of concepts.	3.40
20. The activities are age-appropriate and aligned to the learning competencies	4.60
CATEGORY MEAN	**4.32**
C. INSTRUCTIONAL CHARACTERISTICS	
21.The workbook lay-out is visually appealing and organized.	4.2
22. The font size, style and spacing are appropriate for Grade 4 learners.	4.8
23. The use of colors, images and graphics enhances understanding.	4.8
24. The bilingual presentation is consistently applied through the workbook.	4.6
25. The workbook is easy to use independently by the learners.	4
26. The workbook promotes learner engagement and participation.	5
27. There are adequate opportunities for learners to check their understanding (self-check, reflections).	4.4
28.The workbook provides clear connections between lessons.	4.8
29. The workbook accommodates diverse learner's need.	4.4
30. The overall quality of the workbook meets the instructional materials.	4.2
MEAN	**4.52**
D. LANGUAGE APPROPRIATENESS	
31. The use of both languages is accurate and appropriate for the learners' level.	4.60
32. Translation of key terms and concepts is correct and context-sensitive.	4.20
33. Language used in the instructions is clear, simple, and understandable.	4.80
34. The workbook encourages confidence in using English.	4.40
MEAN	**4.50**
OVERALL MEAN SCORE	**4.41**

The content domain received a high mean of 4.52, reflecting strong alignment with curriculum standards, accurate scientific concepts, and effective use of bilingual explanations. Illustrations and examples were relevant, and topics were well-organized, though slight concerns were noted regarding content objectivity and the clarity of language for learners.

In the activity's domain, the mean score of 4.32 suggests generally effective tasks that are age-appropriate and supportive of critical thinking. Activities also cater well to diverse learning styles. However, they could be improved by making them more engaging, reinforcing of concepts, and connected to real-life applications. Some tasks also showed limited variety, which may affect learner motivation.

The Instructional Characteristics domain matched the content score with a mean of 4.52, highlighting the workbook's appealing design, appropriate layout, and consistent bilingual presentation. It fosters learner

engagement and provides clear lesson connections, though it could further support independent learning by including more guidance and self-check tools.

The Language Appropriateness domain scored 4.50, indicating that the use of English and the Mother Tongue is accurate, age-appropriate, and generally well-translated. Instructions were clear and simple, and the workbook moderately supports learners' confidence in using English.

The overall mean score of 4.47 indicates a strong agreement among respondents that the bilingual bridging workbook is a valuable and effective instructional material. The consistently high ratings across domains suggest that the workbook effectively addresses the need for a resource that bridges the gap between mother tongue and English instruction.

Table 2. Mean Score Rating of Teacher Experts on the Developed Bilingual Science Workbook

Domains	Mean Score
Content	4.52
Activities	4.32
Instructional Characteristics	4.52
Language Appropriateness	4.50
Overall	**4.47**

The evaluation of the Science bilingual workbook reveals a **strong agreement** across all assessed domains. This indicates that respondents generally found the workbook's material relevant and accurate, its activities engaging and effective, its design user-friendly, and its language appropriate for the learners. The **overall mean score of 4.47 which descriptively rated as Strongly Agree** further confirms the validity of the workbook as a valued instructional material in Grade 4 Science.

CONCLUSION

The findings of this study highlight the effectiveness and alignment of the developed bilingual materials in Science 4 competencies, particularly in nurturing student understanding and mastery of scientific concepts. Below are the key conclusions drawn:

1. Bilingual workbook in Science 4 were developed and validated by experts based from the selected competencies from the Matatag Curriculum.
2. The evaluation ratings from subject and instructional materials experts demonstrate that the bilingual workbook meet high design and usability standards, achieving an overall mean score of 4.41 ("Very High Valid"). It meets key educational standards and addresses the needs of learners in bilingual settings.
3. The findings confirm that the bilingual workbook learners gradually shift from their mother tongue to English (or another second language) by reinforcing concepts in both languages, reducing cognitive overload during the transition. To further improve its effectiveness, refinements should focus on reinforcing learning through more varied and practical activities, ensuring all content is bias-free and linguistically accessible, and enhancing features that promote learner independence.

RECOMMENDATIONS

In light of the findings and conclusions of the study, the following recommendations were drawn:

1. The bilingual workbook should be considered as an instructional materials pupils and teachers in teaching Science 4
2. The Department of Education shall provide to teachers such trainings and workshops on the development of bilingual instructional materials.
3. . Future researchers may conduct a similar study along this parameter..

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