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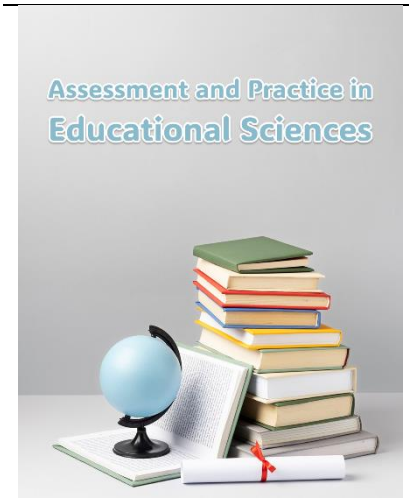

Exploring Factors Affecting Teachers' Competence in Digital Assessment Technologies

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ABSTRACT

This study aims to explore the individual, institutional, and systemic factors influencing teachers' competence in using digital assessment technologies within the context of Tehran's educational system. A qualitative research design was adopted, employing semi-structured interviews to gain in-depth insights into teachers' lived experiences and perspectives. Sixteen in-service teachers from various public and private schools in Tehran were purposefully selected to ensure diversity in teaching backgrounds and technological exposure. Interviews continued until theoretical saturation was achieved. All interviews were audio-recorded, transcribed verbatim, and analyzed using thematic analysis with the support of NVivo software. Open, axial, and selective coding procedures were employed to identify recurrent patterns and thematic categories related to digital assessment competence. Three overarching themes were identified: individual-level determinants, institutional and infrastructural factors, and systemic and policy-level influences. Subthemes included technological self-efficacy, digital literacy, time management, language barriers, access to infrastructure, professional development quality, administrative support, and policy clarity. Teachers emphasized that while personal motivation and peer collaboration facilitated competence, barriers such as lack of time, inadequate training, unclear policies, and inequitable access significantly impeded effective use of digital assessment tools. Language limitations and platform usability were particularly salient in the Iranian context. Teachers' competence in digital assessment technologies is shaped by a complex interplay of personal attributes, institutional environments, and broader educational policies. Supporting competence development requires more than technical training—it necessitates systemic alignment, localized resources, and sustained professional support. Addressing these factors can contribute to more equitable, effective, and future-ready assessment practices in digitally evolving educational settings.

Keywords: Digital assessment, teacher competence, educational technology, professional development, qualitative research, Iran, NVivo, policy barriers, digital literacy, instructional innovation.

Introduction

The integration of digital technologies into assessment practices has transformed the educational landscape, prompting both opportunities and challenges for educators worldwide. In particular, digital assessment technologies—defined as software and platforms used to plan, administer, grade, and analyze assessments—have become increasingly central to modern pedagogical strategies (Redecker & Johannessen, 2013). The transition from traditional paper-based assessments to digital formats is more than a technological shift; it represents a fundamental change in how teachers conceptualize, implement, and evaluate learning outcomes. However, the effectiveness of these tools is contingent on teachers' competence in using them—a multifaceted construct that encompasses technical, pedagogical, and affective dimensions (Pereira et al., 2021). While policy frameworks

and technological infrastructures have advanced rapidly, teacher competence remains a critical determinant of successful digital assessment implementation (Instefjord & Munthe, 2017).

Teacher competence in digital assessment technologies can be broadly defined as the knowledge, skills, and attitudes required to effectively employ technology for formative and summative evaluation purposes. This includes navigating assessment platforms, designing online tests, interpreting data analytics, and aligning digital tools with curricular goals (European Commission, 2017). However, such competence is not uniformly distributed across educational systems, and its development is influenced by a constellation of individual, institutional, and policy-level factors (Tondeur et al., 2017). In recent years, the COVID-19 pandemic further underscored the importance of digital assessment competence. Faced with emergency remote teaching, educators were required to adopt digital tools with minimal preparation, revealing deep gaps in skills, access, and support systems (Bozkurt & Sharma, 2020).

