Online Assessment Tools: The Challenge of Training Pre-Service Teachers

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Abstract
This study explores how online assessment tools can support the development of pre-service secondary teachers' assessment competencies, with a focus on the impact of prior teaching experience. It was conducted with a sample of 3,780 pre-service teachers at Pegaso University in Italy, 64.9% of whom had experience of working in a school for an average of eight years each. A questionnaire was administered in early 2024 to examine the participants' attitudes toward knowledge and use of digital assessment tools. The results revealed a strong preference for online tools due to their perceived efficiency, clarity, and transparency. Although there was little correlation between experience and overall frequency of use (r = 0.02), more experienced teachers reported a higher appreciation of tool selection (r = 0.11), format suitability (r = 0.15), and assessment utility (r = 0.42). These findings highlight that teaching experience enhances critical engagement with digital assessment as well as familiarity. Based on the teacher assessment literacy in practice model, this study recommends that teacher education programs should adapt their training to different levels of experience to promote the development of effective and ethical digital assessment skills.

Keywords: Assessment; Tools; Pre-service teachers

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Introduction

The rapid integration of digital technologies into education has profoundly transformed teaching and learning processes, particularly in the field of assessment. This shift has not only revolutionized the way students learn and are evaluated but has also become a critical area of focus for educational research (Perla & Vinci, 2024). The global pandemic further accelerated the adoption of online learning platforms, making digital assessment tools essential for measuring students' knowledge, providing timely feedback, and supporting personalized learning experiences (Lipnevich et al., 2021; Lobos et al., 2022).

However, despite their growing prevalence, effectively using these tools requires not only technical skills, but also a solid understanding of pedagogical principles, assessment literacy, and alignment between learning objectives and assessment methods.

The research history of online assessment tools began in the 1980s and has evolved through multiple generations, from basic computer-based testing to adaptive systems, continuous measurement and intelligent measurement. While the historical evolution of online assessment from basic computer-based testing to intelligent measurement has been well-documented, the innovations present significant challenges, including the need for digital competencies, data privacy protection, equitable access, and the risk of academic misconduct (Garg & Goel, 2022).

For pre-service teachers, developing competence in using online assessment tools is essential, yet many report feeling unprepared to integrate these technologies into their practice (Xu & He, 2019). This highlights a crucial gap in initial teacher education: while the literature has explored the benefits and challenges of online assessment, there is limited empirical evidence on how educational programs can effectively enhance assessment competencies in digital contexts (Agrati, 2021; Gisbert-Cervera et al., 2022).

To address this gap, this exploratory study examines how online assessment tools influence the development of assessment competencies among pre-service teachers. Specifically, it investigates the factors that shape their understanding and use of these tools, considering the role of prior teaching experience and the criteria they deem most useful for tool selection. Additionally, this research describes how initial teacher training programs address assessment literacy, focusing on the curriculum structure and the pedagogical practices that are prioritized in the context of online assessment.

The findings of this research aim to provide actionable insights for developing robust teacher education curricula that better prepare future educators for the demands of the digital classroom.

Literature Review

Research on Online Assessment Tools: From Historical Evolution to Current Challenges

The body of research on online assessment traces its origins back to the 1980s, spurred by the integration of information technologies into education. The evolution of these tools can be understood through a framework of four distinct generations (Bunderson et al., 1989; Puentedura, 2012).

The first generation, known as computerized testing, focused on delivering conventional standardized tests to reduce teachers' workload, particularly with large student groups. Building on this, the second generation introduced computerized adaptive testing, allowing for the personalization of assessments by adjusting question difficulty based on student responses.

The shift toward more detailed data collection began with the third generation, continuous measurement, which captured granular data on student performance, such as frequency and duration of learning activities. This approach provided rich insights into performance in relation to individual and contextual factors. Finally, the fourth and most recent generation, intelligent measurement, leverages advanced data processing to generate "intelligent scores" that not only interpret performance but also offer real-time guidance to students and educators, enabling a more holistic and personalized approach to learning (Redecker & Johannessen, 2013). This conceptual shift from efficiency-focused testing to a transformative, embedded assessment paradigm marks a key development in the field.

These technological advancements have given rise to a diverse ecosystem of online assessment tools currently available for educational use. This includes widely used platforms like Kahoot! and Quizizz for creating quizzes and tests, advanced adaptive tests that leverage AI to personalize learning experiences, and authentic performance assessments that use simulation platforms like TestGorilla to evaluate practical skills in realistic scenarios. Interactive video platforms like EDpuzzle also integrate assessments directly within video content to enhance engagement. Collectively, these tools highlight the varied and data-driven ways that online assessment can support education.

Research on the benefits of these tools has reported numerous positive outcomes, particularly with regard to verifying student learning and providing prompt, relevant feedback. For instance, the use of learning analytics and data mining has been shown to support formative assessment and personalized tutoring by identifying underperforming students, generating diagnostic reports, and analyzing interaction patterns (Nguyen et al., 2020). Some studies have even found that computer-based performance may surpass traditional paper-based formats for specific skills (Northcote, 2008; Taylor, 2024). Furthermore, online tools offer a significant advantage in scalability, making it possible to administer assessments to large groups simultaneously, thereby saving time and resources (Milat et al., 2020). Studies have also emphasized students' increased engagement through features such as interactivity, gamification, and personalized feedback (Mate & Weidenhofer, 2021). Online tools also facilitate formative assessment, enabling continuous progress monitoring and the adaptation of teaching strategies based on real-time data (Heil & Ifenthaler, 2023).

