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Zhenisbek Nakypbek, Larissa Kainbayeva

Korkyt Ata Kyzylorda University, Kyzylorda, Republic of Kazakhstan

THE LEVEL OF ASSESSMENT LITERACY OF PRE-SERVICE MATHEMATICS TEACHERS

Abstract: Assessment literacy is increasingly recognized as a critical element in the preparation of future teachers, especially in subjects where academic achievement is closely measured, such as mathematics. Yet, the extent to which pre-service teachers develop assessment-related understanding remains a subject of ongoing discussion. This article explores the general patterns and tendencies regarding assessment literacy among future mathematics teachers within the context of higher education. Drawing on conceptual frameworks and previous international findings, the study examines the presence and depth of assessment-related knowledge and attitudes among students preparing for teaching careers. Special attention is given to the role of practical teaching experience in shaping these competencies. While various educational programs emphasize assessment in theory, questions persist about its transfer into real teaching contexts. The study contributes to this dialogue by analyzing indicators of assessment literacy and reflecting on the implications for teacher education. The findings underscore the importance of aligning theoretical content with pedagogical practice and offer suggestions for improving training components related to assessment. This research provides insights relevant to teacher educators and curriculum developers who seek to enhance the effectiveness of initial teacher education and ensure that future educators are well-equipped to assess student learning in a meaningful and responsible way.

Keywords: assessment literacy; pre-service teachers; mathematics.

Introduction

In the context of modern education, assessment literacy has become a foundational competency for future teachers, especially in mathematics education. The ability to design, interpret, and use assessment data effectively is critical not only for measuring student performance but also for guiding instruction, enhancing learning, and fostering reflective practice. According to DeLuca and Klinger (2010), assessment literacy involves knowledge of assessment principles, the ability to apply various assessment methods, and the skill to interpret results meaningfully for pedagogical decisions. Despite its recognized importance, numerous studies (Ayalon & Wilkie, 2020; Deneen & Brown, 2016; Koh, 2011) have reported that pre-service teachers often demonstrate limited competence in practical assessment tasks.

There is growing consensus among scholars that pre-service teacher education programs must prioritize assessment literacy through both theoretical instruction and authentic practice (Canty et al., 2023; Oo et al., 2022). Studies have shown that future teachers frequently perceive assessment as a summative grading tool rather than as a formative process to support student learning (Dehqan & Sorkhi, 2020; McMillan, 2001). This misperception can hinder their ability to use assessment in dynamic and learner-centered ways. Moreover, the development of assessment literacy has been closely linked to experiential opportunities such as pedagogical practicum or approximations of practice (Ayalon & Wilkie, 2020).

In the current study, a quantitative approach was employed to explore the assessment literacy levels of pre-service mathematics teachers enrolled at Korkyt Ata university. A validated instrument partially adapted from McMillan (2001) was used to collect data from 119

participants. The study aimed to test several hypotheses based on prior literature: (1) Pre-service mathematics teachers demonstrate insufficient assessment literacy; (2) Those who have completed pedagogical practicum have significantly higher assessment literacy.

The findings of this study are expected to contribute to improving teacher education programs in Kazakhstan by identifying specific areas where assessment literacy training should be strengthened.

Literature Review

Assessment literacy is broadly defined as the knowledge, skills, and understanding required to design, implement, interpret, and use assessments effectively for teaching and learning (DeLuca & Klinger, 2010; Stiggins, 2010). Popham (2009) characterizes it as a critical teacher competence, essential for making valid educational decisions. The evolution of assessment literacy has transitioned from a narrow focus on testing and grading to a more nuanced understanding that includes formative, summative, and authentic assessment strategies (Deneen & Brown, 2016). In contemporary teacher education, assessment literacy is viewed not only as technical knowledge but also as a reflective and contextual practice (Koh, 2011).

The literature identifies several dimensions of assessment literacy, which typically include: understanding of assessment purposes, selection and design of appropriate tools, data interpretation, feedback provision, and ethical application of assessment results (Alonzo & Oo, 2022; DeLuca & Klinger, 2010). These competencies are often grouped into cognitive (what teachers know), practical (what they do), and affective (their beliefs and attitudes) components (Deneen & Brown, 2016).

Moreover, assessment literacy requires teachers to be capable of aligning learning goals with assessment tasks and using results to inform instruction. Inadequate training in this area can lead to reliance on traditional testing approaches and missed opportunities for formative assessment (Ayalon & Wilkie, 2020).

Numerous studies (Canty et al., 2023; Dehqan & Sorkhi, 2020) have identified that pre-service teachers (PSTs) often enter teacher education programs with limited understanding of assessment principles. Many PSTs perceive assessment as primarily summative, used for grading rather than as a tool for student development (McMillan, 2001). This summative orientation may result from their own schooling experiences, where assessments were used mainly for accountability rather than learning support.

McMillan (2001) found that secondary teachers tend to emphasize grading over feedback, often neglecting the potential of formative techniques such as peer assessment, self-assessment, or portfolio-based evaluation. This orientation influences PSTs' own conceptions of assessment and highlights the importance of explicitly addressing assessment literacy in teacher preparation curricula.

