

Is Online Assessment in Higher Education Institutions during COVID-19 Pandemic Reliable?

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ABSTRACT

The online learning helps to minimise disruptions on teaching and compromising students' learning outcomes; however, there is limited evidence on effective online assessment methods used at Higher Education Institutions during pandemics. This paper aimed to summarise online assessment methods and recommend reliable as well as practical approaches used at HEIs during COVID-19 pandemic. We performed a scoping literature review to identify original papers, reviews and reports that examined the online assessment methods used in higher education before and during COVID-19 pandemic. We identified common themes in data analysis. The psychometric theory is useful when designing valid and reliable online assessment methods for online learning, particularly in medical education. The typical online assessment methods used at HEIs include online quizzes, continuous feedback, multiple-choice questions and automated assessment for essays. The online tools for formative assessment in higher education include feedback, self-test quiz and discussion forums. The critical strategies recommended managing online examination involve setting up online questions using freely available software and utilising free video conferencing tool as CCTV on mobile phones for invigilation purposes. Educators must consider readiness among students and teachers, cheating practices and student diversity when employing online assessment at HEIs. They can benefit from training for online learning and the assessment methods to prepare them better when facing global uncertainties such as COVID-19 pandemic. Furthermore, educators must evaluate the methods and their impact on students' learning outcomes.

Keywords: Online assessment; online learning; COVID-19; medical education; online examination (Siriraj Med J 2021; 73: 61-68)

INTRODUCTION

COVID-19 was declared a Public Health Emergency of International Concern by the World Health Organisation on 30 January 2020 following an outbreak in Wuhan China in December 2019. It has high global risk assessment level and has spread to 213 countries globally.¹ In response to COVID-19 pandemic, most governments worldwide have provisionally closed educational institutions, and about 91% of the world's student population is greatly affected.

Distance learning (DL) may able to assist student learning as well as support parents, teachers, schools and school administrators. Also, it offers social care and establishing communication during periods of school closure.² It has also greatly affected higher education institutions (HEIs) all around the world. The specific guidance for higher education (colleges and universities) during COVID-19 pandemic include planning for digital learning (DL) and temporary dismissal or school closure.³

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The typical methods of DL used include blended learning (BL),^{4,5} live teaching,⁶ flipped classroom (flipped virtual classroom), online practice questions, video conference, teleconference and telehealth.⁷ BL refers to a combination of two instruction modes which are e-learning and didactic (face-to-face) teaching.^{4,5} Live teaching is the delivery of live teaching via online platforms and widely used as an alternative solution for classes cancellations of 'in-person' lectures in universities and colleges.⁶ Flipped or inverted classroom refers to when traditional in-class lectures and homework exercises are reversed⁸ with four core aspects as such pre-class preparation, in-class activities, after-class activities and assessment of student learning. The HEIs have encountered a significant challenge to move forward in teaching and learning activities with minimal disruptions during the pandemic. Although, many HEIs have closed down the institutions for a specific time, others have transitioned to online teaching using technology that is freely available to compromise the students' learning and their learning outcomes minimally. It is a great challenge to manage assessment at a distance for HEIs. The paper aimed to summarise online assessment methods and recommend reliable as well as practical approaches used at HEIs during COVID-19 pandemic. It also examined the advantages and disadvantages of online assessment methods in teaching and learning.

Methods of scoping review

We employed a scoping literature review to identify original papers, review and reports that examined the online assessment methods used in higher education before and during COVID-19 pandemic. The key search terms used include an online assessment, COVID-19, online tests, online examination, concept and other relevant terms, specifically in a higher education context. We used Google Scholar and Pub Med search engines focussing on articles published since the year 2000 and identified common themes during data analysis.