Despite these significant benefits, the literature also identifies several practical and pedagogical challenges. Technical issues, such as internet connectivity problems, software incompatibility, and device malfunctions, can disrupt the smooth administration of assessments and negatively impact students' experiences (Garg & Goel, 2022). Concerns about academic integrity are paramount, as the ease with which unauthorized materials can be accessed or inappropriate collaboration can occur during online assessments increases the risk of cheating and plagiarism. This has prompted studies to identify the gaps that facilitate online cheating in tools integrated into digital platforms like Canvas LMS and Moodle (Trifonova & Ivanova, 2024; Mehrishi et al., 2025). Additionally, the integration of learning analytics raises important concerns about student privacy and data security, as sensitive

information is collected and stored without adequate protection. Furthermore, issues of access and equity persist, as a lack of reliable internet and devices can create a significant digital divide. Critically, the effective use of these tools is often hampered by limited digital literacy among both teachers and students (Kruger et al., 2015). This has been particularly evident in studies highlighting how individual factors, such as prior experience with these tools, appear to outweigh contextual factors in shaping teachers' competence (Zhang et al., 2021). Finally, the field still lacks validated theoretical models to guide teachers' critical pedagogical practice in a digital assessment context, representing a fundamental challenge that needs to be addressed by future research (Viberg et al., 2024).

Training Pre-Service Teachers to Use Online Assessment Tools

Since technology is now integral to contemporary learning environments, it is essential to train teachers in the use of online assessment tools. Teachers must understand the different tools and how they work, including creating quizzes, providing real-time feedback and monitoring student progress. They must also be able to integrate these tools effectively into instructional design. This involves aligning learning objectives with assessment methods and feedback mechanisms while ensuring accessibility and security for all learners (Agrati, 2021; Gisbert-Cervera et al., 2022).

During the COVID-19 pandemic, many educational institutions adopted a wide range of online assessment systems. In schools, tools hitherto used only in experimental or innovative contexts became part of everyday practice. This shift necessitated emergency digital training for teachers and staff who were not yet proficient in instructional and assessment technologies (Agrati & Vinci, 2022; Perla et al., 2025; Topuz et al., 2022).

Research on assessment training for pre-service teachers has become increasingly structured over time (Looney et al., 2018). However, despite growing interest, studies have shown that pre-service teachers often feel unprepared for conducting assessments (Lutovac & Flores, 2022; Poth, 2013; Xu & He, 2019).

A study conducted in Ukraine with a sample of 162 prospective primary school teachers confirmed the value of training programs dedicated to online assessment tools (Zhorova et al., 2022). However, it also highlighted the need for enhanced postgraduate pedagogical training, as many participants reported difficulties in effectively integrating technological and pedagogical elements. Similarly, a recent qualitative study in Turkey involving 136 pre-service teachers revealed that summative assessment formats were still most prevalent despite the participants acknowledging the limited feedback and adaptability these formats offer (Öztürk, 2024). They also reported encountering difficulties in monitoring student performance, particularly when dealing with large groups of learners, which can undermine the fairness and adequacy of the assessment process.

Exploratory Study of Online Assessment Tools

This section presents an exploratory study examining the impact of online assessment tools on the development of pre-service teachers' assessment competencies. Conducted between February and March 2024, it included students enrolled in the 60-credit teacher qualification program (as per Article 23 of the Italian Ministerial Decree of August 4, 2023). These students were attending cross-disciplinary courses at Pegaso Online University.

Purpose and Research Questions

The study's primary objective was to examine how online assessment tools facilitate the acquisition of assessment knowledge and skills among early-career teachers. In particular, it addressed the following research questions (RQs):

RQ1. How does prior teaching experience influence pre-service teachers' understanding of and ability to use online assessment tools?
RQ2. What factors do teachers consider to be more or less useful when choosing online assessment tools?

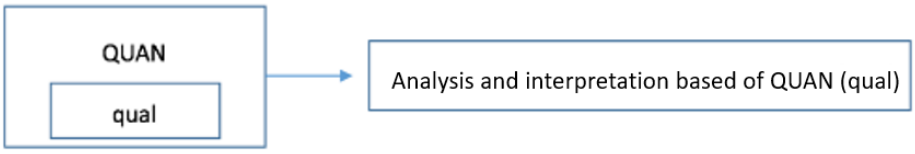
The study also aimed to describe how initial teacher training in secondary education addresses assessment literacy, focusing on the program delivered by the university. To this end, it examined the structure of training curricula, the dimensions of assessment competence that were prioritized and the types of knowledge and practices that were emphasized, particularly concerning the selection and use of online assessment tools.

