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Development and Validation of Inclusive Mathematics Worksheets on Angles for Grade 7 Learners: Addressing Student Challenges and Enhancing Competencies Under the Matatag Curriculum

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Abstract

Globally, there is a growing focus on creating inclusive educational resources to support diverse learners in mastering fundamental concepts, ensuring equitable access to quality education and improving mathematical skills across various curricula. Thus, this study focuses on developing inclusive mathematics worksheets on angles for Grade 7 learners at Koronadal National Comprehensive High School, aiming to address student challenges and enhance competencies under the MATATAG curriculum. The researcher employed a Developmental Research Design and utilized the Input-Process-Output (IPO) framework through the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model to produce the worksheet. The study involved mathematics teachers, mathematics master teachers, and Grade 7 learners. To assess the effectiveness and acceptability of the developed worksheets, the researcher used statistical tools, specifically the mean and t-test, to analyze the evaluators' assessments. The results showed that the evaluators rated the developed worksheets very highly**.** There was no significant difference in the evaluation of mathematics teachers, master teachers, and Grade 7 learners on the acceptability of the inclusive mathematics worksheets on angles. Hence, the developed worksheets are valid and suitable as instructional materials to improve learners' academic performance and develop critical, creative, and problem-solving skills.

Keywords: Development; Validation; Inclusive Mathematics Worksheets; Angles; Grade 7 Learners

1. INTRODUCTION

Student performance in mathematics, particularly in geometry, has been a persistent challenge worldwide. While numerous studies emphasize high school mathematics, a recurring difficulty in understanding angles has been a prominent issue at the Grade 7 level. This difficulty is even more pronounced in regions with limited educational resources, where the absence of interactive materials hinders students' ability to connect abstract mathematical concepts with real-world applications. As such, there is a pressing need for effective interventions that promote active learning, enhance mathematics instruction in Grade 7 classrooms, and deepen students' comprehension of geometrical concepts, especially angles.

Integrating real-world contexts into lessons has proven to be an effective strategy for enhancing students'

understanding of angles. This approach aligns with the findings of Johnson and Lee (2020), who emphasized the importance of contextualized problem-solving in fostering a deeper comprehension of mathematical concepts. Similarly, Phan (2020) identified common misconceptions in learning angles, such as confusing angle size with side length. Furthermore, Johnson and Lee (2020) noted that students often struggle to apply their theoretical knowledge of angles in practical situations. Ahmed and Kumar (2021) also highlighted the influence of students' cultural and linguistic backgrounds on their understanding of geometric concepts, advocating for culturally responsive teaching methods.

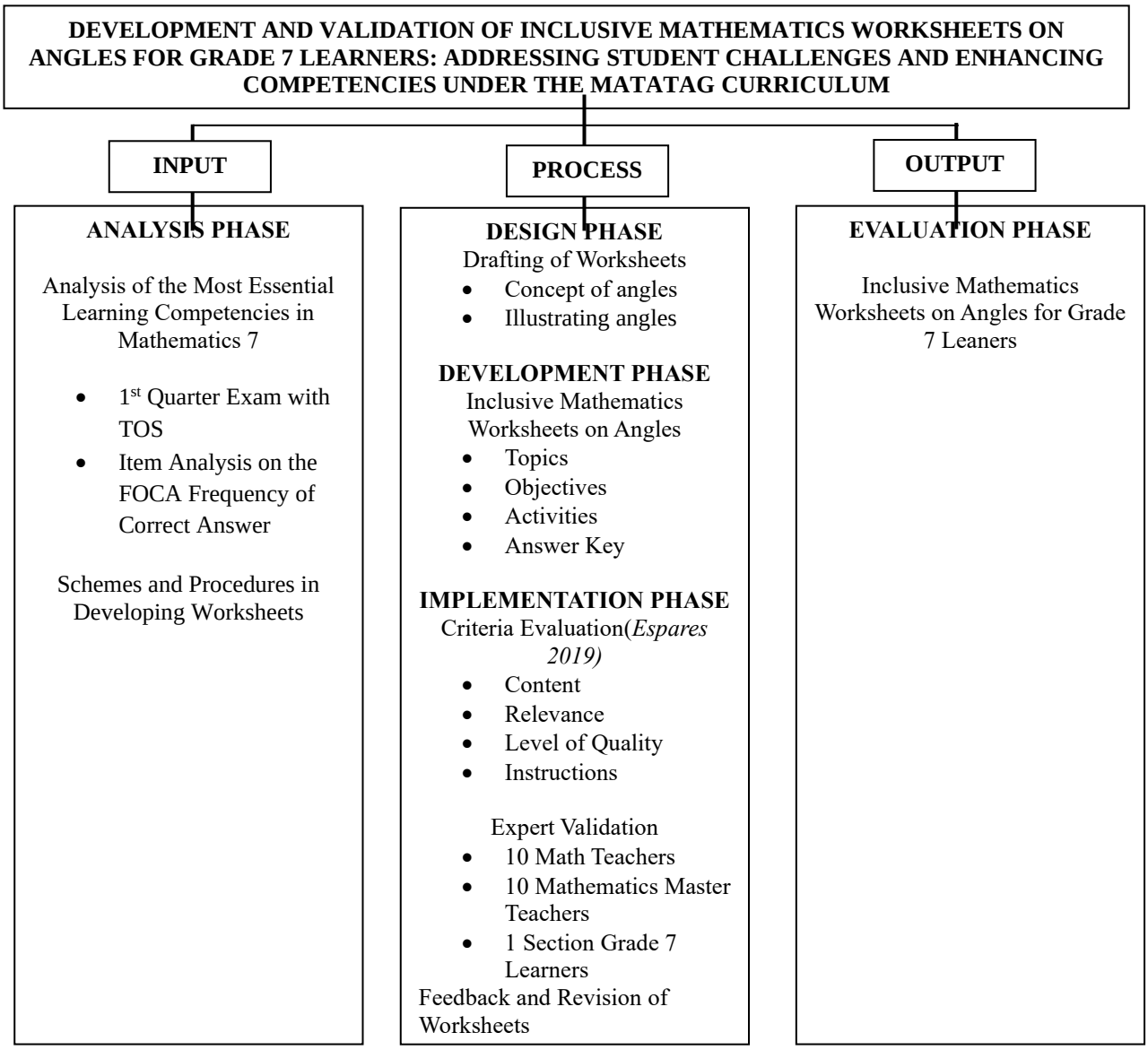
In many countries, including the Philippines, students face significant challenges in learning geometry, particularly angles. Outdated teaching methods and inadequate instructional materials exacerbate this issue (Lee & Torres, 2021). The lack of interactive learning tools and overcrowded classrooms limit students' opportunities to fully grasp geometric concepts, such as the relationships between interior and exterior angles of polygons (Santos & Reyes, 2023). These challenges are further compounded by students' low problem-solving and critical thinking skills in geometry, signaling the need for contextualized learning modules that can address these gaps. As a result, students often struggle to apply their knowledge of angles in real-world scenarios, leading to low performance in mathematics.

