Interdisciplinary Research in Education
Volume 10, Issue 2, 2025: 10-26
DOI: https://doi.org/10.3126/ire.v10i2.88091

Assessment Practices in Online Mathematics Learning: Insights from Nepali Universities

Krishna Prasad Adhikari[1], MPhil
Asst. Professor
Email: krishna.adhikari@cded.tu.edu.np
ORCID: https://orcid.org/0000-0002-4530-2147
[1]Central Department of Education, Tribhuvan University, Nepal

Lekhnath Sharma[1], PhD
Professor
Email: sharmaln012@gmail.com
ORCID: https://orcid.org/0000-0001-8608-3983
[1]Central Department of Education, Tribhuvan University, Nepal

Dirgha Raj Joshi[2*] PhD
Assistant Lecturer
Email: dirgharaj.joshi@mrc.tu.edu.np
ORCID: https://orcid.org/0000-0002-1437-6661
[2]Mahendra Ratna Campus Tahachal, Tribhuvan University Nepal

Keywords

Online assessment, feedback, academic integrity, transparency

Abstract

After the outbreak of COVID-19, Nepal's universities have been adopting online or blended learning systems; however, the quality and credibility of online assessment practices within this emerging system remain unexplored. This study explored how teachers and students experience online assessment design, implementation, and integrity in mathematics. Data was collected through semi-structured interviews and LMS observations from six students and six teachers from three universities using an interpretive research design and were analyzed thematically. The findings show that assessment mainly focuses on assessment of learning rather than as and for learning, a lack of a systematic feedback mechanism, and an authorship checking system. Plagiarism and cheating are major challenges to maintaining the academic integrity of the assessment process. Despite these challenges, some instructors demonstrated effective use of rubrics, automated tools, and authentic assessment design, indicating emerging but uneven progress toward transparent and technology-enhanced assessment.

Introduction

Assessment in our context relied heavily on pen-and-paper-based, fixed hours summative examinations, with limited emphasis on assessment for learning. In my observation, the assessment practices in the face-to-face mode of the semester system are mainly based on paper-and-pen-based written examination, following the traditional psychometric paradigm (Berry & Adamson, 2011). Even in the internal assignment, teachers used to take hour-based examinations, which mirrored the summative examination. This type of assessment system could not measure the higher-order thinking, creativity and problem-solving skills needed for the 21st century (Tinoca et al., 2014).

After the outbreak of Covid-19 as a pandemic shifted our conventional face-to-face system of teaching and learning online. The crisis highlighted the need to explore alternative approaches that are compatible with online learning as well as online assessment practices. In the face-to-face system, we have several options for assessment, including supervised written examination, classroom discussions, presentations, group work, and project work. But in an online learning environment, applying the same assessment techniques used in a face-to-face setting could not be effective. In this context, this study has focused on how universities are implementing assessment strategies for evaluating students in higher mathematics within an online learning environment and how students and teachers perceive the challenges of online assessment with respect to the assessment process, quality, and academic integrity.

Literature Review

Assessment in Education: A Paradigm Shift

The rapid development of ICT tools and techniques in education opened up new promises for teaching and learning activities (Baleni, 2012; Deutsch et al., 2012). The advent of new technology and the evolution of new theories of learning demand a paradigm shift in educational assessment. Teachers have become increasingly aware of the growing use of ICT in higher education (Deutsch et al., 2012), and technology-supported educational systems have transformed the way students assess and enable the acquisition and development of new knowledge and skills (Sampson et al., 2013). While the teaching and learning activities have been shifted online, assessment should be compatible with online pedagogy. Online assessment should provide the opportunity for collaboration between students and teachers in a new dynamic academic environment, which is better than the traditional static environment of paper and pen.

Assessment in the new paradigm should be geared towards the active participation of the students in learning (Osuji, 2015). The education and assessment system should encourage the students to become innovative thinkers for the future (Lubbe et al., 2025; Schleicher, 2018a). The new paradigm should be educative, which focuses on the development of metacognitive skills, like how to teach, how to learn, and how to develop teaching expertise, rather than only focusing on how students, teachers, and institutions are performing (Osuji, 2015).

Assessment Approaches: Of, For, or As Learning

Three approaches of assessment discussed by Earl (2013) are assessment of learning, for learning, and as learning. All three approaches have their importance in the learning process.

Assessment of learning focuses on assessing the students' understanding of the subject matter, while assessment for and as learning are crucial to developing skills like problem-solving, critical thinking, and creativity (Wafubwa & Csíkos, 2021; Yin et al., 2022). Assessment for and as learning enhances engagement, collaboration and active participation in the learning process (Taggart & Wheeler, 2025) and adapt teaching-learning activities according to the students' priorities (Yan et al., 2021).

We can assess students' subject-specific knowledge by designing higher-order summative tasks such as open-book exams, case-based problem-solving tasks etc. (Hoogland & Tout, 2018). This process can make trustworthy by designing randomized question banks, establishing online proctoring by IP tracking, and observing through webcam (Holden et al., 2021; Laamanen et al., 2021; Mellar et al., 2018; Okada, Noguera, et al., 2019; Shraim, 2019). We can use follow-up testing, like an interview after the written examination, to ensure the authorship and originality of the submitted works (Nguyen et al., 2020).