Research Design and Methodology

This exploratory investigation employed a mixed embedded design (see Figure 1) that combined simultaneously collected quantitative and qualitative data (Creswell, 2013; Teddlie & Tashakkori, 2009; Trinchero & Robasto, 2019).

Figure 1

The Mixed Embedded Design



Note. Adapted from Teddlie and Tashakkori (2009).

The authors selected this method because of the characteristics of the available data. A mixed embedded design allows for the use of one primary approach (quantitative, in our case) while embedding another approach (qualitative) to obtain further, more in-depth information. This made it possible, in the context of this study, to explore the quantitative aspects more thoroughly, which—without open-ended responses—would have remained mere mentions rather than the subjects of in-depth examination. This method was employed by the authors in previous studies—on pre-service teachers (Perla et al., 2025) and assessment systems (Agrati & Beri, 2025)—and proved to be particularly suitable for this type of data.

The data were analyzed on three levels: (a) through a descriptive statistical analysis, (b) through an inferential analysis of the quantitative data, and (c) through a qualitative analysis of open-ended responses, which was performed using text coding based on grounded theory principles (Glaser et al., 1968). This coding process was conducted by the authors following an inductive approach, allowing categories to emerge directly from the data. After

initial familiarization with the data, the coders jointly developed a coding framework, which was subsequently applied independently.

Context, Participants, and Data Collection

A convenience sample was drawn from teacher candidates enrolled in a national initial teacher training program for upper secondary education that aimed to prepare them for obtaining subject-specific teaching certification. The course was delivered by Pegaso Online University (Italy).

The sample included 3,780 pre-service teachers[1] (see Table 1). The majority were women (82.9%), 54% held a bachelor's degree, and 32.9% had a postgraduate specialization. Most participants were already employed in schools and had permanent teaching contracts (64.9%).

Prior teaching experience, which was treated as a variable in the statistical analysis, ranged from 5 to 13 years, with an average of 7.95 years and a standard deviation of 1.003.

Table 2

*Characteristics of the Participants (*n = *3780)*

	Number of participants	Percentage of participants (%)
Male	646	17.1
Female	3134	82.9
Bachelor's degree	2040	54.0
Postgraduate degree	1242	32.9
PhD	224	5.9
Other	274	7.2
Permanent teachers	2453	64.9
Fixed-term teachers	1229	32.5
Non-teachers	52	1.4
Other	46	1.2

The questionnaire was administered remotely via Google Forms during dedicated sessions on assessment tools as part of the course. Participant anonymity was ensured, and informed consent to use the data for research purposes was obtained via an introductory explanatory text.

The exploratory questionnaire was aimed at collecting information on the representations and needs of pre-service teachers, in a functional way for a next validation.

For the quantitative data, there were no missing values, as all closed-ended questions were mandatory. For the qualitative data, the percentage of missing responses is reported in

[1] Note that the participants in the study, although referred to as pre-service teachers, already had work experience. This is because it is very common in Italy for teachers to have worked before completing their degree. On the one hand, the law allows those who possess the required university credits to be included in ranking lists for teaching assignments even before completing their university studies. On the other hand, many pre-service teachers have already earned a degree and, after gaining experience in schools, decide to obtain teaching certification in order to move beyond precarious employment.

the manuscript (72% response rate for the first open-ended question and 70% for the second). The questionnaire, designed specifically for this study by the authors, was divided into four sections: (a) an introduction and explanation of the core constructs used, (b) socio-professional information (qualitative and quantitative data), (c) basic knowledge related to assessment concepts, such as assessment phases and the use of paper-based and digital tools (quantitative data), and (d) personal reflections and opinions (qualitative data).

The second section included four closed questions and two open questions designed to explore the following specific aspects of online assessment tools:

- The importance of selecting appropriate assessment tools based on the target of evaluation, available resources, and average student ability.
- The frequency with which online tools were used compared to traditional paper-and-pencil methods.
- The preferred formats for online delivery (e.g., multiple choice, short answers, fill-in-the-blank, or short essays).
- The perceived usefulness of online assessment tools in the various stages of the assessment process, such as tool selection, criteria definition, test administration, data collection, analysis and interpretation and communicating results.

Results

Data Analysis and Preliminary Quantitative Results

To answer the RQs, an initial descriptive and inferential analysis was conducted on in-service teachers' assessment knowledge, based on a questionnaire designed to capture knowledge of and attitudes towards assessment practices (Barnes et al., 2017). The statistical analysis was conducted at two levels:

- A descriptive analysis of the responses, including the calculation of means and standard deviations (see Table 2).
- A correlation analysis between the responses and years of teaching experience to assess the influence of experience on teachers' knowledge and attitudes (see Table 3).

Table 2

*Answers to the Teacher Knowledge/Attitudes Questionnaire (*n = *3780)*

Question	Response option	Percentage (%)
1. In reference to the phases of the assessment process, what weight does the choice of evaluation tool have?	Very low	0.2%
	Low	0.6%
	Medium	12.0%
	High	39.4%
	Very high	47.8%
2. How often do you use online assessment tools compared to traditional tools?	Never	2.6%
	Almost never	10.1%
	Sometimes	41.4%
	Often	36.6%
	Always	9.3%
3. Which of the following assessment tool formats do you	Multiple-choice tests	74.0%
	Short answers	7.8%
	'Fill the gap'	11.5%

consider most appropriate to administer online?	Short essays	3.0%
	Other	3.6%
4. For which stage of the assessment process do you consider online assessment tools useful?	Choice of the tool/clarification of criteria	30.4%
	Administration of tests	11.5%
	Collection–analysis–interpretation of data	42.6%
	Communication of results	8.4%
	Other	3.5%

Table 2 provides a statistical summary of the responses, presenting the mean and standard deviation for each item. A descriptive analysis was performed by assigning numerical values to the various response types.

The participants assigned very high importance (47.8%) or high importance (39.4%) to selecting the appropriate assessment tools. Furthermore, 41.4% of the teachers reported using online assessment tools *sometimes*, while 36.6% indicated using them *frequently*.

Online assessment tools were considered particularly suitable for multiple-choice tests (74%). They were deemed most effective during the data collection, analysis, and interpretation phase (42.6%), followed by the tool selection and assessment criteria clarification phase (30.4%).

Table 3

Answers—Classroom Experience: Correlational Analysis

Correlated Variables	Spearman's ρ	χ^2 (Chi-Square)	Sig. (p-value)
Years of teaching → Choice of evaluation tool	0.030	-	0.068
Years of teaching →Use of online assessment tools	-0.046	-	0.006
Years of teaching →Assessment tool formats	-	8.093	0.088
Years of teaching →Process of assessment	-	2.902	0.574

The relationship between years of teaching experience and various aspects of software evaluation tool usage was investigated. Spearman's rank correlation coefficients (ρ) were computed to assess monotonic associations between years of teaching and ordinal variables such as choice and use of evaluation tools. For categorical variables, Chi-square (χ^2) tests were performed to examine potential associations.

Specifically, the Kruskal-Wallis test, which relies on a χ^2 distribution, was employed to determine whether the distribution of teaching experience differed significantly across categories of the assessment process phase deemed most useful for software evaluation tools. (see Table 3).

Data Analysis and Preliminary Qualitative Results

To address the second research question, the textual data collected from the two open-ended questions were analyzed using inferential coding procedures (Creswell, 2013) structured into the following three phases:

1. Open coding: This involved conceptualizing meaningful textual units and identifying descriptive labels.
2. Axial coding: This involved identifying frequent macro-categories emerging from the data, along with their number of occurrences.
3. Selective coding: This consisted of the hierarchical and analytical organization of macro-categories to extract the final core categories.

Table 4 refers to the following question: "Thinking about your teaching (or general school) experience, what do you consider to be the most helpful factor in selecting appropriate assessment tools?" This question (Q15) received 2,726 open responses, representing 72% of the total sample.

Table 4

*Answers—Useful Factors for Assessment (*n = *2726)*

Main category (*n*)	Axial coding (*n*)	Open coding (*n*)	Example
General answers (99)	Nothing (11)	-	'Nothing'
	I don't know (20)	-	'I don't know'
	No additional specification (68)	-	'I think there are many of them'
Variables upon which it depends (814)	Contextual issues (361)	Time (56)	'The time available'
		Contextual knowledge and analysis (246)	'Knowledge of the classroom context'
		Resources (59)	'Resources made available'
	What you want to assess (453)	Objective to be achieved (193)	'The choice should be made according to the training objectives and the activity to be designed'
		Topic/subject covered (128)	'The type of subject taught'
		Type of test (64)	'Type of test'
		Competence to be assessed (68)	'Skills/knowledge and competence to be assessed'
Assessment tool (437)	Tool type (274)	Observation (139)	'Class observation'
		Structured/semi-structured tests (58)	'The most commonly used structured tests are those involving multiple-choice answers, true/false answers, reordering, matching and

			associating words and concepts and inserting missing words’
		Feedback (56)	‘The decision-making process concerning the most appropriate assessment instrument should be guided by the educational objectives, the diversity of the students and the need for meaningful feedback’
		Other tools (21)	‘Evaluation grids’; ‘Scheme’
	Use of different tools (n = 68)		‘Having different tools at your disposal’
	Tool mode (n = 95)		‘Types of tests used and knowing how to use technology’
			‘Paper and computer mode’
Assessment characteristics (299)	Need for transparency/ objectivity (112)		‘Clarity and transparency’
	Usefulness (51)		‘Utility, applicability, usability’
	Speed (48)		‘Speed of administration of the evaluation instrument’
	Accessible (54)		‘Inclusiveness of tests and accessibility of tools’
	Formative (34)		‘Formative value and the capacity for “faithful” restitution’
Educational relationship (1078)	Teacher (468)	Knowledge of students/classes (142)	‘Knowledge of the students in the class’
		Teacher experience (190)	‘Experience and training’
		Relationship with students (40)	‘Taking into account the importance of relationship and communication’
		Planning/organization (96)	‘The organization and planning of teaching activities’
	Students (610)	Student motivation (29)	‘Student motivation’
		Student characteristics (581)	‘Heterogeneity of student characteristics’

The responses were grouped into five main macro-categories. These were then further detailed through axial and open coding, accompanied by illustrative examples.