Concepts and frameworks for online assessment

The online and blended learning in higher education confronted educators with several critical issues related to teaching, learning and assessment in an unconventional environment. One of the critical issues is the validity and reliability of assessment using online platforms that met the intended purposes.⁹ The online assessment allows the delivery of constant and real-time feedback that can be given at a time and place appropriate for both the student or the educator.¹⁰ Educators must consider fundamental concepts of assessment in online learning specifically for medical education that include theories of expertise

development and psychometric as well as an assessment framework for learning. The expertise development theory states that the progression from novice to expert showing improvement in the ability to integrate basic facts derives from semantic networks to illness scripts and instance scripts into complex concepts. The processes enable the expert to promptly recognise the problem, develop a precise interpretation of the problem and formulate efficient problem-solving approaches. Psychometric theories emphasis on the validity of the assessment, offer reliable measurement, and reproducible outcomes. The questions can be translated into scores and eventually used to make inferences about the construct of interest.¹¹ A framework employed for online assessment in emergency remote teaching during COVID-19 pandemic highlighted nine guidelines that are highly significant to health professions education. The guidelines include ensuring alignment of assessment activities with learning objectives, considering the diversity of students' circumstances, utilising formative and summative assessments, and stimulating student learning with online assessment. Other components are to consider the format of online assessment, ascertain clear communication to students regarding assessment matters, ensure high-quality feedback, and address assessment validity threats.¹² There are ten principles of best-practice online assessment that comprise of: longitudinal reflection where educators use online formative assessment to improve teaching practice and learning tasks; higher-quality feedback; using readymade tools (such as rubrics or assessment standards) as performance criteria for online assessment tasks; technology-enabled authentic learning that encourages students to have real-life value when attempting online assessment tasks; and enhanced collaboration require discussion and collaboration among students.¹³

Evidence-based strategies of online assessment

The evidence-based strategies for online assessment in HEIs include online quizzes,¹⁴ continuous feedback,¹⁰ multiple-choice questions,^{10,15} simulated clinical skills,¹⁰ clinical examinations or viva-voce using real-time communication technology (such as skype, zoom)^{10,15} and automated assessment for essays.^{14,15} The online quiz is a method to assess the knowledge that promotes self-directed learning and may improve the effectiveness of teaching.¹⁴ The closed-answer type questions (multiple-choice questions) can assess essential knowledge and often used for online educational tool and assessment.^{10,15} For viva-voce or actual clinical examinations conducted over online (via skype or zoom) would enable the assessor to observe and interact from a distance location, thus may

reduce costs (such as accommodation, travel and subsistence for both examiner and student) and eliminate difficulties of traditional clinical assessments (e.g. examination halls and printed paper) in medical education.¹⁰ Arguably, essays are the most effective tool to evaluate learning outcomes that indicate learner aptitude to recall, organise and integrate viewpoints in the form of written work. The essay questions can assess learning outcomes that relate to the evaluation and synthesis levels of Bloom's (1956) taxonomy. Therefore, automated assessment for essays arguably offers a reliable scoring method that can be costly and time savings. The methods of automated assessment of free-text answers include Project Essay Grade (PEG), Intelligent Essay Assessor (IEA), Educational Testing service I, Electronic Essay Rater (E-Rater), C-Rater, BETSY, Intelligent Essay Marking System, SEAR, Paperless School free text Marking Engine and Automark. The main problems encountered in automated essay grading are lacking standard to calibrate human marks and ambiguous set of rules for selecting master texts.¹⁶

Meanwhile, the online tools for formative assessment in higher education include self-test quiz tools, discussion forums and e-portfolios. The critical characteristics of practical online formative assessment are the establishment of a learner and assessment centred focus through formative feedback and enhanced learner engagement with valuable learning experiences. The validity and reliability of an online formative assessment include ongoing accurate assessment activities and interactive formative feedback.⁹

The advantages of online assessment include costs saving (such as for printing costs, examination spaces, travel) and use of freely available online tools, e.g. SurveyMonkey, Google Form, HubSpot Forms, CANVAS free for teachers¹⁷ and educational software products. Meanwhile, the disadvantages of online assessment include software costs to develop educational content and supporting infrastructure, for example, internet servers, data storage, computer-aided learning rooms.^{10,18} Other problems of online assessment are unreliable systems (due to poor network connectivity, hardware, software, power supply), lack of online and physical security systems to safeguard assessments and cheating.¹⁰