In the SOCCSKSARGEN region of the Philippines, Grade 7 students face similar difficulties in learning mathematics, especially angles. A lack of access to updated instructional materials and engaging resources further complicates the situation (Alcantara & Cruz, 2024). Many teachers continue to rely on traditional teaching methods that fail to cater to the diverse learning styles of students, leaving them with a poor conceptual understanding of angles (Delos Reyes & Villanueva, 2024). To address these issues, there is a critical need for a shift toward more interactive, student-centered learning approaches in the region.

One such solution is the implementation of inclusive mathematics worksheets, which integrate various teaching techniques aimed at addressing the least-mastered competencies of students. In response to the challenges faced by Grade 7 students, particularly in understanding angles, the researcher was inspired to develop a series of inclusive mathematics worksheets. These worksheets are designed to incorporate drills and exercises that foster independent learning and help students master key mathematical concepts. By offering enjoyable activities and exercises, these worksheets aim to enhance learning outcomes, encourage student engagement, and improve students' problem-solving abilities (Smith & Jones, 2020).

In conclusion, the creation of inclusive mathematics worksheets that focus on angles is a promising strategy to help Grade 7 students master difficult concepts and develop a deeper understanding of geometry. By making learning more interactive and accessible, these worksheets aim to provide students with the tools they need to succeed in mathematics, both in the classroom and beyond.

II. MATERIALS AND METHODS



III. DISCUSSION

The study revealed that Grade 7 learners face significant challenges in understanding angles, primarily due to the concept's abstract nature and limited exposure to real-world applications. Students struggled with differentiating angle types, recognizing angles in various orientations, and illustrating angles accurately, often misplacing protractors and measuring them incorrectly (Taylor 2019).

Interactive visual aids and hands-on activities were found to improve these skills. Inclusive mathematics worksheets aligned with the MATATAG curriculum have been proposed to address these issues. These worksheets feature diverse representations, culturally relevant contexts, real-life problem scenarios, and step-by-step guides, enhancing student understanding and motivation (Brown&Lee, 2021).

Expert evaluators prioritized content accuracy, curriculum alignment, relevance, and clear instructions. They also highly rated the materials' real-life applications and cultural sensitivity. Users, including students and teachers, value worksheets with clear explanations, varied practice exercises, and engaging formats (Miller&Davis, 2022). They appreciate materials that are easy to navigate and relate to familiar

situations.

Differences in perceptions among expert evaluators and users highlight varying priorities. Expert evaluators focused on instructional clarity, emphasizing effectiveness and student-centered design, while users prioritized engagement and ease of use (Jones&Smith, 2020).

