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**ORIGINAL ARTICLE**

# Examining The Development of Classroom Assessment Competencies among Pre-Service Teachers: Focus Areas for Universities of Education

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**ABSTRACT**
With the rapid advancement of digital technology and particularly artificial intelligence in education, technology-driven teaching and assessment methods are evolving at an unprecedented pace. To keep up with these developments, there is an urgent need to update classroom assessment competencies. The effective development of these competencies should begin with the training provided to students at teacher education institutions. This study employs a proposed measurement scale consisting of four competency domains: Assessment content knowledge (K); Classroom assessment practice skills (P); ICT and digital techniques in educational assessment (I); Ethics (E), to evaluate the classroom assessment competencies of 548 pre-service teachers. The findings revealed significant gaps in the assessment competencies of prospective teachers, particularly in the domains of classroom assessment practice skills and the use of ICT in assessment. These insights provide a strong foundation for recommending improvements to teacher education programs and policies, aiming to better prepare teacher students with essential skills required for effective classroom assessment in the digital age.

## 1. INTRODUCTION

In educational activities, teaching and assessment are two essential responsibilities for teachers. Equipping pre-service teachers with comprehensive teaching and classroom assessment competencies before they become future teachers is a crucial task for teacher training universities in particular, and the education system as a whole.

Indeed, teachers' classroom assessment competency plays a significant role and has a positive impact on learners' outcomes (Mellati & Khademi, 2018). Currently, with the rapid development of digital technology, there is an inevitable shift from direct teaching and assessment to blended teaching and assessment (Tran et al., 2022). Consequently, technology-based teaching methods such as blended learning, flipped classrooms, and assessment for learning are becoming an inevitable trend, demonstrating outstanding advantages (Hoang et al., 2022; Hoang et al., 2020; Tran et al., 2021). Along with the development of teaching forms and methods, assessment methods must be adapted to suit this evolving context. Assessment is an inseparable activity within teaching, and teaching competency must be tied to educational assessment competency.

Measuring the educational assessment competency of pre-service teachers is a highly complex task, involving knowledge, skills, ethics, and assessment tendencies (Barnes et al., 2020). How can we accurately assess the classroom assessment competency of pre-service teachers to appropriately adjust the training process? Currently, the standards designed to measure the educational assessment competency of both teachers and education students are

still based on standards that have been used for decades. Teaching methods, environments, and technology are rapidly developing and constantly changing. Meanwhile, the tools and standards for measuring the classroom assessment competency of teachers and pre-service teachers have been slow to adapt, failing to keep pace (White, 2019). Current assessment standards still lack criteria on technology competency and digital assessment competency (Peled, 2021), which can effectively assist teachers in designing assessments in blended learning environments and using new teaching methods (Akbar & Biyanto, 2022; Eyal, 2012; Phan et al., 2021).

In educational assessment, assessment competency is always developed and enhanced from education students to teachers. The assessment of this competency also has different purposes and characteristics. However, existing publications reveal the mere focus on measuring the assessment competency of in-service teachers for retraining and professional development. Meanwhile, measuring the classroom assessment competency of pre-service teachers to improve training quality has not been systematically researched or published.

From the above arguments, to address the identified limitations, this study proposes and employs a scale to measure the educational assessment competencies of pre-service teachers. The study results serve as an important basis for educational institutions to strategize and adjust the training process to meet current assessment and teaching trends. This study aims to answer two following research questions:

RQ1: *What classroom assessment competencies are still weak and underdeveloped within pre-service teachers?*

RQ2: *What do teacher training universities need to do to enhance the classroom assessment competency of pre-service teachers?*

The remainder of the paper is structured as follows: Section 2 reviews the research issues. Section 3 describes the research methods and assessment design. Research results and discussion are presented in Section 4. Finally, conclusions are provided in Section 5 of the paper.

## 2. LITERATURE REVIEW

Classroom assessment literacy is instrumental for teachers in designing, administering, and interpreting assessments to ultimately support student learning. In the case of education students, developing assessment literacy is crucial for their future roles as competent educators. Recent research highlights both the challenges and advancements in preparing education students in this area.

Classroom assessment literacy refers to the understanding and application of assessment principles and practices, enabling teachers to make informed decisions that enhance learning outcomes (DeLuca et al., 2012). It encompasses knowledge of formative and summative assessments, data interpretation, and the ethical use of assessment information (Heritage, 2010).

However, while DeLuca et al. (2012) offer a strong theoretical framework, they provide limited insights into how these competencies can be effectively integrated into teacher education curricula. Heritage (2010) emphasizes the ethical dimension of assessment, yet the application of these ethical principles in practical teaching contexts is underexplored. These limitations suggest that more empirical research is needed to bridge the theoretical and practical gaps in classroom assessment literacy.

Recent studies reveal that many pre-service teachers feel inadequately prepared in assessment literacy, citing insufficient training and practical experience (Hoang et al., 2020, 2022, 2025; Vo et al. 2025). This gap in preparation can lead to challenges in implementing effective assessment practices in the classroom (Looney et al., 2017). Looney et al. (2017) provide empirical evidence connecting limited training with low confidence in real classroom settings, yet their study is focused primarily on general perceptions rather than direct observations of teacher performance.

Effective classroom assessment involves both formative and summative assessments. Formative assessments are ongoing and provide feedback to guide instruction and support student learning (Black & Wiliam, 1998). Summative assessments evaluate student learning at specific points and are often used for grading (Guskey, 2003). Black and Wiliam's foundational work remains highly influential, but later studies have questioned the feasibility of their formative assessment strategies in overcrowded classrooms or under-resourced schools. Guskey (2003) presents a framework for summative assessment, yet his work does not fully account for the digital tools now commonly used to administer and analyze student evaluations. Research emphasizes the need for pre-service teachers to balance these types of assessments to create a comprehensive assessment system (Poth, 2013). Poth's recommendation for an

integrated approach is valuable, though it assumes a level of assessment fluency that many novice teachers do not yet possess, thus requiring scaffolded training interventions.

Several barriers hinder the development of assessment literacy among pre-service teachers. These include limited coursework on assessment, lack of practical application opportunities, and insufficient emphasis on the importance of assessment in teacher education programs (Brookhart, 2011). Brookhart raises critical concerns about gaps in teachers' assessment knowledge and skills and offers practical recommendations for improvement. However, this work does not deeply examine how specific institutional structures such as policy, curriculum frameworks, and faculty capacity perpetuate these challenges. Further research is needed to address these structural dimensions. Additionally, pre-service teachers often struggle with aligning assessments with learning objectives and effectively using assessment data (Xu & Brown, 2016). Xu and Brown contribute valuable insights into the cognitive challenges faced by pre-service teachers, but their research is predominantly situated in Western contexts, calling for comparative studies in diverse educational systems.

The missing gaps in the classroom assessment capabilities of pre-service teachers remain underexplored and have not been fully reported. We need to clearly understand these gaps to enhance their understanding and skills in assessment, to become more competent educators, capable of using assessments to support and improve student learning. Therefore, future research should focus on identifying specific competency deficits within classroom assessment literacy, mapping how they evolve throughout teacher preparation, and testing the efficacy of interventions designed to close these gaps. Continued research and discovery of the gaps in pre-service teachers' assessment literacy are necessary to ensure that they are well-equipped with the assessment literacy needed for their future classrooms.

## 3. MATERIALS AND METHODS

### *3.1. The Scale*

In this study, we use the measurement standards proposed by Hoang et al. (2025), which consist of 43 criteria divided into four competency groups, including: Competencies in assessment content knowledge (K) with 18 criteria; Competencies in classroom assessment practice skills (P) with 12 criteria; Competencies in ICT and digital techniques in educational assessment (I) with 11 criteria; Competency group regarding attitudes, behaviors, and ethics in classroom assessment (E) with 2 criteria.

A 5-level Likert scale is employed to measure the competencies of pre-service teachers based on the definition by Benner (1982). IBM SPSS Statistics 26 software was used to validate the scale through survey data from 314 pre-service teachers. The results of the Cronbach's Alpha coefficient analysis in Table 1 show that the Cronbach's Alpha coefficient of the scale is .986 (>.6), meeting the condition of > .3. Thus, the scale is designed intuitively, clearly, and ensures high statistical reliability. Furthermore, after testing the reliability of the scale, the authors conducted an exploratory factor analysis (EFA). The results show that all criteria meet the extracted factors > .05 (.641 ÷ .836); KMO = .980 > .5 with Sig = .000 < .005 as presented in Table 2, indicating that the scale has internal consistency and is suitable for use.

*Table 1. Scale reliability statistics*

| Cronbach's Alpha | N of Items |
|---|---|
| .986 | 43 |

*Table 2. KMO and Bartlett's Test*

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .980 |
|---|---|---|
| Bartlett's Test of Sphericity | Approx. Chi-Square | 14113.836 |
| | Df | 903 |
| | Sig. | .000 |

### *3.2. Research Sample*

In this study, the research sample consists of 548 pre-service teachers (342 second-year students and 206 third-year students) recruited from various fields. Table 3 shows the statistical results of students by field of study, including: 22.28% in Physics, 3.08% in Political Teacher Education, 2.90% in Chemistry, 43.84% in Primary Teacher Education, 6.34% in History and Geography, 13.95% in Natural Sciences, 1.81% in Informatics and Technology, 1.27% in Biology, and 5.80% in History. The percentages of second-year and third-year students are 61.96% and 37.86%, respectively.

Demographic information about the research sample also reveals that the average age of the students is 21.10 years, with a standard deviation of 2.61. The slightly higher standard deviation is due to a group of students pursuing a second degree, thus being older. According to the statistical data, the gender ratio between female and male students is 85.00% and 15.00%, respectively. These statistical results accurately reflect the current gender ratio of students in teacher training universities.

*Table 3. Research sample*

| **Demographic variables** | | **(N=548)** | **Percent (%)** |
|---|---|---|---|
| Gender | Male | 82 | 15.00 |
| | Female | 466 | 85.00 |
| Year of study | 2 | 342 | 61.96 |
| | 3 | 206 | 37.86 |
| Ology | Physics | 120 | 22.28 |
| | Political Teacher Education | 17 | 3.08 |
| | Chemistry | 16 | 2.90 |
| | Primary Teacher Education | 242 | 43.84 |
| | History and Geography | 35 | 6.34 |
| | Natural science | 77 | 13.95 |
| | Informatics and Primary Technology | 10 | 1.81 |
| | Biology | 7 | 1.27 |
| | History | 32 | 5.80 |

Google Forms was used to collect student feedback during the second semester of the 2023-2024 academic year at teacher training universities.

## 4. RESULTS AND DISCUSSIONS

In this study, we used the proposed scale to measure the classroom assessment competencies of pre-service teachers in the research sample (N = 548). IBM SPSS Statistics 26 software was used to process and report the research results. We used ANOVA to report the results according to the competency groups of students. Since comparing the competencies between second-year and third-year students is not the main focus of this study, we did not delve deeply into this analysis. In Tables 5-8, we report the statistical values for each criterion for second-year, third-year, and all 548 students.

Table 5 presents the evaluation results for the competency group on classroom assessment knowledge (K). The results show that the survey criteria for second-year and third-year students achieved mean values ranging from average (Mean = 3.28) to Good (Mean = 3.66), with standard deviations in the range of .708 to .848. No criterion reached the Very Poor, Poor, or Excellent levels. The criteria K4, K6, K7, K9, K10, K11, K12, K13, K16, K17, and K18 reached the average level, while the remaining criteria reached the Good level. Overall, the criteria do not differ significantly in mean values, and the knowledge assessment competencies of pre-service teachers were relatively

adequate during their training. Most of the criteria in the K competency group for third-year students showed improvement compared to those of second-year students.

The competencies of practical assessment skills (P) in Table 6 reveal that both second-year and third-year students achieved all criteria at an average level, with mean values in the range of 2.99 to 3.30 and standard deviations between .678 and .821. The results in Table 6 also show that third-year students had noticeably higher practical skills than second-year students. However, overall, the measurement results reveal that the practical assessment skills of students are relatively low and do not meet the high requirements of current classroom assessment practice.

The ICT and digital competencies for educational assessment (I), shown in Table 7, indicate that the criteria in this group all achieved average levels, with mean values between 2.87 and 3.11 and standard deviations ranging from .730 to .804. It is clear that this group achieved the lowest scores among the measured competencies.

The competencies related to attitudes, behaviors, and ethics in evaluating students' achievement and learning (E), presented in Table 8, achieved the highest results, with criterion E1 having a mean of 3.56 and E2 a mean of 3.70. There was a slight difference between second-year and third-year students in this competency group, but it was not significant and remained within acceptable limits.