In combating the challenges of online summative assessment, formative assessment strategies are more effective (Fyfe et al., 2014) in terms of continuous learning progress, making self-directed and committed learners, enhancing engagement and understanding of learning (Hodgson & Pang, 2012; McCallum & Milner, 2021). Formative computer-based assessment aligned with assessment for and as learning (Adhikari et al., 2023), especially beneficial to low-performing students to improve performance (Admiraal et al., 2020; Petrović et al., 2017) and encourage students for self-assessment, demystify misconceptions through discussion (Hodgson & Pang, 2012). Gamified quizzes with automated feedback strengthen students' self-regulated learning (Balalle, 2024; Perez-Aranda et al., 2023), purposeful and collaborative group work promotes ownership in the learning process (Taggart & Wheeler, 2025), and presentations and group work allow instructors to adapt teaching and learning according to students' thinking skills, (Veugen et al., 2024). Self and peer-assessment are the key strategies for assessment as learning (Li, 2018), useful to improve self-efficacy, identify their strengths and weaknesses, and develop technological skills (Ismaeel, 2020). Panadero and Alqassab (2019) discussed that an anonymous peer-assessment with clear instructions for assessment is effective in an online setting in improving feedback quality and evaluation skills. However, the concerns about fairness and trust in peer's evaluation skills remain central in peer assessment (Wilson et al., 2015). Thus, properly designed formative assessment that covers assessment of, for and as learning can be an effective method in an online learning system.

Feedback in Online Assessment

The effectiveness of online assessment also depends on the feedback mechanism. The system of feedback and feed-forward mechanism helps students to engage in the learning process, enhances creativity in the students and monitors the students' learning (Harks et al., 2014; Ji-Yoon Jin et al., 2025). Pattalitan (2016) argued that feedback and feedforward processes are vital in instructional scaffolding. So, feedback not only supports students but also the instructors in adapting their teaching and learning process. Feedback is one of the important factors for the acceptance of online assessment (Acosta-Gonzaga & Walet, 2018; Adesemowo et al.,

2016; Bloom et al., 2018; Cheng & Hou, 2015; Debuse & Lawley, 2016; Demir, 2018; Fyfe et al., 2014; Tepgec et al., 2024).

Continuous and constructive feedback can play an important role for students to become self-directed and reflective learners (Debuse & Lawley, 2016; Fyfe et al., 2014), develop higher-order thinking skills (Alruwais et al., 2018), and prevent disengagement from the learning process (Kanchana et al., 2025). Students appreciate the timely given constructive feedback in the online assessment (Fisher et al., 2025; Helfaya, 2019), but the feedback content (Fisher et al., 2025) and students' expectations (Timmers et al., 2013). Feedback plays an important role in its use. AI chatbots can provide higher-quality feedback compared to peers, but peer feedback could be more personalized and context-sensitive (Usher, 2025). Study also found that students expect more affective feedback compared to cognitive and metacognitive feedback at the beginning (Cheng & Hou, 2015). It is also found that immediate knowledge of correct response and elaborated feedback is much more supportive for the improvement in learning (Van Der Kleij et al., 2012). More importantly, the feedback literacy (Tepgec et al., 2024) on students and instructors is crucial to design and implement an effective feedback mechanism.

Issues of Online Assessments

Besides this, there are challenges as well in designing and conducting quality online assessment in terms of commitment at an institutional level and competency of the teacher in handling technologies (Isaias & Issa, 2013; Joshi et al., 2023; Khanal et al., 2022). Tinoca et al. (2014) have explained authenticity, consistency, transparency, and practicability as essential qualities of online assessment in higher education. JISC (2020) has published five principles: authentic, accessible, automated, continuous and secure, based on the vision of Education 4.0. Moreover, for assessing higher-order thinking in mathematics, multimodality of assessment items, multifaceted and advanced representations of reality, modeling and problem-solving situations should be cautiously designed (Schoenfeld, 2017; Stacey & Wiliam, 2013).

In an online environment, maintaining the authorship and authenticity of assessments is challenging because of the increasing rate of plagiarism, AI-generated content and cheating (Mellar et al., 2018; Okada, Noguera, et al., 2019; Okada, Whitelock, et al., 2019; Reedy et al., 2021; Zaheer et al., 2024). An Adaptive Trust-based e-Assessment System (TeSLA) is crucial to maintain authenticity and authorship in the digital age (Mellar et al., 2018; Okada, Noguera, et al., 2019). Cheating is the major problem in all forms of exams either face-to-face or online, proctored or non-proctored (Mellar et al., 2018; Reedy et al., 2021). To prevent cheating, an appropriately designed e-assessment is essential (Reedy et al., 2021). The meta-analysis by Sozon et al. (2025) revealed that laziness, time constraints, lack of confidence, difficult examination system, excessive assignments, fear of poor grades and motivation to achieve good grades are major causes of cheating. The study of Maleki (2025) explored that the mindset of learners matters in cheating activities and the cheating mindset develops due to three psychological reasons: individual, contextual and systemic factors. Thus, technical, organizational and pedagogical aspects should be managed carefully to address the issues related to authenticity, credibility, accessibility, security and privacy.

Methodology

Study Setting

This study adopted a descriptive qualitative research design under the interpretive research paradigm (Creswell & Creswell, 2018). Because the research was not theory-driven, it aimed to understand and interpret the natural conditions of how the online assessment system is implemented in the Nepali universities (Kahlke, 2014; Sandelowski, 2010). Three universities: Tribhuvan University (TU), Kathmandu University (KU), and Nepal Open University (NOU) were selected purposively for the study. NOU is specifically established for online education, while TU and KU had begun implementing online teaching and learning in selected programs, particularly after COVID-19.

Respondents of the Study

The respondents of this study were teachers and students involved in online mathematics teaching and learning. Six mathematics teachers, two from each university, were selected purposively based on their involvement in an online or blended learning system. Additionally, six students from three universities who had completed at least one semester of online learning were included. To ensure confidentiality, all participants were assigned codes, such as U1S1 for the student from university one and U3T1 for the teacher from university third and these codes are used throughout the analysis and reporting process.