Experiential learning particularly through pedagogical practicum has been shown to play a critical role in fostering assessment literacy. Ayalon and Wilkie (2020) demonstrate that when PSTs engage in real-world classroom tasks such as designing rubrics and analyzing student work, they begin to understand assessment as a dynamic and responsive process. Similarly, DeLuca and Johnson (2017) advocate for “approximations of practice” — guided simulations that help PSTs rehearse assessment activities before entering the classroom.

Koh (2011) also stresses the importance of long-term, embedded professional development in contrast to short-term workshops. Pre-service teachers who participate in sustained assessment-focused training tend to show greater growth in assessment-related competencies.

Despite an increasing body of research, gaps remain in understanding how assessment literacy develops among PSTs in specific local contexts, such as Kazakhstan. Many international studies focus on Western or high-resource educational systems, which may not fully reflect the realities of teacher preparation in post-Soviet or Central Asian environments.

Furthermore, there is limited quantitative research directly comparing assessment literacy levels of PSTs with and without practicum experience. The present study addresses this gap by investigating how pedagogical practicum and teaching experience influence assessment literacy among pre-service mathematics teachers at Korkyt Ata university.

Methodology

This study employed a quantitative, non-experimental, cross-sectional design to examine the assessment literacy levels of pre-service mathematics teachers. The research aimed to compare literacy levels between groups based on practicum experience and explore overall proficiency.

The study sample included 119 undergraduate students from Korkyt Ata university majoring in mathematics education. Participants were from all four academic years (Year 1 to Year 4). Grouping was conducted based on their participation in pedagogical practicum (yes/no).

The primary data collection instrument was a structured questionnaire adapted from a validated tool originally developed by the first author of "Pre-service teachers' assessment literacy and its implementation into practice," with several items drawn from McMillan (2001). The original instrument consisted of two sections. For this study, only Section I was used, which included 42 items covering:

- Background and demographic questions (8 items),
- Types of assessment (14 items),
- Evaluation criteria (16 items),

Cognitive levels of assessment (4 items). Nine questions from the "teaching methods" section were excluded, as they were not relevant to the core objective.

To assess the internal consistency of the instrument, Cronbach's alpha coefficient was calculated using SPSS(version 29.0.2.0) software. The result was $\alpha = 0.838$ for 34 items, indicating high reliability.

The survey was distributed in paper format during the 2024–2025 academic year. Participation was voluntary, and students were informed about the purpose and confidentiality of the study. Data were coded and processed using SPSS Statistics 26.

Three statistical procedures were used:

1. Kolmogorov–Smirnov test to assess the normality of data distribution. Results showed that the distribution was not normal ($p < 0.001$).
2. Cronbach's alpha to measure the internal consistency of the questionnaire.
3. Mann-Whitney U test to compare the assessment literacy scores between students who had completed practicum and those who had not.

All participants gave informed consent. Anonymity and confidentiality were ensured, and participation had no effect on academic standing. The research followed ethical guidelines for educational research involving human participants.

Results and discussion

To evaluate the first hypothesis — that pre-service mathematics teachers have low levels of assessment literacy — the mean score of all 119 participants was analyzed. The overall mean score was $M = 1.4706$ ($SD = 0.30953$) on a 4-point Likert scale.

Based on the categorization proposed by the original developers of the instrument (adapted from McMillan, 2001), assessment literacy levels can be interpreted as follows:

0.00–0.80: Traditional
0.81–1.60: Close to Traditional
1.61–2.40: Transitional
2.41–3.20: Close to Constructivist
3.21–4.00: Constructivist

Given that the mean score falls within the "Close to Traditional" range, the findings suggest that pre-service mathematics teachers possess relatively limited assessment literacy. This result supports the first hypothesis and is consistent with previous research emphasizing the underdeveloped assessment skills among pre-service teachers (Canty et al., 2023; Oo et al., 2022; McMillan, 2001).

Table 1 displays the descriptive statistics comparing students who had completed pedagogical practicum with those who had not. Students with practicum experience (n = 60) scored slightly higher (M = 1.5336, SD = 0.30809) than those without practicum (n = 59, M = 1.4065, SD = 0.30014).

Table 1

Descriptive Statistics for Assessment Literacy

Ped. prac.	Mean	N	Std. Deviation
Yes	1,5336	60	0,30809
No	1,4065	59	0,30014
Total	1,4706	119	0,30953

Although the descriptive statistics show a visible difference in means, statistical testing was required to determine its significance.

To determine whether parametric or non-parametric analysis would be appropriate, the Kolmogorov-Smirnov test was used to assess the normality of the distribution. As shown in Table 2, the test yielded a significant result ($p < .001$), indicating that the assessment literacy scores did not follow a normal distribution.