Individual teacher characteristics have been found to significantly influence competence in digital assessment technologies. Among the most salient factors are digital literacy, self-efficacy, and attitudes toward technology use (Ertmer & Ottenbreit-Leftwich, 2010). Digital literacy encompasses not only operational knowledge of hardware and software but also the critical ability to evaluate, select, and adapt technologies for specific learning contexts (Spante et al., 2018). Self-efficacy, or a teacher's belief in their ability to successfully perform digital tasks, has also been consistently linked with greater uptake and effective usage (Bandura, 1997; Hatlevik et al., 2018). Moreover, teachers' attitudes—including openness to innovation, willingness to experiment, and perceived usefulness of digital tools—can either facilitate or impede engagement with digital assessment systems (Teo, 2009).

Institutional support mechanisms further shape teachers' engagement with digital assessment. Access to professional development opportunities, ongoing technical support, and collaborative learning environments are pivotal in building and sustaining digital competence (Koehler et al., 2014). Schools that provide structured time for training and recognize digital innovation through incentive systems tend to report higher teacher confidence and integration levels (Admiraal et al., 2017). On the contrary, institutional neglect or inconsistent policies often result in fragmented adoption and disillusionment among teachers (Howard et al., 2021). Equally important is the role of leadership. School administrators who actively champion digital practices and model their use are more likely to cultivate a supportive culture of digital assessment (Dexter, 2018).

The design and delivery of training programs also play a crucial role in developing digital competence. Research indicates that many professional development initiatives remain too generic, failing to meet teachers' specific needs in the assessment domain (Drossel et al., 2017). Teachers benefit most from hands-on, contextually relevant training that allows them to experiment with tools directly applicable to their classroom settings (Tondeur et al., 2012). In addition, collaborative learning environments—such as communities of practice—have been shown to enhance knowledge exchange and build shared understandings around technology use in assessment (Voogt et al., 2015). Unfortunately, such communities are often informal and unsupported by institutional policy.

Beyond the school level, systemic and policy-level dynamics profoundly affect the development of digital assessment competence. National curricula, educational standards, and assessment policies can either encourage or constrain teachers' use of technology. For example, rigid exam-centered curricula that emphasize standardized testing may discourage the exploration of formative digital assessment tools (Pellegrino et al., 2016). Similarly, the absence of clear national guidelines or approved platforms often creates uncertainty among educators regarding what tools are permissible and how they should be used (Fischer et al., 2020). This ambiguity can be particularly acute in contexts with underdeveloped digital education policies or limited government investment in teacher training.

Equity considerations also loom large in discussions of digital assessment competence. Socioeconomic and geographic disparities in access to technology, internet connectivity, and support services create uneven playing fields for teachers and students alike (van Dijk, 2020). For instance, teachers in urban areas or private schools may enjoy better infrastructure and institutional resources than those in rural or public school settings. These disparities affect not only the ability to use digital assessment tools but also the confidence and willingness to adopt them (Reich et al., 2020). Furthermore, language barriers—such as software interfaces available only in English—can limit accessibility for teachers with limited English proficiency, particularly in non-Anglophone countries (Hatlevik & Christophersen, 2013).

In Iran, efforts to promote digital assessment have gained momentum in the wake of the pandemic and the broader shift toward digital education. Government initiatives such as the National Smart School Program and digital platforms introduced by the Ministry of Education aim to mainstream technology use in classrooms. Nevertheless, studies suggest that Iranian teachers face considerable challenges in developing and sustaining digital competence, particularly in the area of assessment (Tajeri Moghadam et al., 2021). A lack of structured training, limited access to pedagogically oriented tools, and minimal systemic support have been cited as recurring barriers. Moreover, while infrastructural development has progressed in urban centers like Tehran, many teachers continue to rely on personal devices and self-directed learning to navigate digital platforms.

Despite the growing body of literature on technology integration in education, empirical studies focusing specifically on digital assessment competence among teachers remain limited—particularly in developing country contexts (Ng, 2015). Moreover, much of the existing research adopts quantitative survey approaches that capture self-reported readiness but fail to unpack the complex, lived experiences behind those responses (Gil-Fernández et al., 2021). A qualitative exploration is therefore warranted to provide richer insights into the multilayered factors that influence teachers' competence in digital assessment technologies.

This study aims to fill that gap by exploring the individual, institutional, and systemic factors that shape teachers' competence in digital assessment technologies in the context of Tehran. By using a qualitative research design grounded in semi-structured interviews, the study seeks to capture the voices, experiences, and perceptions of educators navigating this evolving domain. Understanding these factors is essential not only for informing targeted professional development and policy reform but also for supporting a more equitable and sustainable digital transformation in education. Ultimately, the findings of this study aspire to contribute to a more nuanced and contextualized understanding of teacher competence in digital assessment, providing practical implications for stakeholders involved in educational technology integration.

Methods and Materials

Study Design and Participants

This study employed a qualitative research design to explore the factors influencing teachers' competence in using digital assessment technologies. A phenomenological approach was adopted to gain deep insights into teachers' lived experiences and perspectives regarding the integration and use of digital assessment tools in their instructional practices. The study targeted in-service teachers from various educational institutions in Tehran who had varying degrees of experience with digital assessment platforms.

Participants were selected through purposive sampling to ensure maximum variation in terms of teaching experience, subject domain, and type of digital assessment technology used. A total of 16 teachers participated in the study. Recruitment continued until theoretical saturation was reached—that is, no new themes or insights emerged from the data, signaling the adequacy of

the sample size. All participants gave informed consent prior to participation and were assured of the confidentiality and anonymity of their responses.

Data Collection

Data were collected using semi-structured interviews, which allowed for in-depth exploration while maintaining consistency across interviews. The interview guide was developed based on a review of the relevant literature and expert consultation. It included open-ended questions designed to elicit participants' views on their perceived competence, experiences, barriers, institutional support, training opportunities, and personal attitudes towards digital assessment technologies. Each interview lasted between 45 and 60 minutes and was conducted either face-to-face or via secure online platforms, depending on participant preference and availability. All interviews were audio-recorded with participants' permission and transcribed verbatim for analysis.

Data analysis

The transcribed interviews were analyzed using thematic analysis, facilitated by NVivo software (version XX). The analysis followed a systematic coding process, beginning with open coding to identify initial concepts, followed by axial coding to group related codes into broader themes and subthemes. A final phase of selective coding was used to refine and integrate the main categories. The coding process was iterative and recursive, with continuous comparison of data across transcripts to ensure consistency and depth in theme development. To enhance the credibility of the findings, member checking was conducted with a subset of participants, and an audit trail was maintained throughout the analytical process.

Findings and Results

Theme 1: Individual-Level Determinants

Technological Self-Efficacy

Participants expressed varying levels of confidence in their ability to use digital assessment tools effectively. Teachers with prior exposure to educational technologies reported greater ease in navigating platforms, while others voiced hesitation due to lack of familiarity. One participant noted, "I'm not afraid of trying new tools, but I often worry I'll press the wrong button and lose all my students' data." Self-learning and trial-and-error strategies were commonly mentioned as substitutes for formal training.

Attitudes Toward Digital Assessment

Attitudinal orientation significantly influenced perceived competence. Teachers with positive beliefs about the pedagogical value of digital assessment showed greater initiative in adopting new tools. In contrast, skeptical or fearful attitudes impeded engagement. As one teacher reflected, "I still think traditional exams are more reliable, and I don't trust online systems to assess fairly." Several participants emphasized that emotional barriers, such as fear of failure, often outweighed technical ones.

Digital Literacy Skills

Competence was closely linked to fundamental digital literacy. Teachers capable of navigating platforms, creating online quizzes, and managing grade exports demonstrated smoother adoption. A participant stated, "I know how to create questions in Google Forms and track student responses, but I get stuck when it comes to integrating that with the school system." Others described struggling with basic functions due to a lack of foundational training.

Adaptability to Change

Teachers' willingness to adapt to technological shifts shaped their engagement. Those with flexible attitudes were more likely to experiment and accept temporary difficulties. A secondary teacher explained, "I don't mind learning new software, even if it takes time. What matters is that it improves how I teach and assess." However, for others, the emotional toll of change was a deterrent, particularly in the absence of support.

Time Management Skills

Effective time allocation emerged as both a barrier and enabler. Participants who set aside regular time for learning digital tools reported more success. However, time constraints, especially during grading periods, limited opportunities for meaningful engagement. One respondent noted, "With our workload, we barely have time to finish marking, let alone sit and learn a new app."

Motivation for Professional Growth

Intrinsic motivation played a vital role. Teachers motivated by student outcomes or professional development sought out opportunities to upskill. Peer comparison also served as a motivator. As one teacher shared, "When I saw my colleague using an app to give instant feedback, I felt I needed to catch up—not just for me but for my students."

Language and Instructional Barriers

For some participants, the interface language posed a significant barrier. Platforms designed in English were less accessible to Persian-speaking teachers with limited English proficiency. One interviewee commented, "The software is in English, and I have to Google every button to understand what it does. It slows me down." Lack of localized tutorials further exacerbated the problem.

Theme 2: Institutional and Infrastructural Factors

Access to Resources

Availability of hardware and internet access was a determining factor. While most urban schools had basic infrastructure, several participants highlighted inconsistent internet or outdated equipment as persistent issues. "Sometimes the system crashes during exams because the internet goes out. It's frustrating," one teacher explained. Limited student access to devices also shaped assessment strategies.

Training and Professional Development

The quality and frequency of training sessions were mentioned repeatedly. Teachers appreciated workshops that were hands-on and tool-specific but criticized generic or outdated training. "We had a session about online assessment last year, but it was just theory. No one showed us how to actually set up a test," one participant remarked.

Administrative Support

Institutional encouragement and leadership support influenced uptake. Teachers felt more confident when school leaders endorsed digital practices or provided implementation guidance. "When our principal asked us to try online quizzes and actually sat in a session with us, it made a big difference," one teacher shared. In contrast, lack of administrative follow-through reduced motivation.

Peer Collaboration and Community of Practice

Informal teacher networks played a key role in skill-sharing and confidence-building. Many participants cited peer mentoring and resource sharing as essential. A teacher noted, "We have a Telegram group where we share tutorials and help each other. It's more helpful than official training sometimes." Collaborative environments boosted collective competence.

Time Allocated for Learning

Institutional recognition of the time needed to build digital competence was inconsistent. Teachers reported difficulty balancing instructional duties with skill development. “They expect us to learn all this in our free time, but we don’t have any,” one participant expressed. Structured time within the work schedule was identified as a missing component.

Evaluation and Incentive Systems

Teachers pointed out a lack of formal recognition or incentives for digital assessment innovation. Some expressed that despite investing effort, their contributions went unnoticed. “I created an entire digital assessment bank, but no one even acknowledged it in my evaluation,” said one respondent. Others suggested that linking digital assessment practices to career advancement could boost motivation.

Theme 3: Systemic and Policy-Level Influences

National Education Policy and Curriculum Fit

Participants discussed the limited integration of digital assessment into the national curriculum. Rigid curricular demands left little room for innovation. “We are bound by fixed content and exams. There’s no space for creativity or trying new formats,” stated a teacher. This policy-level inflexibility discouraged adoption despite teacher interest.

Standardization and Regulation

The lack of unified guidelines or regulated digital tools resulted in confusion and inconsistency. Teachers were often unsure which platforms were officially supported. “One month they tell us to use System A, and the next it’s something else,” said a frustrated participant. This instability undermined long-term confidence and planning.

