

# Exploring Pre-service Elementary Teachers Readiness to Implement Holistic Assessment in Mathematics Learning

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**Abstract.** This study explores the readiness of pre-service elementary teachers to implement holistic assessment in mathematics learning. Holistic assessment includes cognitive, affective, and psychomotor domains, supported by the theory of multiple intelligences and authentic tasks. Using a descriptive survey method, data were collected through a 30-item Likert-scale questionnaire. Results indicate that while participants show positive perceptions of holistic assessment, their practical readiness-especially in evaluating non-cognitive domains-remains limited. The study highlights the need for better preparation through targeted training in teacher education programs.

**Keywords:** holistic assessment, pre-service teachers, mathematics learning, multiple intelligences

## 1 Introduction

Holistic assessment is defined as an evaluation approach that captures the full scope of student learning, encompassing cognitive (knowledge), affective (attitudes), and psychomotor (skills) domains [1]. In the context of mathematics education, such an approach challenges the traditional focus on factual recall and procedural fluency by emphasizing deep understanding, critical thinking, and real-world application. According to Clarke [1], while mathematics has often been treated as a domain of abstract reasoning, the effective teaching of mathematics requires an awareness of students' emotional engagement and their physical interaction with learning tools.

The relevance of holistic assessment in mathematics is strongly supported by Gardner's Theory of Multiple Intelligences [2]. Gardner posits that learners express intelligence in diverse forms, including logical-mathematical, visual-spatial, bodily-kinesthetic, and interpersonal intelligences. When educators acknowledge and integrate this diversity into their assessment practices, they enable a more inclusive and meaningful evaluation of student competence. For example, students with strong bodily-kinesthetic intelligence might better demonstrate understanding through hands-on problem solving or model construction, rather than through conventional written tests.

Wiggins and McTighe [3] further emphasize the value of authentic assessment—a form of holistic evaluation—where learners are required to apply knowledge in real-world contexts. This is particularly relevant in elementary mathematics education, where abstract concepts often need to be grounded in tangible experiences. Authentic tasks, such as measuring classroom objects or designing a simple budget, not only engage students more deeply but also align with 21st-century skills such as collaboration, communication, and problem-solving.

Despite its theoretical grounding, holistic assessment remains underutilized in actual classroom practice. Several studies point to the limited preparation of pre-service teachers in designing and implementing holistic assessment strategies [4], [5]. Many teacher education programs still allocate minimal time to assessment literacy, often focusing predominantly on test construction and grading systems. Consequently, prospective teachers may possess limited knowledge of how to evaluate affective and psychomotor domains, or how to develop rubrics for performance-based tasks.

To address this gap, Niess et al. [4], Nitko and Brookhart [6] argue for a shift in teacher education curricula. They advocate not only for the inclusion of content on holistic and authentic assessment but also for experiential learning opportunities where pre-service teachers can design, implement, and reflect on such assessments in controlled environments. This aligns with the broader movement toward practice-based teacher education, which seeks to bridge the theory-practice divide and foster greater classroom readiness among teacher candidates.

The integration of holistic assessment into mathematics education thus requires more than theoretical awareness. It necessitates structural changes in teacher training programs, including extended coursework, cross-course collaboration, and mentoring by experienced practitioners. These elements are critical to fostering a generation of educators who are not only assessment literate but also capable of evaluating students in ways that reflect their full potential.

## **2 Method**

This study applied a descriptive quantitative approach to explore the readiness of pre-service elementary teachers in implementing holistic assessment within mathematics instruction. The focus was on measuring their understanding, perceptions, and preparedness in relation to multiple intelligences, authentic assessment, and the three learning domains—cognitive, affective, and psychomotor [1]–[3].

Participants were sixth-semester students enrolled in the Primary School Teacher Education (PGSD) program at Universitas Negeri Medan (UNIMED). Purposive sampling was used to select students who had already completed relevant coursework in mathematics pedagogy and educational evaluation, assuming sufficient exposure to the concepts under study.

A 30-item Likert-scale questionnaire was developed based on Gardner's theory of multiple intelligences [2], Wiggins and McTighe's authentic assessment framework [3], and Bloom's revised taxonomy [1]. Items were categorized into three aspects: knowledge of holistic assessment, perception of student intelligence, and readiness to apply authentic tasks. Each aspect contained both positive and negative statements, with responses rated from "Strongly Disagree" (1) to "Strongly Agree" (4).