IV. RESULTS

3.1 Struggles on Angles

Struggles	Concept of Angles	Illustrating Angles
Misunderstanding the definition	Learners often confuse the definition of an angle with other geometric terms (e.g., sides,).	Difficulty in visualizing angles on paper or using tools to represent angles.
Confusion with angle types	Struggling to differentiate between types of angles (acute, right, obtuse, reflex).	Challenges in using protractors or drawing accurate representations of different angles.
Misconception about angle measurement	Confusion between angle size and side length or the units used to measure angles (degrees).	Difficulty in measuring angles accurately with instruments (e.g., protractors).
Inability to apply the concept	Learners have trouble applying angle concepts to solve geometric problems, especially in polygons.	Students find it difficult to translate the concept of angles into a visual format, especially with complex shapes or multiple angles.
Misunderstanding angle relationships	Confusion in understanding the relationship between angles (complementary, supplementary, vertically opposite).	Difficulty in drawing and demonstrating relationships between angles (e.g., adjacent angles forming a linear pair).

The struggles related to the understanding of angles in geometry highlight the necessity for targeted instruction that emphasizes the conceptual understanding of angles and their relationships (Jones, 2020). Students often face difficulties in translating abstract angle concepts into visual representations, indicating a need to enhance visual literacy in geometry (Smith & Lee, 2018). It is crucial for teachers to provide more hands-on practice with tools like protractors and focus on ensuring students achieve a clear and accurate understanding of foundational angle concepts before progressing to more complex geometric applications (Brown, 2019).

3.2 The Inclusive Mathematics Worksheets

3.3 Level of Acceptability of Inclusive Mathematics Worksheet

Indicators	Experts-Evaluator			Users		
	Mean	**SD**	**Interpretation**	**Mean**	**SD**	**Interpretation**
1. Content	4.53	0.58	Very High	4.56	0.60	Very High
2. Relevance	4.28	0.66	High	4.49	0.59	High
3. Level of Quality	4.61	0.53	Very High	4.50	0.67	Very High
4. Instructions	4.34	0.71	High	4.51	0.65	Very High

The table summarizes the acceptability ratings of four indicators—Content, Relevance, Level of Quality, and Instructions—for inclusive mathematics worksheets as evaluated by Experts-Evaluators and Users. Both groups provided high ratings across all indicators, with minor differences between them.

- **Content**: The mean rating for the Content indicator was very high for both groups (Experts: 4.53, Users: 4.56), suggesting that the worksheets align well with the curriculum and effectively enhance students' understanding of mathematical concepts. (Manalaysay, 2021)
- **Relevance**: Experts rated Relevance as high (4.28), while Users rated it slightly higher (4.49), indicating that the worksheets are highly relevant, promote critical thinking, and connect content to real-life applications. (Hattie, 2012)
- **Level of Quality**: Both groups rated the Level of Quality very highly (Experts: 4.61, Users: 4.50), suggesting that the worksheets are visually appealing, well-designed, and engaging.(Mayer, 2021)
- **Instructions**: The Experts rated the Instructions as high (4.34), while Users rated them very high (4.51), indicating that the worksheets provide clear, easy-to-follow, and structured instructions.(Gonzales&Rivera, 2021)

In general, all indicators received high to very high ratings.

3.4 t-test Results Comparing Acceptability Ratings of Experts-Evaluator and the Users

Statistical Measure	Experts-Evaluator	Users
Mean	4.44	4.515
Variance	0.2249	0.0728
Sample Size (n)	20	40

The table presents the results of a t-test comparing the acceptability ratings of Experts-Evaluators and Users. The mean ratings were slightly higher for Users (4.515) than for Experts (4.44), but the difference was not statistically significant. The low variance for Users (0.0728) indicates more consistency in their ratings compared to the higher variance for Experts (0.2249). The calculated t-value (-0.78197) and the p-values (both one-tailed and two-tailed) suggest no significant difference in the ratings between the two groups, as the p-values exceed the critical value (0.05). This means that both Experts and Users rated the worksheets similarly in terms of acceptability.

V. CONCLUSION

Students have difficulty understanding and applying angle pair concepts, highlighting the need for enhanced teaching strategies such as visual aids, interactive activities, and additional practice to improve their comprehension and performance.

Well-designed, accessible worksheets can effectively help Grade 7 learners overcome challenges with angle concepts, fostering deeper understanding and skill development aligned with the Matatag Curriculum.

The inclusive mathematics worksheets were highly quality, featuring solid content, broad approval, and effective instructional design. However, they still have the potential to improve their relevance and instructional efficiency.

The users assessed the developed inclusive mathematics worksheets as outstanding in content, level of quality, and instructions and considered them highly relevant.

The t-test for differences indicated that the mean responses of the expert evaluators and users showed no

significant variation in terms of content, relevance, level of quality, and instructions.

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