Data Collection and Ethical Concerns

Data were collected through semi-structured interviews and observation of the learning management system (LMS). The interview was focused on students' and teachers' perspectives on ongoing online assessment. All interviews were audio-recorded, translated, and analyzed. Observations of LMS were conducted using a structured observation guideline developed in consultation with the supervisor and evaluated by four experts using a modified Delphi method (Nasa et al., 2021). The observations focused on assessment strategies, transparency, grading and feedback system.

Ethical compliances such as voluntary participation, informed consent, transparency of the research process and privacy (Cohen et al., 2018) were carefully addressed throughout the study. Permission to conduct the research was obtained from the Graduate School of Education, Tribhuvan University, Nepal. Voluntary participation was ensured and participants were informed of their right to withdraw at any stage. Confidentiality and anonymity were strictly maintained by assigning codes to participants.

Data Analysis Technique

Data analysis followed a thematic approach (Terry et al., 2017). Interview recordings were first transcribed in the original language (Nepali) and then translated into English. The interview transcripts were read multiple times to make common understandings, familiarize the content and gain an in-depth understanding of participants' perspectives (Terry et al., 2017). Interview transcriptions were coded, identifying meaningful units and these codes were then grouped into categories based on similarities. Broader themes were developed from these categories. The relationships between data, codes, and themes were examined to ensure coherence and meaningful representation of the findings. Observation data were incorporated to triangulate and validate the interview findings to ensure the credibility and trustworthiness of the results.

Results and Discussions

This section presents an analysis of the data obtained from the interview with teachers and students and observation of LMS regarding existing online assessment practices in higher mathematics education among the three selected universities of Nepal. After the analysis of the data, mainly three broader themes were developed: assessment design and diversity, feedback mechanism and issues of online assessment in mathematics. The results under these themes are presented in the following sub-section.

Assessment Design and Diversity in Mathematics

Regarding the assessment varieties, participants mentioned that open-ended questions, written examination, presentation and occasional group projects as the assessment techniques. But the written test, either open-ended or closed, dominated the other types of assessments. For instance, the student U2S1 viewed, *the assignments were generally open-ended questions, which we had to complete by searching various resources.* Other student U1S2 pointed out the lack of diversity in assignment types; *we mostly had written assignments… other than that, there weren't any other types of assignments.* Student U1S1 added that, *in mathematics, I think more than 90% teachers conducted written examinations. We had to write the answers to the questions and submit them or email them to the teachers within the given time frame.* The student highlighted a gap in diverse assessment methods. However, students also viewed positively regarding the existing assignment practices. Student U2S2 viewed, i*n statistics, we had to complete a project using SPSS or R, which served as our final exam, followed by a viva*. This indicates how we can incorporate practical, hands-on experiences in the assessment process.

Regarding assessment diversity, the views of teachers differed based on their institutional practices. Teachers who had updated the activities in Moodle were using different formative assessments and those teachers whose LMS was not functioning were depending on written tests only. Teacher (U2T1) whose LMS was updated expressed, *we have been using presentation, group work, discussion, individual readings, and assignments*, but also mentioned the limitations of peer-graded assessment for subjects like mathematics, as *peer-graded assessment does not work well because of abstract content*. But, the teacher (T1U1), whose LMS was not in use, mentioned, *I took the written examination in all.* There was a difference in the use of assessment techniques based on the teachers. Some teachers used a variety of assessment techniques, but the most commonly used assessment technique was the written examination.

Another essential feature of assessment in an online system is formative assessment. Assessment should not only focus on assessment of learning but also for and as learning (Earl, 2013). The interview with students reveals a limited use of formative assessment methods. Assessment should also inform the existing teaching and learning process and changes in the existing teaching and learning process. But none of the respondents viewed that the assessment was used for and as learning (Earl, 2013). Student U1T2, in this regard, responded that, *I think, the use of assignments is only to grade us, not to reconsider their teaching methods based on our performance.* But student U2S2 viewed the open-book examination positively, as

exams were designed to test understanding rather than rote memorization, so it is hard to find direct answers in the book. This shows some effort to provide assessments that encourage meaningful engagement were in practice, although this practice does not seem consistent across courses.

Written examinations largely dominate the existing online assessment. Written examinations can enhance subject-specific knowledge in mathematics to some extent, but this summative form of assessment mainly focuses on assessment of learning rather than for and as learning to develop higher-order thinking skills (Earl, 2013; Hoogland & Tout, 2018). The example presented regarding the use of statistical tools for data analysis illustrates the possibilities of using a variety of assessment techniques in mathematics to support authentic, hands-on learning experiences (Hoogland & Tout, 2018), which promote confidence, problem-solving skills and metacognition (Balalle, 2024; Lubbe et al., 2025; Schleicher, 2018b). Nevertheless, the data expose the challenges of using such formative assessment strategies due to the abstract nature of mathematics content, so design must be carefully adapted to subject-specific requirements while maintaining authenticity and inclusivity (Fyfe et al., 2014; Wilson et al., 2015).

In fact, online assessment should be continuous, interactive and integrated with diverse strategies (Osuji, 2015). The adoption of continuous assessment strategies varied in the universities, LMS and intentions of teachers (Adhikari et al., 2023; Taggart & Wheeler, 2025; Wafubwa & Csíkos, 2021).This condition highlights the needs of infrastructure and digital readiness in designing online assessments that capture the essence of all three approaches: of, for and as learning (Earl, 2013; Yan et al., 2021).

In summary, the current assessment design and strategies in Nepali universities are mostly dominated by summative-type written assessments. Thus, results indicate the necessity of a systematic approach to design an online assessment that can balance assessment of, for and as learning in mathematics.