From these statistical results, we can see that the standards related to attitudes and ethics in educational assessment were perceived by the students at the highest levels among all competency groups, achieving Good levels. Knowledge-related competencies were also generally well perceived by students during their teacher training. However, the two competency groups related to practical assessment skills and the use of ICT and digital tools for classroom assessment only reached average levels. These results also reveal that the (I) competency group was the weakest among the four, providing evidence that answers RQ1. Without appropriate measurement tools, it would be difficult to identify these weaknesses. It can be implied that suitable training strategies and policies to improve these competencies for pre-service teachers before they become official teachers are essential.

Although this study does not deeply analyze the improvement of assessment competencies over time, the statistical results illustrated in Figure 1 indicate that the students' competencies significantly improved from the second to the third year, likely due to their pedagogical internships and classroom assessment courses.

These experimental evaluation results help identify which competency groups were well developed and which were underdeveloped. The findings provide strong evidence for making necessary changes to training programs, teaching methods, assessment practices, and professional development in classroom assessment to improve the quality of higher education in teacher training universities. Although classroom assessment methods are rapidly evolving in terms of form, method, and tools, recognizing the weaknesses of pre-service teachers in this area is crucial for improving training quality. Many current studies struggle to clearly identify the missing competencies, especially those related to ICT and digital skills, which directly impact the ability to organize and conduct assessments in today's digital classroom environment.

*Table 5. Descriptives of the competencies of assessment content knowledge*

| | | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound | | |
| K1 | 2 | 342 | 3.64 | .736 | .040 | 3.56 | 3.72 | 1 | 5 |
| | 3 | 206 | 3.69 | .753 | .052 | 3.59 | 3.79 | 2 | 5 |
| | Total | 548 | 3.66 | .742 | .032 | 3.60 | 3.72 | 1 | 5 |
| K2 | 2 | 342 | 3.36 | .686 | .037 | 3.28 | 3.43 | 1 | 5 |
| | 3 | 206 | 3.60 | .744 | .052 | 3.50 | 3.70 | 2 | 5 |
| | Total | 548 | 3.45 | .717 | .031 | 3.39 | 3.51 | 1 | 5 |
| K3 | 2 | 342 | 3.40 | .664 | .036 | 3.33 | 3.47 | 1 | 5 |
| | 3 | 206 | 3.51 | .842 | .059 | 3.39 | 3.63 | 1 | 5 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | 548 | 3.44 | .737 | .031 | 3.38 | 3.51 | 1 | 5 |
| K4 | 2 | 342 | 3.32 | .732 | .040 | 3.24 | 3.40 | 1 | 5 |
| | 3 | 206 | 3.49 | .782 | .055 | 3.38 | 3.60 | 2 | 5 |
| | Total | 548 | 3.39 | .755 | .032 | 3.32 | 3.45 | 1 | 5 |
| K5 | 2 | 342 | 3.47 | .675 | .036 | 3.40 | 3.54 | 2 | 5 |
| | 3 | 206 | 3.56 | .786 | .055 | 3.46 | 3.67 | 1 | 5 |
| | Total | 548 | 3.50 | .719 | .031 | 3.44 | 3.56 | 1 | 5 |
| K6 | 2 | 342 | 3.32 | .724 | .039 | 3.24 | 3.40 | 1 | 5 |
| | 3 | 206 | 3.43 | .786 | .055 | 3.32 | 3.54 | 1 | 5 |
| | Total | 548 | 3.36 | .749 | .032 | 3.30 | 3.43 | 1 | 5 |
| K7 | 2 | 342 | 3.30 | .746 | .040 | 3.22 | 3.38 | 2 | 5 |
| | 3 | 206 | 3.37 | .778 | .054 | 3.27 | 3.48 | 2 | 5 |
| | Total | 548 | 3.33 | .758 | .032 | 3.26 | 3.39 | 2 | 5 |
| K8 | 2 | 342 | 3.53 | .688 | .037 | 3.46 | 3.60 | 2 | 5 |
| | 3 | 206 | 3.68 | .768 | .053 | 3.57 | 3.79 | 1 | 5 |
| | Total | 548 | 3.59 | .722 | .031 | 3.53 | 3.65 | 1 | 5 |
| K9 | 2 | 342 | 3.25 | .811 | .044 | 3.17 | 3.34 | 1 | 5 |
| | 3 | 206 | 3.33 | .905 | .063 | 3.21 | 3.46 | 1 | 5 |
| | Total | 548 | 3.28 | .848 | .036 | 3.21 | 3.35 | 1 | 5 |
| K10 | 2 | 342 | 3.26 | .769 | .042 | 3.18 | 3.34 | 1 | 5 |
| | 3 | 206 | 3.37 | .833 | .058 | 3.26 | 3.49 | 1 | 5 |
| | Total | 548 | 3.30 | .795 | .034 | 3.24 | 3.37 | 1 | 5 |
| K11 | 2 | 342 | 3.33 | .722 | .039 | 3.26 | 3.41 | 1 | 5 |
| | 3 | 206 | 3.37 | .832 | .058 | 3.25 | 3.48 | 1 | 5 |
| | Total | 548 | 3.35 | .765 | .033 | 3.28 | 3.41 | 1 | 5 |
| K12 | 2 | 342 | 3.28 | .788 | .043 | 3.20 | 3.37 | 1 | 5 |
| | 3 | 206 | 3.34 | .798 | .056 | 3.24 | 3.45 | 1 | 5 |
| | Total | 548 | 3.31 | .791 | .034 | 3.24 | 3.37 | 1 | 5 |
| K13 | 2 | 342 | 3.30 | .763 | .041 | 3.22 | 3.39 | 1 | 5 |
| | 3 | 206 | 3.42 | .803 | .056 | 3.31 | 3.53 | 1 | 5 |
| | Total | 548 | 3.35 | .779 | .033 | 3.28 | 3.41 | 1 | 5 |
| K14 | 2 | 342 | 3.46 | .661 | .036 | 3.39 | 3.53 | 1 | 5 |
| | 3 | 206 | 3.65 | .768 | .053 | 3.55 | 3.76 | 2 | 5 |
| | Total | 548 | 3.53 | .708 | .030 | 3.47 | 3.59 | 1 | 5 |
| K15 | 2 | 342 | 3.45 | .720 | .039 | 3.38 | 3.53 | 1 | 5 |
| | 3 | 206 | 3.55 | .762 | .053 | 3.45 | 3.66 | 1 | 5 |
| | Total | 548 | 3.49 | .737 | .031 | 3.43 | 3.55 | 1 | 5 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| K16 | 2 | 342 | 3.41 | .695 | .038 | 3.34 | 3.49 | 1 | 5 |
| | 3 | 206 | 3.59 | .765 | .053 | 3.48 | 3.69 | 2 | 5 |
| | Total | 548 | 3.48 | .727 | .031 | 3.42 | 3.54 | 1 | 5 |
| K17 | 2 | 342 | 3.33 | .733 | .040 | 3.25 | 3.41 | 1 | 5 |
| | 3 | 206 | 3.44 | .840 | .059 | 3.33 | 3.56 | 1 | 5 |
| | Total | 548 | 3.37 | .776 | .033 | 3.31 | 3.44 | 1 | 5 |
| K18 | 2 | 342 | 3.28 | .741 | .040 | 3.20 | 3.36 | 1 | 5 |
| | 3 | 206 | 3.44 | .767 | .053 | 3.33 | 3.54 | 1 | 5 |
| | Total | 548 | 3.34 | .754 | .032 | 3.28 | 3.40 | 1 | 5 |

*Table 6. Descriptives of the competencies of practical assessment skills*

| | | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound | | |
| P1 | 2 | 342 | 3.01 | .698 | .038 | 2.94 | 3.09 | 1 | 4 |
| | 3 | 206 | 3.36 | .825 | .058 | 3.25 | 3.48 | 1 | 5 |
| | Total | 548 | 3.14 | .767 | .033 | 3.08 | 3.21 | 1 | 5 |
| P2 | 2 | 342 | 3.09 | .696 | .038 | 3.02 | 3.17 | 1 | 5 |
| | 3 | 206 | 3.50 | .795 | .055 | 3.39 | 3.60 | 1 | 5 |
| | Total | 548 | 3.24 | .759 | .032 | 3.18 | 3.31 | 1 | 5 |
| P3 | 2 | 342 | 2.83 | .735 | .040 | 2.75 | 2.91 | 1 | 4 |
| | 3 | 206 | 3.30 | .875 | .061 | 3.18 | 3.42 | 1 | 5 |
| | Total | 548 | 3.01 | .821 | .035 | 2.94 | 3.07 | 1 | 5 |
| P4 | 2 | 342 | 2.92 | .712 | .039 | 2.85 | 3.00 | 1 | 4 |
| | 3 | 206 | 3.39 | .829 | .058 | 3.27 | 3.50 | 1 | 5 |
| | Total | 548 | 3.10 | .791 | .034 | 3.03 | 3.16 | 1 | 5 |
| P5 | 2 | 342 | 3.04 | .684 | .037 | 2.96 | 3.11 | 1 | 5 |
| | 3 | 206 | 3.47 | .794 | .055 | 3.36 | 3.58 | 1 | 5 |
| | Total | 548 | 3.20 | .757 | .032 | 3.14 | 3.26 | 1 | 5 |
| P6 | 2 | 342 | 2.85 | .717 | .039 | 2.77 | 2.93 | 1 | 4 |
| | 3 | 206 | 3.30 | .836 | .058 | 3.19 | 3.42 | 1 | 5 |
| | Total | 548 | 3.02 | .794 | .034 | 2.95 | 3.09 | 1 | 5 |
| P7 | 2 | 342 | 2.93 | .705 | .038 | 2.86 | 3.01 | 1 | 5 |
| | 3 | 206 | 3.40 | .794 | .055 | 3.29 | 3.51 | 1 | 5 |
| | Total | 548 | 3.11 | .773 | .033 | 3.04 | 3.17 | 1 | 5 |
| P8 | 2 | 342 | 3.14 | .750 | .041 | 3.06 | 3.22 | 1 | 5 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | 206 | 3.56 | .811 | .056 | 3.45 | 3.67 | 1 | 5 |
| | Total | 548 | 3.30 | .799 | .034 | 3.23 | 3.37 | 1 | 5 |
| P9 | 2 | 342 | 3.06 | .678 | .037 | 2.99 | 3.14 | 1 | 5 |
| | 3 | 206 | 3.52 | .770 | .054 | 3.41 | 3.63 | 1 | 5 |
| | Total | 548 | 3.24 | .746 | .032 | 3.17 | 3.30 | 1 | 5 |
| P10 | 2 | 342 | 2.98 | .697 | .038 | 2.91 | 3.06 | 1 | 5 |
| | 3 | 206 | 3.47 | .788 | .055 | 3.36 | 3.58 | 1 | 5 |
| | Total | 548 | 3.17 | .769 | .033 | 3.10 | 3.23 | 1 | 5 |
| P11 | 2 | 342 | 2.94 | .695 | .038 | 2.87 | 3.02 | 1 | 5 |
| | 3 | 206 | 3.41 | .808 | .056 | 3.30 | 3.52 | 1 | 5 |
| | Total | 548 | 3.12 | .774 | .033 | 3.05 | 3.18 | 1 | 5 |
| P12 | 2 | 342 | 2.84 | .723 | .039 | 2.76 | 2.92 | 1 | 4 |
| | 3 | 206 | 3.25 | .891 | .062 | 3.13 | 3.37 | 1 | 5 |
| | Total | 548 | 2.99 | .815 | .035 | 2.93 | 3.06 | 1 | 5 |

*Table 7. Descriptives of ICT and digital competencies for educational assessment*

| | | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound | | |
| I1 | 2 | 342 | 2.82 | .725 | .039 | 2.75 | 2.90 | 1 | 5 |
| | 3 | 206 | 3.24 | .838 | .058 | 3.13 | 3.36 | 1 | 5 |
| | Total | 548 | 2.98 | .795 | .034 | 2.92 | 3.05 | 1 | 5 |
| I2 | 2 | 342 | 2.84 | .687 | .037 | 2.76 | 2.91 | 1 | 5 |
| | 3 | 206 | 3.31 | .856 | .060 | 3.19 | 3.43 | 1 | 5 |
| | Total | 548 | 3.01 | .788 | .034 | 2.95 | 3.08 | 1 | 5 |
| I3 | 2 | 342 | 2.77 | .709 | .038 | 2.69 | 2.84 | 1 | 5 |
| | 3 | 206 | 3.20 | .876 | .061 | 3.08 | 3.32 | 1 | 5 |
| | Total | 548 | 2.93 | .804 | .034 | 2.86 | 3.00 | 1 | 5 |
| I4 | 2 | 342 | 2.91 | .674 | .036 | 2.83 | 2.98 | 1 | 5 |
| | 3 | 206 | 3.32 | .817 | .057 | 3.21 | 3.43 | 1 | 5 |
| | Total | 548 | 3.06 | .758 | .032 | 3.00 | 3.13 | 1 | 5 |
| I5 | 2 | 342 | 2.82 | .684 | .037 | 2.74 | 2.89 | 1 | 4 |
| | 3 | 206 | 3.21 | .885 | .062 | 3.09 | 3.34 | 1 | 5 |
| | Total | 548 | 2.97 | .789 | .034 | 2.90 | 3.03 | 1 | 5 |
| I6 | 2 | 342 | 2.92 | .619 | .033 | 2.85 | 2.98 | 1 | 5 |
| | 3 | 206 | 3.27 | .840 | .059 | 3.16 | 3.39 | 1 | 5 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | 548 | 3.05 | .730 | .031 | 2.99 | 3.11 | 1 | 5 |
| I7 | 2 | 342 | 2.95 | .657 | .036 | 2.88 | 3.02 | 1 | 5 |
| | 3 | 206 | 3.35 | .823 | .057 | 3.24 | 3.46 | 1 | 5 |
| | Total | 548 | 3.10 | .748 | .032 | 3.04 | 3.16 | 1 | 5 |
| I8 | 2 | 342 | 2.96 | .649 | .035 | 2.89 | 3.03 | 1 | 4 |
| | 3 | 206 | 3.37 | .838 | .058 | 3.25 | 3.48 | 1 | 5 |
| | Total | 548 | 3.11 | .752 | .032 | 3.05 | 3.18 | 1 | 5 |
| I9 | 2 | 342 | 2.67 | .671 | .036 | 2.60 | 2.74 | 1 | 4 |
| | 3 | 206 | 3.20 | .880 | .061 | 3.08 | 3.32 | 1 | 5 |
| | Total | 548 | 2.87 | .797 | .034 | 2.80 | 2.94 | 1 | 5 |
| I10 | 2 | 342 | 2.91 | .650 | .035 | 2.84 | 2.98 | 1 | 4 |
| | 3 | 206 | 3.31 | .860 | .060 | 3.19 | 3.42 | 1 | 5 |
| | Total | 548 | 3.06 | .760 | .032 | 2.99 | 3.12 | 1 | 5 |
| I11 | 2 | 342 | 2.86 | .595 | .032 | 2.80 | 2.93 | 1 | 4 |
| | 3 | 206 | 3.32 | .858 | .060 | 3.20 | 3.44 | 1 | 5 |
| | Total | 548 | 3.03 | .739 | .032 | 2.97 | 3.10 | 1 | 5 |

*Table 8. Descriptives of the ethic competencies*

| | | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound | | |
| E1 | 2 | 342 | 3.48 | .679 | .037 | 3.40 | 3.55 | 2 | 5 |
| | 3 | 206 | 3.70 | .793 | .055 | 3.59 | 3.81 | 2 | 5 |
| | Total | 548 | 3.56 | .732 | .031 | 3.50 | 3.62 | 2 | 5 |
| E2 | 2 | 342 | 3.71 | .659 | .036 | 3.64 | 3.78 | 2 | 5 |
| | 3 | 206 | 3.69 | .815 | .057 | 3.58 | 3.80 | 1 | 5 |
| | Total | 548 | 3.70 | .721 | .031 | 3.64 | 3.76 | 1 | 5 |

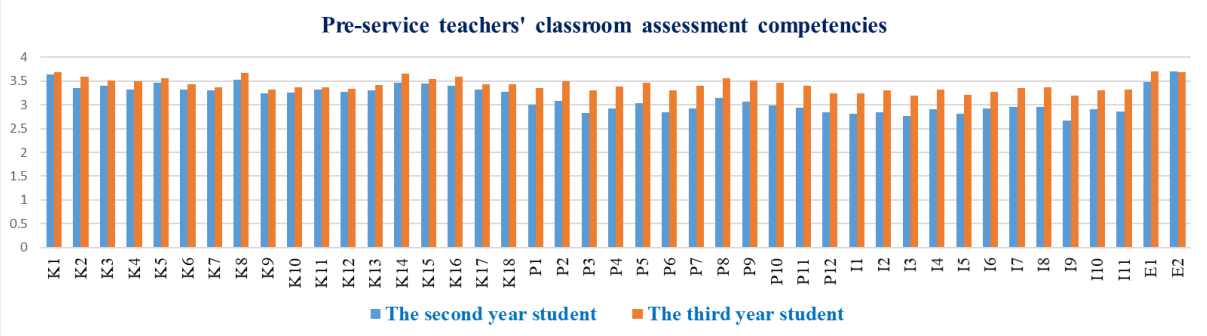


*Figure 1. Classroom assessment competencies achieved by second-year and third-year students*

This study has achieved important findings in identifying weaknesses in pre-service teachers' assessment competencies, providing a foundation for policymakers and educators to make adjustments to enhance student competencies.