The first category, *general responses* (*n* = 99), included vague or non-informative answers and expressions of uncertainty. Examples include statements such as “Nothing” and

"I don't know," as well as generic declarations such as "I think there are many of them," which did not provide specific insights into the topic.

The second category, *dependent variables* (*n* = 814), included factors that influenced the choice of assessment tools. These included contextual issues, such as available time, knowledge of the educational context and accessible resources. A significant proportion of the responses related to what was intended to be assessed, considering the educational objective, the subject matter, the type of test and the competence to be verified.

The third macro-category, *assessment tools* (*n* = 437), included the various types of tools that could be adopted, such as observation, structured or semi-structured tests, feedback mechanisms and other instruments, such as rubrics or schemes. Consideration was also given to the combined use of multiple tools and their modes of use, including technology and the distinction between paper-based and digital tools.

The fourth category, *assessment characteristics* (*n* = 299), included references to the desired qualities of assessment tools, such as transparency and objectivity, usefulness and ease of use, speed of administration, accessibility, and inclusiveness. The formative value attributed to the assessment was also considered.

Finally, the largest category was *Educational Relationship* (*n* = 1078), which was subdivided into two main areas: the teacher's role—referring to their knowledge of the class, their professional experience, the quality of the teacher-student relationship and their ability to plan instruction—and aspects related to the students, including their motivation and, above all, the heterogeneity of their characteristics, which emerged as a particularly significant factor.

An analysis was conducted on question Q16, which asked, "Thinking about your teaching (or general school) experience, what do you consider to be the main obstacle to selecting the most appropriate assessment tools?" There were 2638 valid responses to this question (70% of the total; see Table 5).

Table 5

*Answers—Hindering Factors for Assessment (*n = *2638)*

Main category (*n*)	Axial coding (*n*)	Open coding (*n*)	Example
General answers (237)	Nothing (116) I don't know (75) No additional specification (46)		'Nothing' 'I don't know' 'I think there are many of them'
Variables on which it depends (1,210)	Contextual issues (1043)	Time (278) Contextual problems (147) Lack of resources (292) Routine (13) Cost (13) Bureaucracy (95)	'Lack of time to assess' 'Class context' 'The limited availability of resources' 'The scholastic routine' 'Cost' 'The bureaucracy of the education system'

		Inadequate technology (192)	‘Resistance to technology’
		Too much technology (13)	‘The use of too much technology’
	Assessment (167)	Topic type (29)	‘Topic type’
		Too complex assessment (109)	‘The need to encapsulate a complex evaluation of a grade or judgement’
		Evaluation limited to grades (29)	‘A system based on votes’
Educational relationship (1191)	Students (922)	Student behavior/lack of interest (136)	‘Class behaviour’
		Too large or heterogeneous class group (402)	‘The heterogeneity of classes and different needs’
		Lack of collaboration (93)	‘Student non-cooperation’
		Unpreparedness (291)	‘Lack of knowledge’
	Parents (16)		‘Parents’ comments’
	Teachers (253)	Unpreparedness (151)	‘The lack of specific training on the different assessment tools available and modern pedagogical methodologies might be a further obstacle’
		Lack of innovation (102)	‘Lack of support in promoting and sustaining innovation’

The responses were organized into three main categories. The first, *general responses*, included 237 codes and consisted of vague or non-informative statements. Subcategories consisted of answers such as “Nothing” (*n* = 116), “I don’t know” (*n* = 75) and other unspecified expressions (*n* = 46)—for example, “I think there are many of them.”

The second macro-category, *dependent variables*, include 1,210 codes—representing a substantial portion. Within this category, contextual issues dominated, with 1,043 codes, encompassing various factors perceived as obstacles to assessment. The most frequently mentioned issues were lack of time (*n* = 278), scarcity of resources (*n* = 292) and class-context problems (*n* = 147). Structural aspects of the school system were also mentioned, including bureaucracy (*n* = 95 codes), cost (*n* = 13 codes), and school routine (*n* = 13 codes). Technology was viewed ambivalently—technological inadequacy was highlighted (*n* = 192), but there was also a perception of excessive reliance on technology (*n* = 13). Within this macro-category, there was also a section dedicated to the challenges inherent in the assessment process itself (*n* = 167). These included the nature of the subject matter (*n* = 29), the fact that assessment processes were reduced to simplified grades or judgments (*n* = 109) and the limitations of a grading-centric system (*n* = 29).

The third and largest category, *educational relationship*, received 1,191 responses. Most of these were related to students (*n* = 922) and emphasized factors that hindered the assessment process. These included problematic behaviors or a lack of interest (*n* = 136), the excessive heterogeneity of classroom groups (*n* = 402), a lack of collaboration (*n* = 93) and student unpreparedness (*n* = 291). Parents were mentioned to a much lesser extent (*n* = 16), often in relation to comments or attitudes that interfered with the assessment process. Regarding teachers (*n* = 253), the main difficulties lay in their lack of preparation (*n* = 151), which was linked to a lack of specific training on assessment tools and modern teaching methodologies. Another issue was the lack of support for innovation (*n* = 102).