Studies showed the benefits of using online assessments are reduction of paper usage, decreased concerns over the security of transporting test papers, flexible time and venue, continuous feedback and random selection and reproducibility of exam questions.^{19,20} The value of online formative assessment tools includes enhancement of learner engagement and the creation of a learning community.⁹ In contrast, some studies argued that online assessments

have negative impacts, mainly psychological stress to both teachers and students due to rigid technological settings, reduced personalised engagement with faculty¹⁹ and negatively influence student's grades.^{20,21} The factors that may influence students' scores and grades for online assessment involve the comparability of identical tests taken in different formats, students' level of preparedness for the mode of test and the quality of the test,²² slow logins to test, delayed loading of a test, and inexperienced teachers.^{21,23} The aspects that may increase acceptance for online assessments among students are students' accustomed to the format, high students' confidence in the system,²⁴ use of online formative assessments for practice before in-class tests²⁵ and technological adoptions.^{21,26} Recent study highlighted that students did not understand the necessity for online assessments due to technological incompetence of students and teachers, mistrust in the technology infrastructure and significant reliance on multiple-choice questions format. The students preferred online assessments that provide constructive, timely and personalised feedback, as well as a gradual transition towards online assessments together with technical training for both students and faculty. They also required active individualised interaction with instructors to incorporate online assessments into higher education²¹ effectively.

Online examination

Before educators decide to go for online examination, they may consider other alternative assessment options such as assignments, writing reports (that require students to choose different titles and different settings from classroom exercises), or open-book examination. Evidence shows that assessment by coursework alone or by blending coursework and examinations tends to produce higher marks than assessment by examinations alone.²⁷ The courses that need alternative assessment poses several challenges when higher-level learning objectives (based on levels of revised Bloom's Taxonomy such as apply, analyse, evaluate and create).²⁸ These methods require more time reading the write-up and checking for plagiarism, and also there is subjectivity issue in marking and grading those materials. Potential problems with coursework assessment include collusion, plagiarism and personation (in particular 'contract cheating' through the use of tailored essays).²⁷ Educators may use online plagiarism checking platform,²⁹ which are freely available at present, such as DupliChecker and Grammarly. Also, educators must recognise that there were differences between sciences and arts-type subjects which indicate distinctive assessment practices.³⁰

Nonetheless, educators have increasingly utilised assessment by coursework that may less likely cause possible risks to academic standards,²⁷ and students prefer them highly for online distance learning.³¹ Educators are required to assess lower-order learning objectives (e.g. remember and understand) in some courses.²⁸ Some educators in many HEIs may have made fewer efforts to assess lower-order learning objectives in the current situation of COVID-19 outbreak and rapid transition from traditional to online learning. These circumstances could lead to some degree of compromise in assessing intended learning outcomes. On the other hand, the

primary challenge for online examination is to prevent or control potential cheating among students. Table 1 shows a comparison between online and traditional assessment, while we present a summary of formative and summative of online assessment methods in Table 2. We use online free software for teaching and learning in the courses. The two key strategies recommended to manage online examination are 1) set up online questions using free software, and 2) use a free video-conferencing tool as closed-circuit television (CCTV) through the candidates' mobile phones for invigilation purposes.

TABLE 1. Comparison between online and traditional assessment.

Items	Online assessment	Traditional assessment
Benefits	Allows delivery of constant and real-time feedback that can be given at a time and place appropriate for both the student or the educator	Assessment by coursework alone or by blending coursework and examinations tends to produce higher marks than assessment by examinations alone
Concept & Framework	Online assessment in emergency remote teaching framework, principles of best-practice online assessment	Theory of expertise development, theory of psychometric and assessment framework for learning
Methods	<ul style="list-style-type: none"> • Online quizzes, • Built-in continuous feedback, • Multiple-choice questions, • Simulated clinical skills, • Clinical examinations or viva-voce using real-time communication technology, • Automated assessment for essays, • True/false, fill in the blank, fill in multiple blanks, and essay question, • Speed grader • Plagiarism check software 	<ul style="list-style-type: none"> • Multiple-choice questions • Short-answer questions • Short essays • Assignments • Writing reports • Open-book examination • Traditional paper feedback • Traditional paper grading and marking • Checking plagiarism manually
Disadvantage	<p><i>Student perspectives:</i></p> <ul style="list-style-type: none"> • Internet unavailability • Internet instability • Unable to afford internet • Cost of internet/wifi <p><i>Faculty perspectives:</i></p> <ul style="list-style-type: none"> • Require training • Require motivation • Require online platform • Require technical support 	<p><i>Student perspectives:</i></p> <ul style="list-style-type: none"> • Cost for paper and other logistics • Slow feedback <p><i>Faculty perspectives:</i></p> <ul style="list-style-type: none"> • More time for grading • More time for checking plagiarism • Logistics for invigilation

TABLE 2. Summary of formative and summative online assessment methods.

	Formative	Summative
Individual	<ul style="list-style-type: none"> • Online quizzes • Probing short questions to enhance the study, • Interactive formative feedback immediate automatic or built-in feedback • Simulated clinical skills • Self-test quiz tools • Discussion forums • E-portfolios 	<ul style="list-style-type: none"> • Multiple-choice questions • Short answer questions • Clinical examinations • Viva-voce using communication technology (such as skype, zoom) • Automated assessment for essays
Group	<ul style="list-style-type: none"> • Group online quizzes • Group presentation and feedback 	<ul style="list-style-type: none"> • Group community outreach project online written report • Group community outreach project presentation • Peer-assessment for group interaction

Setting up online questions

Teachers can use several free online tools,¹⁷ SurveyMonkey, Google Form, HubSpot Forms, CANVAS³² to set up online questions. Among all these free tools, we would like to recommend the following features available on CANVAS which are suitable for online examination:

- Set up different types of exam questions such as multiple-choice, true/false, fill in the blank, fill in multiple blanks, multiple answers, multiple dropdowns, matching, numerical answers, formula question, essay question, and file upload questions. Some of these questions are suitable for lower-order learning objectives in online examination, and also for coursework assessment.
- Set up the questions to appear one question at a time that only allows candidates to see and attempt each question while moving forward when answering them. If we set one question at a time, there is an option available to lock each question so that the candidates cannot go back to previous questions and change their answers.
- For multiple-choice questions, there is a function to shuffle answers randomly that enable the sequence or order of answers to choose for each question to be different for each candidate.
- For all question types, educators can set starting available time and date, end time and date, and duration for the examination. The timer is shown

on the screen while the candidate is attempting the examination.

- For multiple-choice and true/false questions, set correct answer so that CANVAS will automatically mark the questions at a set due date and time of examination. The candidate can see the marks immediately after the submission. Therefore, educators may have to set the option to hide the marks if they wish not to show the marks then.

Setting up a CCTV with a candidate mobile phone

Some free video conferencing software³³ (such as Skype, Zoom, ezTalk and Webex) can be downloaded to the candidate's mobile phone and used as CCTV for invigilation tool. The candidate's mobile phone is placed about one meter away at right or left side, while the candidate is sitting facing a computer. The invigilator should be able to see the candidate's computer screen, keyboard and the candidate from the side through the mobile phone during the examination time. The software (e.g. Webex, Skype, Zoom) also can record the entire duration of the examination; thus, it serves as additional deterrent to prevent cheating. Before the start of the examination, the invigilator can use the CCTV mobile phone to check candidate's identity (ID card), and 360-degrees scan view of the room where the candidate is setting up for the examination.

Recommended measures for online examination

The following are recommended measures for the online examination that educators should consider:

- Use the mobile phone as CCTV to check pre-examination room set up for candidate's laptop, table, chair and position. The set up is organised a day, preferably before the examination. It may take time to set the position of the mobile phone that enables invigilator to see clearly on areas mentioned above, and most often the area needs proper lighting.
- Clear rules are given to the candidate in advance
- Mock online examination if the candidate is first-timer.
- Short multiple examination sessions such as for 2 hours session break it down into 30 minutes per session with a 10-minute break is given in between each session. Some free software (like Zoom, ezTalk) may impose usage limit of 40 minutes per session, and then the user must reconnect to the software.
- Candidate must not wear earphone or headset.
- During the examination, the candidate is only allowed to view the computer screen but not a mobile phone, and also not allowed to browse other web page or software. Invigilator monitors the candidate through the CCTV mobile phone.
- Setting up rules, guidelines and backup plan if the internet is interrupted during the examination. Both educator and candidate must take some degree of responsibility to ensure proper internet connection, and stable streaming is available on site.
- Assign one invigilator to observe eight candidates via nine small screens on the computer monitor (screen).
- Conduct few mock online examination sessions to be familiar with procedures, software and testing/checking internet stability. Educators can take roles as invigilators and students during each mock examination.

Considerations for online assessment

Readiness

In the light of pandemic, institutional and educator readiness are essential requirements of the online assessment. Institutional readiness refers to institutional policies, resources and practices, for instance, internet coverage and availability of the IT support team. