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Assessment strategies in digital learning environments: insights from teacher education institutions

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ABSTRACT

This study explores the adaptation of assessment strategies in teacher education programs within digital learning environments (DLEs). The perspectives and experiences of faculty members from teacher education institutions (TEIs) were analyzed using an embedded mixed-methods approach. The findings reveal significant advancements in enhancing instructor digital literacy and student engagement with DLEs. However, challenges such as the authenticity of assessments and increased student workload were identified. Faculty members recommended frequent feedback and authentic evaluations to address these issues. The study also highlights areas for improvement, including the diversification of evaluation tools, broader technology integration, and additional administrative support. These insights are crucial for TEIs to refine their assessment processes in DLE-based teacher training programs and contribute to ongoing discussions in ASEAN teacher education and global educational development.

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1. INTRODUCTION

The COVID-19 pandemic has fundamentally transformed various sectors globally, with education being one of the most affected. The pandemic significantly disrupted the education sector, compelling teacher education institutions (TEIs) to re-evaluate their processes for assessing student completion and success in teacher education programs [1], [2]. While e-learning offers benefits such as increased access and reduced costs [3], concerns persist regarding its potential negative impact on social-emotional development [4]. This study addresses the gap in understanding how TEIs have adapted their assessment methods in response to these challenges.

Despite the rise of online education and new types of assessment [5], the literature presents a mixed picture. Some studies propose online assessment as a solution to selection dilemmas in the distance teaching and learning process [6], while others highlight the need for transforming examination methods to provide better longitudinal feedback than traditional exams [7]. However, the lack of high-stakes online exams may benefit students psychologically, emphasizing the importance of formative assessments for success in remote learning [8].

This study is crucial given the growing demand to adjust evaluation systems for digital learning environments (DLEs). Unprecedented events such as school closures necessitate adaptive assessment models [7]. Teacher preparation programs must equip future educators with the skills to effectively evaluate student

work online [9], aligning with modern teaching approaches [1], [10]. This aligns with UNESCO's call for innovative performance-based evaluation tools to ensure effective assessment protocols in contemporary education [7], [11].

Recent years have seen a surge in higher education educators employing technology to support students' holistic competency development. A systematic review of 37 studies from January 2008 to March 2024 evaluated how technology assists in enhancing teamwork competencies in higher education. The findings reveal that technology integration helps students realize the importance of teamwork, understand team dynamics, develop practical skills, and foster team spirit. However, technological interventions also present challenges, including increased training complexity and negative impacts on motivation [12].

In the field of education, automated assessment has become a critical tool. A state-of-the-art review highlights the complexity of evaluating programming competencies and the evolution of automated assessment tools. These tools now assess program efficiency, behavior, and readability, providing detailed feedback to optimize learning [13]. Similarly, simplified tools for image processing in problem-based learning environments have been developed to support natural science education, enabling students to analyze remote sensing data effectively. This study investigates how TEIs have adjusted their methods of assessing students during the period following COVID-19 school closures. By examining faculty experiences, student participation, and encountering challenges, this research aims to contribute to enhancing evaluation procedures in teacher education programs amidst online learning.

The shift to online learning during the COVID-19 pandemic has necessitated a re-evaluation of assessment practices in education. Students may require support in remote study programs to promote online learning effectively. Xie and Liu [13] emphasize the importance of individualized and continuous feedback to support remote study programs and address instructional barriers. Assessment is described as a systematic process to determine students' knowledge, especially in the context of problem solving [14], involving various methods to evaluate learning, which are complex and help measure abilities and skills [15], [16]. However, online assessments are prone to academic dishonesty, though tools like plagiarism detection software can mitigate this issue [17]. The sudden shift to online learning has made assessment more challenging for teachers, impacting teaching effectiveness [18], [19].

Several studies have revisited the challenges faced by university instructors during online assessments, with Dwivedi *et al.* [20] highlighting the importance of formative evaluation and feedback, is the negative effect of artificial intelligence (AI). Adjustments may be needed due to institutional traditions and limited internet connectivity [7]. Implementing appraisals is important for tutors, and the shift to online teaching has led to new appraisal methods like peer assessment and multimodal assignments, which can provide authentic evaluations [21]–[25].