RQ1. How Does Prior Teaching Experience Influence Pre-Service Teachers' Understanding of and Ability to Use Online Assessment Tools?

The descriptive analysis (Table 2) revealed that the participating teachers were inclined to use online assessment tools in their teaching practice. They assigned great importance to selecting appropriate tools and reported using these with a frequency equal to—or even exceeding—that of traditional assessment methods. Teachers particularly valued the usefulness of online tools during the phases of data collection, analysis and interpretation, as well as for clarifying the evaluation criteria.

The correlation analysis (Table 3) showed a very low direct correlation between years of classroom experience and responses to Question 2 ($r_2 = 0.02$). More significant correlations emerged with responses to Questions 1 ($r_{(1,q)} = 0.11$) and 3 ($r_{(3,q)} = 0.15$). The strongest correlation was identified with Question 4 ($r_4 = 0.42$), indicating a closer relationship between years of experience and the perceived usefulness of online assessment tools in various phases of the evaluation process.

Overall, the descriptive and correlational analyses suggested that years of classroom experience were an influential factor in the perception of the usefulness of online tools in the various phases of the assessment process (Question 4, r = 0.42) but had less influence on the choice of assessment tools (Question 1, r = 0.11).

RQ2. What Factors Do Teachers Consider to Be More or Less Useful When Choosing Online Assessment Tools?

A qualitative analysis of the open-ended responses (*n* = 2,726 for facilitating factors and *n* = 2,638 for hindering factors) revealed a complex set of elements that influenced the selection of assessment tools. According to the participating teachers, these elements could be categorized as either facilitating or hindering.

Teachers indicated that the following four domains were the most relevant in the selection of assessment tools: the educational relationship, the characteristics of the assessment tool, contextual variables that influence the choice, and the assessment tools themselves.

The most prevalent category related to the educational relationship (*n* = 1,078) and included elements pertaining to both the teacher—such as personal experience (*n* = 190), knowledge of the class (*n* = 142), and planning ability (n = 96)—and the students, particularly individual characteristics (*n* = 581) and motivation (*n* = 29).

Another central category concerned contextual variables (*n* = 814), particularly knowledge of the context (*n* = 246), availability of resources (*n* = 59) and time available (*n* = 56). Important dimensions also related directly to the assessment tools themselves (*n* = 437), including observation tools (*n* = 139), structured or semi-structured tests (*n* = 58), and feedback (*n* = 56). The variety of available tools (*n* = 68) and the mode of administration (paper-based or digital; *n* = 95) were also valued.

Finally, the intrinsic characteristics of the tools were valued for their transparency (*n* = 112), accessibility (*n* = 54), ease of use (*n* = 48), and formative function (*n* = 34).

Conversely, the factors perceived as obstacles largely mirrored the same categories, but from a problematic perspective. Contextual variables emerged as the main critical area (*n* = 1,210), with a marked prevalence of references to lack of time (*n* = 278), scarcity of resources (*n* = 292) and technological barriers (*n* = 192). Systemic elements, such as school bureaucracy (*n* = 95) and costs (*n* = 13), were also reported.

Within the educational relationship domain (*n* = 1,191), critical factors included student behavior and lack of interest (*n* = 136), the complexity and heterogeneity of classes (*n* = 402) and students' insufficient preparation (*n* = 291).

The teachers acknowledged personal limitations, such as insufficient specific training (*n* = 151) and resistance to innovation (*n* = 102), which hindered the adoption of more effective assessment tools.

Finally, it is noteworthy that there was a negative perception of assessment being reduced to mere numeric grades (*n* = 29) or too complex to summarize (*n* = 109), fostering a sense of inadequacy of the available tools in relation to educational objectives.

Discussion

The results obtained enabled some interesting inferences to be drawn about the impact of prior teaching experience on understanding and using online assessment tools. Furthermore, they provided insights into the factors that teachers perceived as facilitating or hindering the selection of such tools.

The majority of teachers (*n* = 3,296, 87.2%) acknowledged the significant role of the choice of assessment tool in the assessment process and, more broadly, in teaching and learning. This is consistent with previous findings by Heil and Ifenthaler (2023), who noted that online assessment tools can support real-time monitoring and improve feedback delivery—thus enhancing both instructional design and student learning outcomes.

However, the actual use of online assessment tools was concentrated primarily on the responses "sometimes" (*n* = 1,565, 41.4%) and "often" (*n* = 1,383, 36.6%), suggesting that while these tools are widely used, they are not used systematically in daily teaching activities.

This partial adoption aligns with the observations by Agrati and Vinci (2022), who argued that despite increased exposure to digital tools during the COVID-19 pandemic, many teachers still struggle to fully incorporate them into routine assessment practices.

Online tools were predominantly used for multiple-choice tests (*n* = 2,864, 74%), confirming what Taylor (2024) and Öztürk (2024) also reported: traditional assessment formats continue to dominate, despite increased awareness of the benefits of formative and personalized assessment approaches. Other types of tools were used marginally, suggesting a need for more widespread training and familiarity with a broader range of functionalities.

Regarding the assessment phase, teachers were divided between *tool selection/criteria clarification* and *data collection–analysis–interpretation*. This confirms that many educators still adopt a procedural rather than a conceptual approach to assessment—an issue noted by Redecker and Johannessen (2013), who emphasized the importance of a paradigm shift from procedural efficiency to transformative, embedded assessment supported by learning analytics.

These results were then analyzed in relation to years of classroom experience to understand the influence of teaching experience on the choice and use of online assessment tools.

The results indicated negligible or non-significant correlations and associations between years of teaching and the examined variables, suggesting that teaching experience does not significantly influence educators' preferences or usage patterns of software evaluation tools across different phases of the assessment process.

The second phase of the research involved a textual analysis of the open-ended responses, enabling a deeper exploration of the teachers' perceptions that had been expressed in the closed-ended questions. The percentage of valid responses remained high for both factors considered useful (*n* = 2,722, 72%) and those viewed as obstacles (*n* = 2,646, 70%).

In both categories, aspects related to the teacher–student relationship emerged strongly. Among the useful factors, teachers emphasized the importance of getting to know the class and its needs as well as the level of the students. These are considered fundamental elements for choosing the most appropriate assessment tool, which reflects the emphasis on personalization in adaptive and intelligent measurement models (Bunderson et al., 1989; Redecker & Johannessen, 2013).

In contrast, the most frequently reported obstacles included student misconduct, large or heterogeneous class sizes, and lack of preparation—both technological and pedagogical—on the part of students and teachers. These concerns echo those discussed by Garg and Goel (2022) and Kruger et al. (2015), who found that digital literacy and classroom management challenges are major barriers to effective online assessment.

Interestingly, while responses concerning useful factors were often vague—referring to general objectives or competencies without operational detail—the descriptions of hindering factors painted a clearer picture of systemic issues. Teachers frequently mentioned bureaucratic overload, financial constraints and inadequate technological infrastructure. These practical concerns mirror those identified by Nguyen and colleagues (Nguyen et al., 2020) and highlight the importance of institutional support and investment in infrastructure if the pedagogical potential of online assessment tools is to be fully realized.

Limitations

While this study provides valuable insights into teachers' perceptions of the use of online assessment tools, it has several limitations that must be acknowledged. First, a convenience sample of participants from a specific initial teacher training course at an Italian online university was used, which may limit the generalizability of the results to broader teacher populations or other educational contexts. Additionally, the self-reported nature of the data—particularly with regard to attitudes and the perceived use of assessment tools—introduced potential biases, such as social desirability.

Although the mixed methods approach enabled an in-depth exploration of both quantitative trends and qualitative nuances, the embedded design prioritized quantitative data, which may have limited the depth of the qualitative analysis. Furthermore, while the coding of open responses adhered to the principles of grounded theory, the lack of triangulation with other data sources, such as classroom observations or interviews, could have reduced the robustness of the qualitative interpretations.

Finally, many qualitative responses were very brief—often consisting of a single word. This made it difficult to interpret the underlying motivations and intentions, suggesting the need for further qualitative research in future studies.

Conclusion

Research has highlighted the valuable opportunities offered by online assessment tools to enhance teaching and learning (Heil & Ifenthaler, 2023; Taylor, 2024). These tools have the potential to improve student engagement, provide timely feedback, and adapt to diverse learning needs. However, the challenges associated with online assessments, such as academic integrity and the need for digital training of students and teachers, must also be addressed (Garg & Goel, 2022).

Digital literacy among teachers is a particularly complex challenge. Using online assessment tools requires an understanding of their technical features and can entail a considerable workload (Kruger, 2015), for which specific training is not always available. It also demands the ability to manage online learning environments in which traditional roles are altered—for instance, students become more active participants, while teachers become facilitators rather than mere information providers.

Therefore, pre-service teacher training in the use of online assessment tools must not be limited to technical and technological aspects but must also develop competences that bridge techno-pedagogical skills in content management (Koehler & Mishra, 2009) and the personalization of learning proposals based on students' needs, abilities and resources, as well as the culture of learning contexts (Xu & Brown, 2016).

Although research into assessment processes has provided robust descriptive models of teachers' assessment competences—for example, the framework of teacher assessment literacy in practice (Xu & Brown, 2016)—in the context of pre-service teacher education, there is an increasing need to develop even more sophisticated models, such as the "sophisticated" knowledge framework (Agrati, 2021; Perla et al., 2019). These models should be capable of integrating the technological skills dimension (e.g., selection of tools based on offered services and ease or difficulty of access) with a specifically pedagogical dimension

(e.g., alignment with curriculum learning objectives and students' learning needs), particularly in relation to online teaching and learning.

Teacher training in the use of online assessment tools faces demanding future directions, including understanding the sophisticated mechanisms of artificial intelligence that enable timely feedback and adaptive testing based on students' learning levels, developing strategies to personalize learning experiences and meet diverse student needs and implementing methods to uphold academic integrity while mitigating the potential risks of inequity and exclusion associated with online assessments.

Declarations

Conflicts of Interest

The authors declare no conflicts of interest.

Ethics Board Approval

The study was conducted in Italy, where institutional guidelines and national legislation, aligned with the European Union's General Data Protection Regulation (GDPR), provide a clear framework for when formal ethics board review is required.

According to Italian law (Legislative Decree No. 196/2003, as amended, and in line with EU Regulation 2016/679), formal IRB approval is not mandated for research that uses exclusively anonymized or pseudonymized data and does not involve "sensitive personal data." This category of data is strictly defined to include information that could reveal racial or ethnic origin, political opinions, religious or philosophical beliefs, or data concerning health, sexual life, or genetic and biometric data.

The questionnaire for this study collected only non-sensitive personal data, such as age, gender, educational background, and prior teaching experience. This type of information is not considered sensitive under the aforementioned Italian and EU regulations. Furthermore, all data were collected and processed in an anonymized format, ensuring that no individual participant could be identified.

Consistent with all ethical research practices, participants were fully informed about the study's purpose, the nature of the data collected, and the voluntary nature of their participation. Informed consent was obtained from all participants before data collection began. This rigorous adherence to national and EU data protection regulations, which govern the ethical use of non-sensitive, anonymized data, ensured the study was conducted to the highest ethical standards applicable in our jurisdiction.

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Appendix

Questionnaire Used in the Study

Introduction
This questionnaire aims to investigate trainee teachers' perceptions of their personal assessment skills, particularly their knowledge of the types of assessment tools used in schools. The constructs used refer to the main studies in this area of research (see below), and the statements refer to possible assessment practices that have already been implemented or have yet to be implemented for typical students. You are therefore you are asked to answer the questions anonymously, either by selecting an answer option or by providing a brief written response. These responses may be analyzed, and the resulting data will be processed in aggregate form for research purposes only. This will be done in accordance with EU General Data Protection Regulation No. 679/2016 and Legislative Decree No. 196/2003 and the Personal Data Protection Code (amended by Legislative Decree No. 101 of 10/08/2018). The data controllers are Prof. Laura Sara Agrati (laurasara.agrati@unipegaso.it) and Prof. Viviana Vinci (viviana.vinci@unifg.it). Thank you for your cooperation. Constructs • Stages of the assessment process: a. Develop/select appropriate assessment methods and techniques to collect valid and reliable data. b. Administer tools according to appropriate procedures. c. Efficiently collect, analyse and interpret the obtained data without neglecting important information. d. Communicate the results to parents and students to guide them in their educational journeys (Gardner et al., 2010). • Assessment tools are means, devices or settings that are used to adequately express the knowledge, skills and/or competences being assessed. • A software assessment tool allows the assessor (e.g. a teacher) to carry out the stages of the assessment process with digital support, such as choosing formats, assessment criteria, the scores/levels to be assigned, methods of interpretation and the communication of results. • 'Pen and paper' assessment tools are a general type of assessment tool in which students read the stimulus (e.g. a question) and respond in writing. Formats include multiple-choice tests, quizzes, short answers, fill-in-the-blank answers and short essays.
Socio-professional information
Sex o Male o Female
Educational qualification (mark the highest qualification) o Master's degree o Postgraduate degree o PhD

- Other

Job position
- Permanent teacher
- Fixed-term teacher
- Non-teacher
- Other

Years of teaching (if a teacher, include the current year and use numbers, e.g. 3)

Short answer text

School level in which you currently work (if a teacher)
- Kindergarten
- Primary school
- Secondary school (first level)
- Secondary school (second level)

University where you are taking the course

Short answer text

Motivation that led you to enroll in the course

Short answer text

Basic knowledge

With respect to the main phases of the evaluation process, what weight do you give to the appropriate choice of evaluation tools?

	1	2	3	4	5	
not at all	○	○	○	○	○	very much

How much do you use/would you use ‘paper and pencil’ assessment tools?

	1	2	3	4	5	
not at all	○	○	○	○	○	very much

Which of the following assessment tool formats do you think is most appropriate to administer in the ‘paper and pencil’ format?
- Multiple choice tests
- Short answers
- ‘Fill the gap’
- Short essays
- Other

For which phase of the evaluation process do you consider ‘paper and pencil’ evaluation tools useful?
- Choice of tool/clarification of criteria
- Administering tests
- Collection–analysis–interpretation of data

○ Communication of results ○ Other
How much do you use/would you use software evaluation tools? 
Which of the following assessment tool formats do you think is most appropriate for administering in 'software' mode? ○ Multiple-choice tests ○ Short answers ○ 'Fill the gap' ○ Short essays ○ Other
For which phase of the evaluation process do you consider software evaluation tools useful? ○ Choice of tool/clarification of criteria ○ Administering tests ○ Collection–analysis–interpretation of data ○ Communication of results ○ Other
Personal considerations
Consider your experience as a teacher (or in education in general). What do you think facilitates the choice of the most appropriate assessment tools? *Short answer text*
Consider your experience as a teacher (or in education in general). What do you think is the factor that hinders the choice of the most appropriate assessment tools? *Short answer text*