Table 2

One-Sample Kolmogorov–Smirnov Test

N			119
Normal Distribution Parameters[a,b]	Mean		1,4706
	Standard Deviation		0,30953
Most Extreme Differences	Absolute		0,244
	Positive		0,220
	Negative		-0,244
Test Statistic			0,244
Asymp. Sig. (2-tailed)[c]			<0,001
Monte Carlo Sig. (2-tailed)[d]	Sig.		<0,001
	99% Confidence Interval	Lower Bound	0,000
		Upper Bound	0,000

a. The distribution being tested is normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. Lilliefors Method based on 10,000 Monte Carlo samples with starting seed 299883525.

This confirmed the use of non-parametric tests for subsequent analysis.

The second hypothesis — that students who had completed a pedagogical practicum would demonstrate significantly higher assessment literacy — was tested using the Mann–Whitney U test.

Table 3
Mann-Whitney U Test Results

Statistical criteria[a]	
Mann-Whitney U	1665,500
Wilcoxon W	3435,500
Z	-0,556
Asymp. Sig. (2-tailed)	0,578

a. Grouping variable: Pedagogical practice

Table 4
Mean Ranks by Practicum Group

Ped. prac.	N	Mean Rank	Sum of Ranks
Yes	60	61,74	3704,50
No	59	58,23	3435,50
Total	119		

Although students with practicum experience showed higher average ranks and means, the Mann–Whitney U test indicated no statistically significant difference ($p = 0.578$). Therefore, the second hypothesis was not supported by the data.

The purpose of this study was to investigate the assessment literacy levels of pre-service mathematics teachers and examine the potential influence of pedagogical practicum experience. Two hypotheses were formulated and tested. The findings are discussed below in relation to existing literature.

The first hypothesis proposed that pre-service mathematics teachers exhibit low levels of assessment literacy. The average literacy score of 1.4706 falls into the “close to traditional” category based on the classification framework used by the developers of the instrument (adapted from McMillan, 2001). This finding supports the hypothesis and is consistent with previous studies that report underdeveloped assessment competencies among pre-service teachers (Canty et al., 2023; Oo et al., 2022; McMillan, 2001).

The result reflects a persistent challenge in teacher preparation: many candidates continue to view assessment as a grading mechanism rather than as a tool for learning and improvement (Dehqan & Sorkhi, 2020). Such perspectives may be shaped by the teachers' own educational experiences in assessment-driven environments where summative evaluations dominate instructional decisions.

The second hypothesis assumed that students who had completed a pedagogical practicum would demonstrate significantly higher assessment literacy. While descriptive data

showed that practicum-experienced students had higher average scores (M = 1.5336 vs. M = 1.4065), the Mann–Whitney U test indicated that this difference was not statistically significant ($p = 0.578$).

This contrasts with previous research that links practice-based experiences to improved assessment competencies (Ayalon & Wilkie, 2020; DeLuca & Johnson, 2017). A possible explanation is that the practicum experience provided in the local context may not have emphasized assessment tasks or provided enough structured support. Without guided opportunities to engage in real assessment design, feedback provision, or data analysis, students may fail to develop deeper literacy despite their field experience.

The findings suggest that teacher preparation programs in Kazakhstan may benefit from a more explicit and structured focus on assessment literacy. This includes integrating formative assessment strategies into course content, providing hands-on activities in rubric development, and ensuring that practicum experiences include guided assessment practice.

Reinforcing assessment literacy as a core component of teacher identity and professional competence could enhance instructional decision-making and ultimately improve student learning outcomes.

Conclusion

This study examined the assessment literacy of pre-service mathematics teachers at Korkyt Ata University, Kazakhstan, focusing on two key research questions: (1) What is the general level of assessment literacy among these students? and (2) Does pedagogical practicum experience significantly influence their literacy levels?

The results indicated that the overall level of assessment literacy falls into the "close to traditional" category, confirming the first hypothesis that students possess relatively low assessment literacy. This finding echoes previous international research and underscores the need to strengthen assessment training within teacher education.

Regarding the second hypothesis, although practicum-experienced students demonstrated slightly higher average scores, the difference was not statistically significant. This suggests that current practicum structures may not sufficiently support the development of assessment skills.

Based on these findings, it is recommended that teacher education programs integrate more explicit instruction in assessment literacy, including both theoretical foundations and practical application. Enhancing practicum quality, especially in relation to assessment activities, can further support pre-service teachers in becoming competent, reflective practitioners capable of using assessment to improve student learning.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

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Information about authors:

Nakypbek Zhenisbek Yergazyuly – Master of Pedagogical Sciences, PhD student of the educational programs "Physics and mathematics", Korkyt Ata Kyzylorda university, Kyzylorda, Kazakhstan, e-mail: zhenisbek.nakypbek99@gmail.com, ORCID 0009-0009-6655-2194 ***(corresponding author)***

Kainbaeva Larissa Sagizhanovna – Candidate of Pedagogical Sciences, Head of the educational programs "Physics and mathematics", Korkyt Ata Kyzylorda university, Kyzylorda, Kazakhstan, e-mail: kainbaeva_l@korkyt.kz, ORCID 0000-0002-2927-6575