The table below presents the aspects, indicators, and item classifications:

**Table 1.** Mapping of Items to Research Constructs and Indicators.

Aspect	Indicator	Item Numbers	Item Type
Perception of Multiple Intelligences	Belief that students possess diverse types of intelligence that should be accommodated in assessment.	1, 3, 6, 8, 10	Positive
		2, 4, 5, 7, 9	Negative
Knowledge of Holistic Assessment	Understanding the importance of assessing cognitive, affective, and psychomotor domains in elementary mathematics learning.	12, 14, 16, 18, 20	Positive
		11, 13, 15, 17, 19	Negative
Readiness for Authentic Assessment	Confidence in designing and implementing real-world tasks and performance-based rubrics in math instruction.	21, 22, 24, 27, 28, 29	Positive
		23, 25, 26, 30	Negative

The instrument's content validity was confirmed through expert judgment, and its reliability was tested in a pilot involving 20 comparable respondents. Internal consistency was considered acceptable with a Cronbach's Alpha coefficient of 0.733.

Data were collected online via Google Forms, ensuring voluntary participation and confidentiality. Negatively worded items were reverse-coded. Descriptive statistics were used to analyze the data, focusing on means and standard deviations for each aspect.

### 3 Result and Discussion

The findings of this study reveal that prospective primary school teachers at Universitas Negeri Medan (UNIMED) demonstrate a generally positive orientation toward holistic assessment in elementary mathematics education. The results are summarized in Table 2.

**Table 2.** Mean and Standard Deviation for Each Assessment Aspect.

Aspect	Mean	Standard Deviation
Perception of Multiple Intelligences	3,025	0,453
Knowledge of Holistic Assessment	3,160	0,425
Readiness for Authentic Assessment	3,031	0,351

Among the three aspects measured, the highest average score was recorded in the Knowledge of Holistic Assessment ( $M = 3.16$ ,  $SD = 0.43$ ), suggesting that prospective teachers have developed a strong conceptual understanding of the importance of assessing students in a comprehensive manner. Holistic assessment refers to the evaluation of student learning that goes beyond cognitive performance to include affective dimensions (such as attitudes, interests, and values) and psychomotor skills (such as demonstration of procedures or use of learning tools). This multidimensional view of assessment aligns with the revised version of Bloom's taxonomy, which emphasizes the integration of cognitive, affective, and psychomotor domains as fundamental to effective teaching and learning [7].

The relatively high score in this area indicates that the teacher education program has successfully introduced key theoretical frameworks of assessment to pre-service teachers. Students appear to recognize that learning is a complex, integrated process that cannot be accurately captured through conventional testing alone. This is consistent with Popham's argument that high-quality classroom assessment should inform instructional decisions and promote student growth across multiple dimensions of learning [6]. Similarly, Nitko and Brookhart emphasize that assessments designed with only one domain in mind fail to reflect the full scope of student development, especially in subjects like mathematics, where process, attitude, and application are equally important [6].

Moreover, the findings support the notion that teacher education programs are increasingly responsive to the need for inclusive and authentic assessment practices. Future teachers not only acknowledge the significance of assessing knowledge, but also understand the necessity of observing students' approaches to learning, their ability to collaborate, communicate, and apply mathematical concepts in real-world contexts. Such understanding is particularly relevant in 21st-century education, where the role of assessment extends to preparing students for lifelong learning and problem-solving. However, despite the strong conceptual grasp, the gap observed between knowledge and actual classroom readiness raises questions about how this understanding is translated into practice.

On the aspect of Perception of Multiple Intelligences, the average score was slightly lower ( $M = 3.03$ ,  $SD = 0.45$ ), but still within a generally positive range. This result indicates that respondents are moderately aware of the diversity in students' cognitive profiles, such as interpersonal, visual-spatial, musical, bodily-kinesthetic, and intrapersonal intelligences, and understand that these differences hold pedagogical value in mathematics instruction. While traditional mathematics education often prioritizes logical-mathematical intelligence, this broader view acknowledges that students may approach and understand mathematical concepts in a variety of ways—through movement, visualizations, collaboration, or personal reflection.

This finding resonates with Gardner's theory of multiple intelligences [2], which asserts that human intelligence is multifaceted and that effective teaching should be responsive to individual strengths. It also aligns with the work of McClellan and Conti, who argue that recognizing and incorporating these varied intelligences into teaching strategies can make learning experiences more inclusive, engaging, and meaningful [4]. In mathematics education, for instance, visual-spatial learners might benefit from diagrams and manipulatives, while kinesthetic learners may grasp concepts more effectively through hands-on tasks like measuring, constructing, or modeling.

However, despite this conceptual awareness, the data also reveal limitations. Several negatively worded items within this aspect received higher levels of agreement than expected. This suggests that while respondents may endorse the importance of addressing multiple intelligences in principle, they lack confidence or possibly knowledge in applying this framework to actual assessment practices. In other words, although they recognize that students learn differently, they may not yet feel prepared to design assessment tools that accurately reflect and accommodate such diversity. This gap between recognition and implementation is a recurrent theme in teacher education literature, where many pre-service teachers report uncertainty about operationalizing inclusive pedagogies in real classrooms.

Such findings highlight the need for practical training in aligning assessment design with diverse learner profiles. For example, future teachers might benefit from guided opportunities to create differentiated assessment tasks that cater to multiple intelligences within a single lesson or unit. Without this kind of scaffolding, there is a risk that MI theory remains a theoretical ideal rather than an instructional reality. Therefore, bridging the gap between awareness and practice must be a priority within teacher education programs to ensure that all students regardless of their dominant intelligence are assessed fairly and meaningfully.

The aspect with the lowest standard deviation was Readiness for Authentic Assessment ( $M = 3.03$ ,  $SD = 0.35$ ), suggesting a relatively uniform, yet only moderate, level of confidence among pre-service teachers in applying authentic assessment practices. This result points to an important gap in teacher education: while theoretical understanding may be solid, its practical application in classroom settings especially within the context of mathematics instruction remains limited.

Authentic assessment, which requires students to perform meaningful tasks that reflect real-world challenges, is conceptually embraced by many teacher candidates. However, studies have consistently shown that translating this concept into actual classroom practices is difficult for pre-service teachers. Thanheiser et al. found that many teacher candidates struggle to design and implement mathematical tasks that are grounded in students' lived experiences or real-life contexts [5]. This difficulty often stems from limited exposure to modeling, practice, and feedback during teacher preparation programs.

A contributing factor to this readiness gap is the lack of structured opportunities in coursework for pre-service teachers to engage deeply with authentic assessment design. As Namakshi et al. emphasize, many teacher candidates are still developing their ability to "notice" student thinking and translate it into meaningful assessment criteria—an essential skill in authentic assessment [5]. Without repeated, supported practice in crafting and using such tools, pre-service teachers may feel unprepared to judge student performance beyond right or wrong answers.

Moreover, the difficulty in designing assessments that reflect diverse learner profiles also appears to stem from limited practical training on applying multiple intelligences theory. McClellan and Conti highlight that many pre-service teachers recognize the value of multiple intelligences but lack confidence in tailoring assessment strategies to address students' varied strengths and preferences [4]. For instance, designing a geometry assessment that accommodates visual-spatial learners while also engaging kinesthetic or interpersonal intelligence types demands pedagogical flexibility and creativity, skills that require guided development through coursework and field experience.

These interconnected challenges suggest that current teacher education curricula may not adequately prepare pre-service teachers for the complex demands of authentic, holistic assessment. The moderate readiness scores in this study support the argument for extending assessment-related coursework in both content and duration. Additional time would allow for iterative cycles of designing, implementing, evaluating, and revising assessment tasks, ideally with input from peers and mentor teachers. Microteaching, teaching simulations, and case-based learning activities could also be leveraged to provide low-risk, high-impact practice environments.

Ultimately, the consistent but moderate levels of readiness to use authentic assessments call attention to a critical opportunity for improvement in teacher preparation programs. By creating more deliberate bridges between theory and practice especially in the context of real-life mathematics learning, teacher education programs can better equip future educators with the confidence and competence to assess student learning in a holistic and meaningful way.

## 4 Conclusion

This study underscores the importance of preparing pre-service teachers not only to understand the principles of holistic and authentic assessment but also to implement them effectively in mathematics instruction. While conceptual knowledge is strong, readiness to apply authentic strategies remains an area for growth. Addressing this challenge requires a systemic approach involving curriculum enhancement, experiential learning, and institutional support.

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