The study is based on learning Piaget's constructivist theory, which holds that knowledge is created through experiences and that students actively participate in their educational process [26], which emphasizes active engagement and the instructor's role. It examines how TEIs have adapted assessment methods during the pandemic, focusing on digital literacy and formative assessments to enhance evaluation procedures in DLEs. This research investigates assessment practices employed by TEI faculty within DLEs. Specifically, it aims to answer the following questions:

- What types of assessments do TEIs faculty employ to evaluate student performance in DLEs?
- What strengths and weaknesses has TEI's faculty experienced in assessing students within DLEs?
- How have teachers found solutions for assessing students in DLEs?

2. METHOD

The study employed a mixed-methods approach with a descriptive design to investigate how TEIs adapted evaluation processes for online teacher preparation programs. A web-based survey with closed-ended questions was administered to 15 faculty members from the University of Eastern Philippines, while semi-structured interviews provided insights from 7 experts. The sample size for the quantitative component was validated using Cohen's statistical power analysis, and interview recruitment was guided by data saturation. The research instruments underwent expert review and pilot testing to ensure validity and reliability, with Cronbach's alpha used to assess internal consistency. Confounding variables were controlled through standardized survey administration, strict participant selection, and triangulation of data sources. Ethical protocols, including institutional review board approval and secure data collection procedures, were strictly followed. Data analysis incorporated descriptive statistics to quantify evaluation tools, while thematic analysis with coding techniques and computer-assisted qualitative data analysis software was applied to interview transcripts. Triangulation strengthened the findings, providing a comprehensive perspective on how TEIs navigated the transition to digital evaluation methods.

3. RESULTS AND DISCUSSION

3.1. Level of assessment tools utilization

Figure 1 shows a clear preference for assessments that encourage deeper learning, such as essay questions and project-based tasks. Previous studies [6], [27] suggested that these high-order critical thinking assessments, if reliable when conducted online, have the potential to help universities bridge the gap between the benefits and drawbacks of online education. However, Ferretti *et al.* [28] and Onu *et al.* [29] highlight that ensuring the reliability of these assessments online can be challenging and there might be a gap between the intended benefits and the online reality. Many of these high-order assessments are currently supplemented with traditional practices like multiple-choice questions, indicating a balanced approach [6]. Traditional assessment methods like multiple-choice questions are still widely used, suggesting a combination of both innovative and conventional techniques [27]. This balanced approach can help mitigate the limitations of each method and provide a more holistic evaluation of student performance [28].

The challenge of ensuring the reliability of high-order assessments online remains significant [28], [29]. There might be a gap between the intended benefits and the online reality, which needs to be addressed to leverage the potential of these assessments fully [6]. It is also worth noting that several assessment techniques are currently underrepresented and should be further promoted [27]. The findings indicate a need for further promotion and development of these techniques to enhance the overall assessment strategy [28]. According to Tuah and Naing [30], the typical online assessment methods used at higher education institutions (HEIs) include online quizzes, continuous feedback, multiple-choice questions, and automated essay assessment. The online tools for formative assessment in higher education include feedback, self-test quizzes, and discussion forums [30].

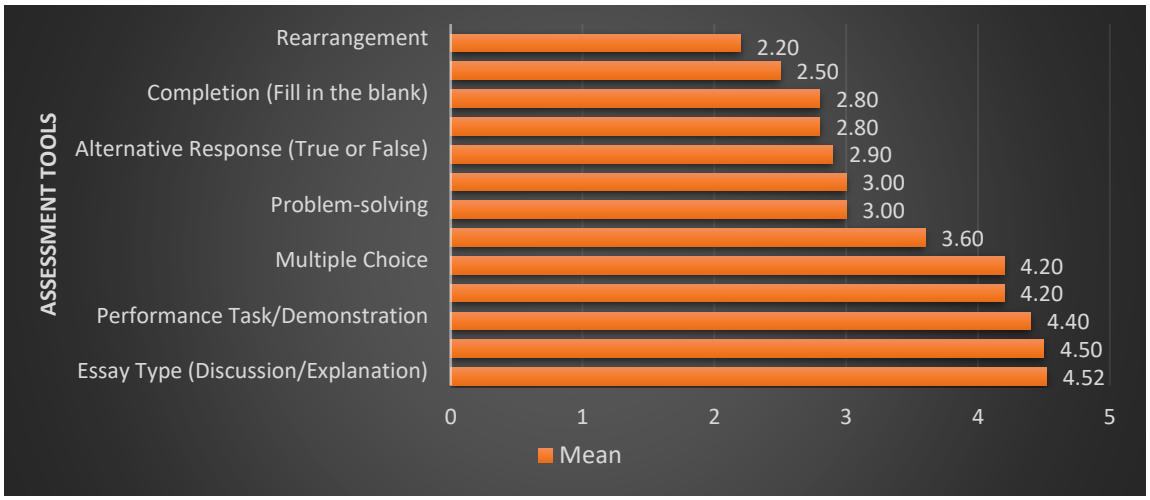

Figure 1. Level of assessment tools utilization

3.2. Assessment experiences in distance learning

3.2.1. Positive

Table 1 highlights several advantages of online assessment: technological proficiency, innovative teaching, flexible learning schedules, improved study habits, increased student engagement, access to diverse resources, collaboration opportunities, personalized learning, and cost-effectiveness. Most respondents recognized advancements in technology skills and pedagogical practice, with many lecturers noting improved student time management skills [31]. However, lower costs were not seen as a significant benefit, and the study's focus on a single university may limit its generalizability [32], [33].

The findings align with previous research on the benefits of online assessments in promoting critical thinking and deeper learning [6], [27]. Challenges such as plagiarism and technical issues are consistent with other studies on the reliability of online assessments [28], [29]. Lee and Hwang [34] support the need for hands-on learning-to-teach opportunities with emerging technology, while Park *et al.* [35] suggest that digital innovations will revolutionize medical and dental education.

Research by Rapanta *et al.* [36] emphasize the importance of designing better learning experiences with digital technologies. Junior *et al.* [37] identified predictors of students' self-perception of performance in online courses. Alam [38] notes that students' accomplishments can be monitored more precisely while

remaining anonymous. In addition, Qureshi *et al.* [39] concluded that collaborative learning and social factors improve student activities. Chisadza *et al.* [40] found that technology integration enhances learning for students with speech disorders. Furthermore, Curelaru *et al.* [41] highlight the benefits of online learning, such as comfort, accessibility, economy, and psychological and medical safety [42].

Table 1. Positive experiences of the respondents

Themes	Sample responses
Technological proficiency	"*Technology enhances the connection between teachers and students, making learning more effective.*"
	"*Using new tech tools has boosted my ability to teach and engage with my students.*"
	"*I've become more proficient in using educational technology to support my teaching.*"
Innovative teaching and assessment	"*I've implemented new strategies for assessing students using digital tools.*"
	"*Digital assessments have transformed how I evaluate student progress.*"
	"*I've adopted new teaching strategies that leverage technology to better assess student understanding.*"
Flexible learning schedules	"*The flexibility of online learning allows me to balance my teaching schedule more effectively.*"
	"*Students appreciate the ability to learn at their own pace.*"
	"*The adaptable nature of online classes has been beneficial for both students and teachers.*"
Improved study habits and time management	"*Students have demonstrated improved time management skills.*"
	"*My students are now better at managing their study time effectively.*"
	"*I've seen a noticeable improvement in my students' study habits.*"
Increased student engagement	"*I've seen a noticeable increase in student engagement during online classes.*"
	"*Students are more interactive and participative in the virtual learning environment.*"
	"*Interactive tools have significantly boosted student interest and involvement.*"
Access to diverse resources	"*I've accessed a diverse array of resources to enhance my teaching.*"
	"*Students have benefited from the variety of online materials available.*"
	"*Digital resources have enriched the learning experience.*"
Collaboration opportunities	"*Online platforms have provided more opportunities for collaboration with colleagues.*"
	"*I've worked more closely with other educators through virtual meetings.*"
	"*Collaborative projects are easier to manage and execute online.*"
Personalized learning	"*I've personalized learning experiences to meet student needs better.*"
	"*The online format allows for more individualized attention and support.*"
	"*Students have benefited from customized learning paths.*"
Cost-effectiveness	"*The cost of online learning is very reasonable.*"
	"*The expenses associated with online learning have been minimal.*"

3.2.2. Negative

Table 2 highlights several challenges with online assessment, such as verifying student work authenticity, plagiarism, time management issues, lack of engagement, technical difficulties, and distractions at home. Faculty members struggled with accountability and timely submissions due to poor internet connectivity, which affected the overall online class experience [43], [44]. Additionally, the lack of personal interaction in virtual environments made it harder for faculty to connect with students, impacting engagement [45], [46].

To address these issues, TEIs should invest in diverse online assessment techniques, train faculty on best practices in live instruction [47], and explore innovative tools [48]. Including student perspectives in future research can provide a more comprehensive understanding of online education processes [32], [33]. The study's limitations, such as its focus on a single university, highlight the need for broader research involving multiple institutions and larger participant pools [6], [27].

Paredes *et al.* [49] found that remote proctored exams improve academic honesty. In addition, Mulenga and Shilongo [48] identified factors contributing to plagiarism and emphasized the role of detection software. Barrot *et al.* [50] discussed resource management and technical skills. Bergdahl [45] noted engagement challenges, while Özüdoğru [46] highlighted issues like communication failures and technical problems. Kostaki and Karayianni [51] reported concentration and technical issues, while other study [52] found that online teaching impacts motivation due to a lack of social interaction. Lastly, Curelaru *et al.* [41] also noted the psychological and medical safety benefits of online learning.

3.3. Solutions made for the problems met in assessing students

As presented in Table 3, several solutions were identified to address challenges in online teacher training assessments, including enhancing student accountability, improving assessment design and integrity, enhancing time management, utilizing technology, increasing parental involvement, and fostering professional development. Faculty members actively monitored student performance through quizzes, exams, and communication, and used plagiarism detectors to maintain academic integrity [53]–[56]. Flexible deadlines and time management tools were also provided to manage the workload [53], [57]. However, issues with plagiarism detection persist, indicating a need for further research into alternative methods of assessing critical thinking and higher-order learning skills [56], [58].

The study emphasizes the importance of active monitoring and communication in supporting student performance [53], [54]. The use of plagiarism detection tools is consistent with other studies highlighting the challenges of ensuring academic integrity in online assessments [55], [56]. Recommendations include training faculty on best practices, exploring alternative assessment methods, and providing flexible deadlines and time management strategies to support student well-being [30], [59]. Future research should involve multiple institutions and larger participant pools to validate the findings and provide more general insights into effective assessment strategies in online education [6], [27].

Tuah and Naing [30] suggests using free software and video conferencing tools for online exams. Maqableh and Alia [59] recommend a unified online learning platform to enhance the learning experience [60]. Surahman and Wang [61] advocate for technology-based approaches like plagiarism-checking software and AI in learning management systems, as well as pedagogical approaches to reduce cheating. In addition, Yeung and Yau [62] found that self-regulated learning strategies, including time management apps and lecture videos, facilitate learning. Sevnarayan and Maphoto [63] recommend interactive module design, lecturer training, and stringent academic integrity policies to minimize cheating [64]. Additionally, Lo [65] revealed that remotely proctored exams improve academic honesty, while Otto *et al*. [66] identified factors contributing to plagiarism and emphasized the role of detection software.

Table 2. Negative experiences of respondents

Negative themes	Sample responses
Difficulty verifying the authenticity of student work	"*It's challenging to verify if students are completing their assessment tasks.*" "*I often struggle to confirm the authenticity of submitted work.*" "*Ensuring student accountability has been a significant challenge.*"
Issues with uniformity and plagiarism	"*Many student responses are identical, indicating potential copying.*" "*I've noticed similar answers, raising concerns about plagiarism.*" "*Students heavily depend on the same sources.*"
Problems with time management	"*Late submissions are common due to poor internet connectivity.*" "*Students frequently submit work late because of connectivity issues.*" "*Managing timely submissions has been difficult with unreliable internet access.*"
Lack of student engagement	"*There's a concern that students are not thoroughly reading and studying their lessons.*" "*Some students are not fully engaging with their study materials.*" "*Ensuring active learning is a challenge.*"
Frequent technical difficulties	"*Technical glitches often disrupt online classes.*" "*I've faced numerous technical difficulties that hinder teaching.*" "*Frequent software and hardware issues are a major challenge.*"
Lack of personal interaction	"*The lack of personal interaction makes it harder to connect with students.*" "*I miss face-to-face communication that helps build rapport.*" "*The virtual environment feels impersonal and affects engagement.*"
Distractions at home	"*Students often get distracted by their home environment during online classes.*" "*It's challenging for students to stay focused with so many distractions at home.*" "*The home setting can be quite disruptive for students.*"
Challenges with motivation and self-discipline	"*Keeping students motivated in a virtual setting is challenging.*" "*Some students lack the self-discipline needed for online learning.*" "*Maintaining student motivation has been a persistent issue.*"

Table 3. Solutions made for the problems met in assessing students

Themes	Sample responses
Enhancing student accountability	"*I provide regular updates to students about their performance and areas for improvement.*" "*I encourage students to reflect on their performance and set personal goals.*" "*I use self-assessment and peer-assessment techniques to promote student accountability.*"
Improving assessment design and integrity	"*I switch from an objective type of exam to a subjective type to reduce the probability of cheating.*" "*I require students to complete performance tasks to ensure the authenticity of their work.*" "*I conduct plagiarism tests to check the uniqueness of their answers.*"
Enhancing time management	"*I implement effective time management strategies for managing all performance tasks.*" "*I provide a specific time frame for every assessment task.*" "*I create a detailed schedule for students to follow for their assignments.*"
Utilizing technology	"*I utilize online platforms to streamline the submission and grading process.*" "*I incorporate educational software to monitor student progress in real-time.*" "*I use digital tools to create interactive and engaging assessment tasks.*"
Increasing parental involvement	"*I encourage parents to monitor and support their children's learning at home.*" "*I regularly communicate with parents about their child's progress and areas for improvement.*" "*I organize parent-teacher meetings to discuss student performance.*"
Fostering professional development	"*I attend workshops and training sessions to improve assessment techniques.*" "*I collaborate with colleagues to share best practices and innovative assessment methods.*" "*I stay updated with the latest research and trends in educational assessment.*"

4. CONCLUSION

This study explored how TEIs adapted their evaluation methods for online teacher preparation programs, addressing gaps in the literature regarding assessment effectiveness and challenges. Findings indicate that educators prefer assessments promoting critical thinking and deeper learning, such as essay questions and project-based tasks. However, ensuring the reliability of these methods in online settings remains a challenge. Traditional assessments, like multiple-choice questions, are still widely used, suggesting a balanced approach to evaluation. The study also highlights the need to promote underrepresented assessment techniques to enhance evaluation quality.

Online assessments have a significant impact on students' technology skills, pedagogical practices, and learning behaviors, including time management. However, challenges such as plagiarism and technical difficulties persist. The study emphasizes the importance of active monitoring and effective communication to maintain academic integrity. Additionally, it recommends investment in diverse assessment techniques, faculty training, student perspectives, and technical infrastructure to improve evaluation methods. A blended approach combining traditional and innovative strategies is suggested to optimize online assessment processes.

While the study concludes that online assessments can enhance educational practices and student behaviors, it also acknowledges persistent challenges. It calls for continuous improvements in assessment design, particularly in ASEAN teacher education, and recommends a holistic approach integrating various evaluation methods. The limitations include its focus on a single university with a small sample size, which affects generalizability. Future research should involve multiple institutions, larger sample sizes, and student perspectives to provide a more comprehensive understanding of online education processes and best practices.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

DATA AVAILABILITY

The authors confirm that the data supporting the findings of this study are available within the article.

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