Equity in Digital Access

Disparities in access were evident, particularly between urban and rural schools and between public and private institutions. Teachers in under-resourced schools struggled with basic implementation. “My students don’t even have smartphones, so how can I ask them to take an online quiz?” one teacher questioned. These gaps posed ethical and practical challenges.

Vendor-Platform Limitations

Participants reported several usability challenges related to vendor-based tools. Common issues included lack of Farsi support, high subscription costs, and poor customer service. One teacher stated, “The platform we use is expensive, and we don’t get proper support. If something breaks, we’re on our own.”

Integration with Existing Assessment Systems

Teachers emphasized the difficulty of syncing digital tools with traditional grading systems and student records. “I can’t integrate the digital scores into the school’s system without doing everything manually,” said a participant. The lack of integration created redundancy and extra workload, disincentivizing continued use.

Discussion and Conclusion

This study sought to explore the multifaceted factors affecting teachers' competence in digital assessment technologies within the context of Tehran. Through semi-structured interviews with 16 teachers and subsequent thematic analysis, three major themes emerged: individual-level determinants, institutional and infrastructural factors, and systemic and policy-level influences. These findings offer a nuanced understanding of how personal, organizational, and structural conditions intersect to shape educators’ ability and willingness to effectively utilize digital tools for assessment purposes.

A prominent finding was the critical role of technological self-efficacy in shaping digital assessment competence. Teachers who exhibited confidence in their ability to troubleshoot, adapt, and learn new digital tools demonstrated more proactive and sustained engagement. This aligns with Bandura’s (1997) self-efficacy theory, which posits that individuals’ beliefs in their capabilities influence their motivation and performance. Prior studies similarly indicate that teachers with high self-efficacy

are more likely to integrate technology into their instructional and assessment practices (Hatlevik et al., 2018; Ertmer & Ottenbreit-Leftwich, 2010). In contrast, participants who lacked confidence, particularly in unfamiliar platforms, tended to avoid or limit their use of digital assessment tools. This supports research by Tondeur et al. (2017), which emphasizes the need to address affective barriers in professional development programs, not just technical skills.

Another key finding centered on teachers' attitudes toward digital assessment. Educators who perceived digital tools as beneficial for enhancing student engagement and feedback quality were more likely to explore and integrate them into their teaching. Conversely, those who viewed such technologies with skepticism or fear—often citing concerns over fairness, data privacy, or technical malfunctions—were hesitant to rely on them. These attitudes echo findings from Teo (2009), who demonstrated that perceived usefulness and perceived ease of use are significant predictors of technology acceptance among teachers. Moreover, the emotional component of resistance, including anxiety and fear of making errors, resonates with the findings of Howard et al. (2021), who argue that digital transformation must address emotional readiness in addition to technical readiness.

Digital literacy skills were also highlighted as foundational to digital assessment competence. Participants' proficiency in navigating platforms, designing digital quizzes, and managing assessment data varied widely. These disparities suggest an uneven distribution of digital capital among teachers, mirroring broader trends observed by Spante et al. (2018). Educators with higher digital literacy were not only more competent in execution but also more innovative in leveraging digital assessments for formative purposes. This supports prior research indicating that digital literacy underpins all dimensions of effective educational technology use (Instefjord & Munthe, 2017; European Commission, 2017).

The findings further underscore the importance of adaptability to change, a trait that facilitated experimentation and resilience in the face of challenges. Teachers who embraced uncertainty and were willing to learn through trial and error made significant strides in digital competence. This result parallels studies by Koehler et al. (2014) that identify openness to new pedagogical models as a predictor of successful technology integration. Conversely, teachers with rigid routines or strong preferences for traditional methods were more likely to view digital tools as disruptive rather than complementary.

Time management skills emerged as a practical but often overlooked enabler of competence development. Participants consistently reported that lack of time—whether for learning new platforms, designing assessments, or attending training—was a significant barrier. Similar concerns have been raised in the literature, particularly in studies highlighting time constraints as one of the primary obstacles to meaningful professional development in technology (Admiraal et al., 2017; Drossel et al., 2017). This suggests that competence is not solely a function of ability or attitude, but also of opportunity.

Teachers' motivation for professional growth also played a crucial role. Intrinsically motivated educators were more likely to pursue self-directed learning, participate in peer networks, and innovate within their classrooms. This finding is consistent with research on teacher agency and continuous learning (Pereira et al., 2021). Social comparison—particularly observing peers using digital tools successfully—also emerged as a motivational driver, reinforcing the potential of collaborative environments in enhancing digital competence.

A particularly context-sensitive finding was the influence of language and instructional barriers, especially regarding English-language platforms. Several teachers expressed difficulty in navigating software that lacked Farsi localization. This barrier is rarely discussed in global literature but is of critical importance in non-Anglophone settings. It aligns with Hatlevik and Christophersen's (2013) observation that language proficiency can influence digital inclusion and exclusion.

At the institutional level, the presence—or absence—of supportive infrastructure significantly influenced teachers' digital assessment practices. Access to reliable internet, modern devices, and platform licenses determined whether teachers could implement digital tools effectively. These findings mirror those of van Dijk (2020), who emphasized the structural dimension

of the digital divide. Schools with limited infrastructure, particularly public institutions, struggled to maintain consistency and quality in digital assessments.

The study also highlighted the mixed efficacy of professional development and training programs. While most teachers had attended workshops, many criticized the content as either too theoretical or insufficiently tailored to their assessment needs. This reflects the critique by Tondeur et al. (2012) that much technology training remains generic, failing to translate into classroom application. Teachers voiced a preference for hands-on, tool-specific training with follow-up support—a finding aligned with Koehler et al.'s (2014) TPACK model, which emphasizes the integration of content, pedagogy, and technology.

Administrative support emerged as a facilitator of digital competence. Teachers who received encouragement, guidance, or even participation from school leaders reported higher confidence and adoption levels. This finding is consistent with studies that link instructional leadership with teacher innovation (Dexter, 2018). However, in schools where leadership was disengaged or indifferent, teachers expressed a sense of isolation and a lack of direction.

Peer collaboration and communities of practice played a crucial role in enabling informal learning and problem-solving. Teachers frequently cited Telegram groups or informal mentorships as more impactful than formal training. This resonates with research by Voogt et al. (2015), which shows that peer learning fosters professional growth and sustained innovation. These informal networks allowed for real-time support, resource sharing, and emotional reassurance.

The lack of dedicated time for training and experimentation was another major concern. Many teachers felt that professional development was expected to occur outside of regular work hours, contributing to burnout and resistance. As Admiraal et al. (2017) argue, time must be institutionalized as part of the professional learning process if digital transformation is to succeed.

Teachers also pointed to the inadequacy of evaluation and incentive systems, noting that digital innovation was often unrewarded. Some expressed frustration that their efforts in digital assessment were not recognized in performance reviews. This finding aligns with Fischer et al. (2020), who argue that systemic incentives are essential for sustaining technological change at the school level.

At the systemic and policy level, rigid curriculum frameworks and exam-oriented policies limited the flexibility needed for digital assessment innovation. Participants felt constrained by outdated standards that did not account for formative or performance-based assessments. This finding supports Pellegrino et al. (2016), who argue that misalignment between policy and pedagogy impedes meaningful assessment reform.

Teachers also highlighted a lack of standardization and regulatory clarity, citing confusion over which platforms were officially sanctioned. This ambiguity led to inconsistent adoption and in some cases, abandonment of tools after initial investment. Similar dynamics have been observed in other developing country contexts (Ng, 2015; Tajeri Moghadam et al., 2021).

Lastly, equity in digital access remained a cross-cutting concern. Teachers working in under-resourced schools reported that even if they were competent, their students lacked the devices or connectivity needed to participate in digital assessments. These findings resonate with Reich et al. (2020) and emphasize the systemic nature of digital inequality, which cannot be resolved solely at the teacher level.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adheried in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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