Feedback Mechanism in Online Assessment

Feedback is important for the learning process. Particularly in an online learning environment, feedback and feedforward mechanisms help students to be engaged in the learning process (Harks et al., 2014; Ji-Yoon Jin et al., 2025). But the interviews with students showed that the feedback mechanism in the universities is often inadequate or inconsistent. A student U2S2 stated, *feedback was usually delayed… sometimes we did not get any feedback at all*. The lack of timely feedback can hinder students' ability to learn and improve, as they receive the necessary information to understand their mistakes and make the necessary adjustments. Another student, U3S1 stated, *we only got generic feedback, like 'Good job' or 'Needs improvement,'* and student U1S1 added, *feedback was generally provided to the group rather than the individual.* This suggests that even when feedback was provided, it was too vague to understand. Student U1S2 mentioned, *after completing exams and assignments, I often realized I needed to improve my learning process. This motivated me to study more, but there was no such feedback from the teachers.* Student U3S2 viewed, *the teacher sometimes gave feedback, pointing out weaknesses or suggesting improvements, but overall, we did not receive much support, nor did we ask*

for it. This view indicates that the problem was not only in the teachers but also in the students who did not expect any feedback regarding submitted tasks.

The versions of students were also matched with the practice of teachers regarding feedback. Mostly, teachers used to give generic feedback. But Teacher U2T2 stated a quite different view, *I use both types of feedback, if the error is generic and does not have serious comments, I usually provide the feedback in Moodle. Otherwise, I download the file and check line by line and provide detailed feedback.* This dual approach of feedback addresses individual needs. Except for this, the rest of the others had not taken feedback as an important aspect in online assessment. The teacher U1T1 said, *it is easy in face-to-face but in online, I could not provide feedback properly due to the time constraints.* That means teachers in the online mode did not give priority to feedback, but feedback in online mode is much more crucial than in face-to-face mode (Sjolie et al., 2022) because they could be emotionally and socially detached from the teachers and teaching and learning environment.

The analysis of the expressions of students and teachers reveals a significant gap in the feedback mechanism within the online learning environment. The existing feedback mechanism was insufficient and ineffective in terms of time, specificity and need-based. The literature focuses on feedback and feedforward mechanisms in online environments for student engagement, self-regulated learning and instructional scaffolding (Harks et al., 2014; Ji-Yoon Jin et al., 2025; Pattalitan et al., 2016), but the views of students and teachers indicate the lack of an appropriate feedback mechanism.

Issues of Online Assessment in Mathematics

From the interview with teachers and students and observation of LMS, different issues such as academic integrity, transparency, accessibility and automation regarding the implementation of online assessment in mathematics were identified.

The major challenge of assessment in online learning is maintaining academic integrity (Sabrina et al., 2022). The issues of plagiarism, cheating and copying others' work were highlighted by the respondents during the interview. Regarding plagiarism, student U3S2 expressed, *some students who had already submitted their assignments would be asked by others to share them, leading to the possibility of plagiarism.* Further, student U1S2 pointed out that the serious issues of mass cheating, *everyone shared answers, so even weak students performed well*, suggesting that the assessment design might not accurately reflect individual student abilities. However, U2S2 expressed, *the exams are designed in such a way that you barely have enough time to complete them, so there's no time to look around*. Similarly, other student U2S1 viewed, *the questions were designed to test understanding rather than rote memorization, so it is not easy to find direct answers in books.* This approach could ensure authorship, but the teacher needs to be more attentive while checking assignments to minimize the copying work from peers.

Regarding academic integrity, teachers from U2 expressed confidence that they are maintaining authorship by using different software, while others were in confusion. Teacher U2T1 said, *we use Feedback Studio where we can see the AI-generated text as well. We accept up to 10% of the similarity;*

otherwise, students have to revise it. Teacher U3T1 expressed the practical problem of online assessment as, f*or example, student A can submit the assignment from student B. I don't know who uploaded this file. Or use the other's ID and upload the assignment. I have to trust them.* Further, teacher U3T1 added, th*ey can use multiple screens or take support from others. We don't know more about the part of technology; they can turn off video saying my internet is slow.* These expressions indicate the inherent weaknesses in the online assessment environment, where students can easily take advantage of the assessment conditions. Technology can check the originality of the submitted assignments, but in mathematics, the solution of the questions could be the same.

Another issue we raised during the interview was transparency in the assessment process. Regarding this, teacher U2T2 replied, *I have developed the rubric for grading the assignment and students can get the rubric from Moodle easily.* This indicates that one level of transparency was maintained in the assessment, but only two teachers from the same university (U2) showed their rubrics and the rest of other did not have this. The teachers from other universities highlighted the inconsistencies in the assessment practices. Teacher U1T1 said, *if all of us do uniform in all subjects, then students have to do the task; if I only force them to work, they get negative, they accuse this teacher of putting excessive pressure on us.* This indicates the lack of consistency across different subjects and teachers, which results negative perception of students regarding the assessment process.

Automation and accessibility features of assessment are also essential for online assessment (JISC, 2020). Automation in the assessments not only presents the assessment tasks in an adaptive form (Kabudi et al., 2021) but also provides instant feedback, grading, evaluates the effectiveness of the teaching and learning process and academic integrity (Huang et al., 2023; Luckin, 2017). Only two teachers had developed a system where students could submit the assignment within the given time frame and get instant feedback based on the submitted assignment. But most of the teachers were unaware of this system. Regarding the automation on assessment tasks, teacher U3T2 replied, *I used several assessment techniques, mostly I used Google Quiz and other is ...(paused).. for the measurement of participation of the students I used a discussion forum.* The teacher seemed confused about the tool used during the assessment. This indicates that the tool was not used uniformly and frequently. Most of the teachers did not use LMS, so it is clear that the automation feature in the assessment was missing. Regarding accessibility, teachers did not feel the content should be accessible for all learners. Teachers mentioned that the online platform is more accessible than the traditional in-person formats. Teachers are concerned only with the completion of assessment tasks rather than focusing on making the system accessible to all types of learners.