The statistical results in Table 8 show that the (E) competency group achieved the highest scores, indicating that pre-service teachers have been well equipped with attitudes, behaviors, and ethics in classroom assessment prior to entering the profession. These results align with the findings reported by DeLuca et al. (2016, 2018).

The statistical results for the (K) competency group show that 11 criteria reached the average level and 7 reached the Good level, indicating that students had a fair grasp of classroom assessment knowledge. These findings are consistent with those of Ogan-Bekiroglu and Suzuk (2014). The (P) competency group shows that most pre-service teachers achieved only average levels in practical classroom assessment skills, confirming findings by Leong (2015), Ogan-Bekiroglu & Suzuk (2014), Stiggins (2006), and Xu & Brown (2016). As highlighted by Ogan-Bekiroglu and Suzuk (2014), enhancing these skills is critical before students enter the teaching profession.

Finally, the evaluation results for the (I) competency group were the lowest. Although all 11 criteria reached average levels, they were lower than those in the P group. ICT and digital competencies are crucial for designing and organizing modern classroom assessments. However, these findings show that this competency group remained underdeveloped among the pre-service teachers, echoing the concerns raised by Loureiro & Gomes (2023) and Maderick et al. (2016). Current studies have not adequately identified or reported the gaps in the (P) and (I) competency groups to develop appropriate training policies.

From these results, it is evident that the (K) and (E) competency groups are fairly well perceived by students in teacher education programs. However, the (P) and (I) groups require increased training time and practical application (Hussain et al., 2021).

These findings may lead to new insights, perspectives, and understandings regarding the expansion of ICT standards and digital competencies related to classroom assessment. This discovery could influence the adjustment and innovation of training content, program duration, and institutional policies in teacher training universities.

It can be concluded that targeted training strategies and policies are required to enhance practical classroom assessment capabilities for teacher students, integrating hands-on experience into the training process. Additionally, strengthening the training and practice of ICT and digital competencies is essential for supporting effective classroom organization and assessment. These recommendations provide a clear answer to RQ2.

## 5. CONCLUSIONS

This study measures the classroom assessment competencies of 548 pre-service teachers across two teacher education institutions. The findings underscore the necessity of embedding digital and ICT competencies into classroom assessment practices within teacher preparation programs. Expanding assessment criteria can enrich existing competency frameworks and foster more effective use of digital tools, which remains underdeveloped in many institutions. This perspective aligns with ongoing efforts to modernize teacher education and respond to evolving educational demands.

The results offer practical implications for enhancing the quality of teacher training. Improving pre-service teachers' assessment competencies, particularly in areas that remain underdeveloped, requires extending training duration and increasing opportunities for structured, hands-on experiences. This calls for curriculum reforms that integrate relevant coursework and prioritize both practical assessment skills and ICT-related capabilities. Achieving these goals demands coordinated actions and shared commitment from educational leaders, teacher educators, and other stakeholders.

These findings provide a foundation for revising teacher education programs and informing strategies that support both pre-service and in-service teachers within the context of educational reforms. They offer valuable insights for policymakers, curriculum developers, and institutional leaders seeking to design robust assessment tools, digital platforms, and supportive policy frameworks. In particular, the evidence highlights the need to restructure the timing and design of practical assessment training while incorporating digital competency development prior to teachers' entry into the profession.

Moreover, extending ICT and digital assessment competencies to in-service teacher evaluation can inform targeted professional development and retraining strategies.

A notable limitation of this study is its focus on second and third-year pre-service teachers, excluding those in their final year. Future research should include fourth-year students to gain a comprehensive picture of assessment competency development throughout the teacher education trajectory.

To further strengthen ICT and digital assessment literacy, students must engage with assessment systems and digital resources through practical applications. Integrating peer assessment into formative assessment practices within subject-specific courses offers a promising approach. This strategy is currently being piloted and will be explored in more detail in forthcoming publications.

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