We triangulate the results of the interview through the observation of the LMS. Only three teachers had their LMS, and Table 1 presents the summary of the LMS observation. LMS justified the views of students and teachers in the interview because only two teachers from the university U2 had included a few components of online assessment.

Table 1. *Assessment design in LMS*

Learning tasks/ assessments	Teacher U2T1	Teacher U2T2	Teacher U3T1
Assignments, timetable, and assessment methods	Yes, the assessment types and criteria were mentioned using a rubric in Moodle.	The rubric was developed and all the processes of assessment were explained clearly	Assignments were given without any instructions but the deadline of submission was mentioned
Learning tasks are linked to the learning objectives.	To some extent, but lack of skills-based assessment and mostly writing assignments were given.	To some extent. Most of the assessments were written format	Not matched
Tasks to encourage student activity and independence are included.	Only the text-based assignments were included.	No	No
Peer assessment methods	Peer assessment was in practice using the Workshop tool.	Not mentioned	Not mentioned
Feedback	Feedback was given in the assignments, but in a more generic format	Same as U2T1	More generic

The analysis of the data shows that maintaining the academic integrity of online assessment is challenging because of the increasing rate of plagiarism and cheating (Mellar et al., 2018; Okada, Noguera, et al., 2019; Okada, Whitelock, et al., 2019a; Reedy et al., 2021). The findings showed that we do not have any system of authorship checking. So, an Adaptive Trust-based e-Assessment System (TeSLA) is crucial in maintaining authenticity and authorship in assessment (Mellar et al., 2018; Okada, Noguera, et al., 2019). Another way to maintain authorship and authenticity is by designing higher-order thinking multiple-choice questions, short-answer questions, increasing assessment frequency, academic integrity pledge, etc., as mentioned by Nguyen et al. (2020). We have challenges to make diversity in terms of assessment tasks in higher mathematics because some content of higher mathematics is more abstract and cannot be developed as the authenticity principle advocates. We can minimize the challenges regarding authorship and transparency in the assessment process by using formative assessment techniques.

Conclusions

The result of the data analysis and discussion revealed the domination of written assignments and the limited use of formative assessment methods. The findings also indicate to incorporate more diverse and interactive assessment strategies that cater to individual differences of the learners. Due to the lack of consistent feedback and feed forward mechanism, students felt isolated and disengaged in the learning process. Due

to the over-reliance on the written assignment in online format, the issue of plagiarism and cheating is seen as problematic. To improve online assessment practices, instructors should use a wider range of assessment types, emphasizing the formative nature of tests, ensuring the credibility of assessments through robust design and academic integrity measures and fostering originality by designing tasks that require critical thinking and individual input. Overall, the findings highlight the need for institutional support, teacher capacity-building, and stronger system-level policies to enhance credibility, fairness, and effectiveness of online assessment. The findings of the study carry important implications for universities and instructional designers to develop the mechanism for online assessment design, academic integrity and accessibility. It also highlighted the need for clear assessment guidelines for teachers.

This study is qualitative in nature, so generalization of the results could be an issue. Because it has several limitations in terms of site selection, sample selection and tools for data collection. Moreover, this study was conducted during a period of transition to an online system, so institutional structure, teacher readiness and technological stability could affect the results of the study.

Acknowledgments: The authors express their gratitude to the UGC, Nepal, for providing a fellowship for study to the first author to initiate this study (**PhD-79/80 Edu-01)**. We would like to thank the students and teachers who participated in the research procedures.

Conflict of Interest

The authors have no conflict of interest.

References

Acosta-Gonzaga, E., & Walet, N. R. (2018). The role of attitudinal factors in mathematical online assessments: a study of undergraduate STEM students. *Assessment and Evaluation in Higher Education*, *43*(5), 710–726. https://doi.org/10.1080/02602938.2017.1401976

Adesemowo, A. K., Johannes, H., Goldstone, S., & Terblanche, K. (2016). The experience of introducing secure e-assessment in a South African university's first-year foundational ICT networking course. *Africa Education Review*, *13*(1), 67–86. https://doi.org/10.1080/18146627.2016.1186922

Adhikari, K. P., Joshi, D. R., Belbase, S., Sharma, L., & Khanal, B. (2023). Mathematics teachers' self-reported practices of formative assessments in teaching mathematics online. *International Journal of Online Pedagogy and Course Design*, *13*(1), 1–19. https://doi.org/10.4018/IJOPCD.324603

Admiraal, W., Vermeulen, J., & Bulterman-Bos, J. (2020). Teaching with learning analytics:how to connect computer-based assessment data with classroom instruction? *Technology, Pedagogy and Education*. https://doi.org/10.1080/1475939X.2020.1825992

Alruwais, N., Wills, G., & Wald, M. (2018). Advantages and challenges of using e-assessment. *International Journal of Information and Education Technology*, *8*(1), 34–37. https://doi.org/10.18178/ijiet.2018.8.1.1008

Balalle, H. (2024). Exploring student engagement in technology-based education in relation to gamification, online/distance learning, and other factors: A systematic literature review.

Social Sciences and Humanities Open, *9*(February), 100870. https://doi.org/10.1016/j.ssaho.2024.100870

Baleni, Z. G. (2012). Why and how academic staff adopt e-assessment in a higher education institution (HEI). In H. Beldhuis (Ed.), *11th European Conference on e-Learning* (Vol. 28, pp. 28–36). Academic Publishing International Limited.

Berry, R., & Adamson, B. (2011). Assessment reform past, present and future. In R. Berry & B. Adamson (Eds.), *Assessment Reform in Education* (pp. 3–14). Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0729-0_1

Bloom, T. J., Rich, W. D., Olson, S. M., & Adams, M. L. (2018). Perceptions and performance using computer-based testing: One institution's experience. *Currents in Pharmacy Teaching and Learning*, *10*(2), 235–242. https://doi.org/10.1016/j.cptl.2017.10.015

Cheng, K. H., & Hou, H. T. (2015). Exploring students' behavioural patterns during online peer assessment from the affective, cognitive, and metacognitive perspectives: a progressive sequential analysis. *Technology, Pedagogy and Education*, *24*(2), 171–188. https://doi.org/10.1080/1475939X.2013.822416

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge.

Debuse, J. C. W., & Lawley, M. (2016). Benefits and drawbacks of computer-based assessment and feedback systems: Student and educator perspectives. *British Journal of Educational Technology*, *47*(2), 294–301. https://doi.org/10.1111/bjet.12232

Demir, M. (2018). Using online peer assessment in an Instructional Technology and Material Design course through social media. *Higher Education*, *75*(3), 399–414. https://doi.org/10.1007/s10734-017-0146-9

Deutsch, T., Herrmann, K., Frese, T., & Sandholzer, H. (2012). Implementing computer-based assessment – A web-based mock examination changes attitudes. *Computers & Education*, *58*(4), 1068–1075. https://doi.org/10.1016/j.compedu.2011.11.013

Earl, L. (2013). *Assessment as learning using classroom assessment to maximize student learning* (Second). SAGE.

Fisher, D. P., Brotto, G., Lim, I., & Southam, C. (2025). The impact of timely formative feedback on university student motivation. *Assessment and Evaluation in Higher Education*, *50*(4), 622–631. https://doi.org/10.1080/02602938

Fyfe, G., Fyfe, S., Meyer, J., Ziman, M., Sanders, K., & Hill, J. (2014). Students reflecting on test performance and feedback: An online approach. *Assessment and Evaluation in Higher Education*, *39*(2), 179–194. https://doi.org/10.1080/02602938.2013.801063

Harks, B., Rakoczy, K., Hattie, J., Besser, M., & Klieme, E. (2014). The effects of feedback on achievement, interest and self-evaluation: The role of feedback's perceived usefulness. *Educational Psychology*, *34*(3), 269–290. https://doi.org/10.1080/01443410.2013.785384

Helfaya, A. (2019). Assessing the use of computer-based assessment-feedback in teaching digital accountants. *Accounting Education*, *28*(1), 69–99. https://doi.org/10.1080/09639284.2018.1501716

Hodgson, P., & Pang, M. Y. C. (2012). Effective formative e-assessment of student learning: A study on a statistics course. *Assessment and Evaluation in Higher Education*, *37*(2), 215–225. https://doi.org/10.1080/02602938.2010.523818

Holden, O. L., Norris, M. E., & Kuhlmeier, V. A. (2021). Academic integrity in online assessment: A research review. *Frontiers in Education*, *6*, 639814. https://doi.org/10.3389/FEDUC.2021.639814/BIBTEX

Hoogland, K., & Tout, D. (2018). Computer-based assessment of mathematics into the twenty-first century: Pressures and tensions. *ZDM - Mathematics Education*, *50*(4), 675–686. https://doi.org/10.1007/s11858-018-0944-2

Huang, A. Y. Q., Lu, O. H. T., & Yang, S. J. H. (2023). Effects of artificial intelligence-enabled personalized recommendations on learners' learning engagement, motivation, and outcomes in a flipped classroom. *Computers & Education*, *194*, 104684. https://doi.org/10.1016/j.compedu.2022.104684

Isaias, P., & Issa, T. (2013). E-learning and sustainability in higher education: An international case study. *International Journal of Learning in Higher Education*, *19*(4), 77–90. https://doi.org/10.18848/1447-9494/CGP/v19i04/48673

Ismaeel, D. A. (2020). Alternative web-based assessment and academic self-efficacy of pre-service student teachers. *International Journal of Web-Based Learning and Teaching Technologies*, *15*(4), 66–81. https://doi.org/10.4018/IJWLTT.20201001.oa1

Ji-Yoon Jin, F., Yan, L., Martinez-Maldonado, R., Gašević, D., Keung Chan, P. W., & Tsai, Y. S. (2025). Latent classes of self-reported feedback experiences: Exploring students' challenges, motivations, and action-taking behaviours in feedback processes. *Instructional Science*, *53*(6), 1395–1427. https://doi.org/10.1007/S11251-025-09744-5

JISC. (2020). *The future of assessment: five principles, five targets for 2025*. https://www.jisc.ac.uk/reports/the-future-of-assessment

Joshi, D. R., Khanal, B., & Adhikari, K. P. (2023). Effects of digital pedagogical skills of mathematics teachers on academic performance. *International Journal of Educational Reform*, *34*(4), 665–688. https://doi.org/10.1177/10567879231164615

Kabudi, T., Pappas, I., & Olsen, D. H. (2021). AI-enabled adaptive learning systems: A systematic mapping of the literature. *Computers and Education: Artificial Intelligence*, *2*, 100017. https://doi.org/10.1016/j.caeai.2021.100017

Kahlke, R. M. (2014). Generic qualitative approaches: Pitfalls and benefits of methodological mixology. *International Journal of Qualitative Methods*, *13*(1), 37–52. https://doi.org/10.1177/160940691401300119

Kanchana, R., Techanan, P., Phusavat, K., Kusumastuti, A., & Lesjak, D. (2025). Sustaining learning interest among disengaged students: Impacts of constructive feedback. *Sustainability*, *17*(9), 3830. https://doi.org/10.3390/SU17093830

Khanal, B., Joshi, D. R., Adhikari, K. P., & Khanal, J. (2022). Problems of mathematics teachers in teaching

mathematical content online in Nepal. *International Journal of Virtual and Personal Learning Environments*, *12*(1), 1–17. https://doi.org/10.4018/ijvple.312845

Laamanen, M., Ladonlahti, T., Uotinen, S., Okada, A., Bañeres, D., & Koçdar, S. (2021). Acceptability of the e-authentication in higher education studies: Views of students with special educational needs and disabilities. *International Journal of Educational Technology in Higher Education*, *18*(1). https://doi.org/10.1186/s41239-020-00236-9

Li, X. (2018). Self-assessment as 'assessment as learning' in translator and interpreter education: Validity and washback. *Interpreter and Translator Trainer*, *12*(1), 48–67. https://doi.org/10.1080/1750399X.2017.1418581

Lubbe, A., Marais, E., & Kruger, D. (2025). Cultivating independent thinkers: The triad of artificial intelligence, Bloom's taxonomy and critical thinking in assessment pedagogy. *Education and Information Technologies*, *30*(12), 17589–17622. https://doi.org/10.1007/S10639-025-13476-X

Luckin, R. (2017). Towards artificial intelligence-based assessment systems. *Nature Human Behaviour*, *1*(3), 28. https://doi.org/10.1038/s41562-016-0028

Maleki, A. (2025). Mindset matters more than you think: Investigating psychological reasons behind online exam cheating behaviors among EFL learners in higher education. *Journal of Academic Ethics 2024 23:3*, *23*(3), 405–422. https://doi.org/10.1007/S10805-024-09591-Y

McCallum, S., & Milner, M. M. (2021). The effectiveness of formative assessment: student views and staff reflections. *Assessment and Evaluation in Higher Education*, *46*(1), 1–16. https://doi.org/10.1080/02602938.2020.1754761

Mellar, H., Peytcheva-Forsyth, R., Kocdar, S., Karadeniz, A., & Yovkova, B. (2018). Addressing cheating in e-assessment using student authentication and authorship checking systems: Teachers' perspectives. *International Journal for Educational Integrity*, *14*(1). https://doi.org/10.1007/s40979-018-0025-x

Nasa, P., Jain, R., & Juneja, D. (2021). Delphi methodology in healthcare research: How to decide its appropriateness. *World Journal of Methodology*, *11*(4). https://doi.org/10.5662/wjm.v11.i4.116

Nguyen, J. G., Keuseman, K. J., & Humston, J. J. (2020). Minimize online cheating for online assessments during Covid-19 pandemic. *Journal of Chemical Education*, *97*(9), 3429–3435. https://doi.org/10.1021/acs.jchemed.0c00790

Okada, A., Noguera, I., Alexieva, L., Rozeva, A., Kocdar, S., Brouns, F., Ladonlahti, T., Whitelock, D., & Guerrero-Roldán, A. E. (2019). Pedagogical approaches for e-assessment with authentication and authorship verification in Higher Education. *British Journal of Educational Technology*, *50*(6), 3264–3282. https://doi.org/10.1111/bjet.12733

Okada, A., Whitelock, D., Holmes, W., & Edwards, C. (2019). e-Authentication for online assessment: A mixed-method study. *British Journal of Educational Technology*, *50*(2), 861–875. https://doi.org/10.1111/bjet.12608

Osuji. (2015). Shifting paradigm in our educational assessment. *Global*

Advanced Research Journal of Educational Research and Review, *4*(1), 1–5.

Panadero, E., & Alqassab, M. (2019). An empirical review of anonymity effects in peer assessment, peer feedback, peer review, peer evaluation and peer grading. *Assessment and Evaluation in Higher Education*, *44*(8), 1253–1278. https://doi.org/10.1080/02602938.2019.1600186

Pattalitan, A. P. (2016). The implications of learning theories to assessment and instructional scaffolding techniques. *American Journal of Educational Research*, *4*(9), 695–700. https://doi.org/10.12691/education-4-9-9

Pattalitan, A. P., Jr., A. P. P., Pattalitan, A. P., Pattalitan Jr., A. P., & Pattalitan, A. P. (2016). The implications of learning theories to assessment and instructional scaffolding techniques. *American Journal of Educational Research*, *4*(9), 695–700. https://doi.org/10.12691/education-4-9-9

Pérez-Aranda, J., Medina-Claros, S., & Urrestarazu-Capellán, R. (2023). Effects of a collaborative and gamified online learning methodology on class and test emotions. *Education and Information Technologies*, 1–33. https://doi.org/10.1007/s10639-023-11879-2

Petrović, J., Pale, P., & Jeren, B. (2017). Online formative assessments in a digital signal processing course: Effects of feedback type and content difficulty on students' learning achievements. *Education and Information Technologies*, *22*(6), 3047–3061. https://doi.org/10.1007/s10639-016-9571-0

Reedy, A., Pfitzner, D., Rook, L., & Ellis, L. (2021). Responding to the COVID-19 emergency: student and academic staff perceptions of academic integrity in the transition to online exams at three Australian universities. *International Journal for Educational Integrity*, *17*(1). https://doi.org/10.1007/s40979-021-00075-9

Sabrina, F., Azad, S., Sohail, S., & Thakur, S. (2022). Ensuring academic integrity in online assessments: A literature review and recommendations. *International Journal of Information and Education Technology*, *12*(1), 60–70. https://doi.org/10.18178/ijiet.2022.12.1.1587

Sampson, D. G., Ifenthaler, D., Spector, J. M., & Isaias, P. (2013). Digital systems for open access to formal and informal learning. In D. G. Sampson, D. Ifenthaler, J. M. Spector, & P. Isaias (Eds.), *Digital systems for open access to formal and informal learning* (pp. 1–7). Springer.

Sandelowski, M. (2010). What's in a name? Qualitative description revisited. *Research in Nursing and Health*, *33*(1), 77–84. https://doi.org/10.1002/NUR.20362

Schleicher, A. (2018a). Educating learners for their future, not our past. *ECNU Review of Education*, *1*(1), 58–75. https://doi.org/10.30926/ECNUROE2018010104

Schleicher, A. (2018b). World class: How to build a 21st-century school system, strong performers and successful reformers in education. In *Comparative Education* (Vol. 56, Issue 2). OECD. https://doi.org/10.1080/03050068.2020.1741792

Schoenfeld, A. H. (2017). On learning and assessment. *Assessment in Education: Principles, Policy \& Practice*, *24*(3), 369–378. https://doi.org/10.1080/0969594X.2017.1336986

Shraim, K. (2019). Online examination practices in higher education institutions: Learners' perspectives. *Turkish Online Journal of Distance Education*, *20*(4), 185–196. https://doi.org/10.17718/TOJDE.640588

Sjolie, E., Espenes, T. C., & Buo, R. (2022). Social interaction and agency in self-organizing student teams during their transition from face-to-face to online learning. *Computers & Education*, *189*, 104580. https://doi.org/10.1016/j.compedu.2022.104580

Sozon, M., Pok, W. F., Sia, B. C., & Alkharabsheh, O. H. M. (2025). Cheating and plagiarism in higher education: A systematic literature review from a global perspective, 2016–2024. *Journal of Applied Research in Higher Education*, *17*(5), 1728–1742. https://doi.org/10.1108/JARHE-12-2023-0558

Stacey, K., & Wiliam, D. (2013). Technology and assessment in mathematics. In Clements M., Bishop A., Keitel C., Kilpatrick J., & Leung F. (Eds.), *Third International Handbook of Mathematics Education* (Vol. 27, pp. 721–751). Springer New York. https://doi.org/10.1007/978-1-4614-4684-2_23

Taggart, J., & Wheeler, L. B. (2025). Collaborative learning as constructivist practice: An exploratory qualitative descriptive study of faculty approaches to student group work. *Active Learning in Higher Education*, *26*(1), 59–76. https://doi.org/10.1177/14697874231193938

Tepgec, M., Heil, J., & Ifenthaler, D. (2024). Feedback literacy matters: Unlocking the potential of learning analytics-based feedback. *Assessment and Evaluation in Higher Education*, *50*(1), 50–66. https://doi.org/10.1080/02602938

Terry, G., Hayfield, N., Clarke, V., & Braun, V. (2017). Thematic analysis. In C. Willng & W. Stainton-Rogers (Eds.), *The SAGE handbook of qualitative research in psychology* (pp. 17–37). SAGE.

Timmers, C. F., Braber-Van Den Broek, J., & Van Den Berg, S. M. (2013). Motivational beliefs, student effort, and feedback behaviour in computer-based formative assessment. *Computers and Education*, *60*(1), 25–31. https://doi.org/10.1016/j.compedu.2012.07.007

Tinoca, L., Pereira, A., & Oliveira, I. (2014). A Conceptual Framework for E-Assessment in Higher Education. In *Handbook of Research on Transnational Higher Education* (pp. 652–673). https://doi.org/10.4018/978-1-4666-4458-8.ch033

Usher, M. (2025). Generative AI vs. instructor vs. peer assessments: A comparison of grading and feedback in higher education. *Assessment and Evaluation in Higher Education*, *50*(6), 912–927. https://doi.org/10.1080/02602938

Van Der Kleij, F. M., Eggen, T. J. H. M., Timmers, C. F., & Veldkamp, B. P. (2012). Effects of feedback in a computer-based assessment for learning. *Computers and Education*, *58*(1), 263–272. https://doi.org/10.1016/j.compedu.2011.07.020

Veugen, M. J., Gulikers, J. T. M., & den Brok, P. (2024). Secondary school teachers' use of formative assessment practice to create co-regulated learning. *Journal of Formative Design in Learning*, *8*(1), 15–32. https://doi.org/10.1007/S41686-024-00089-9

Wafubwa, R. N., & Csíkos, C. (2021). Formative assessment as a predictor of mathematics teachers' levels of metacognitive regulation. *International*

Journal of Instruction, *14*(1), 983–998. https://doi.org/10.29333/iji.2021.14158a

Wilson, M. J., Diao, M. M., & Huang, L. (2015). 'I'm not here to learn how to mark someone else's stuff': an investigation of an online peer-to-peer review workshop tool. *Assessment and Evaluation in Higher Education*, *40*(1), 15–32. https://doi.org/10.1080/02602938.2014.881980

Yan, Z., Li, Z., Panadero, E., Yang, M., Yang, L., & Lao, H. (2021). A systematic review on factors influencing teachers' intentions and implementations regarding formative assessment. *Assessment in Education: Principles, Policy and Practice*, *28*(3), 228–260. https://doi.org/10.1080/0969594X.2021

Yin, S., Chen, F., & Chang, H. (2022). Assessment as learning: How does peer assessment function in students' learning? *Frontiers in Psychology*, *13*(June), 1–14. https://doi.org/10.3389/fpsyg.2022.912568

Zaheer, M., Munir, S., & Sherazi, S. N. (2024). Exploring the issues and challenges of online assessment and evaluation in the era of artificial intelligence. *Journal of Asian Development Studies*, *13*(1), 185–197. https://doi.org/10.62345/JADS.2024.13.1.16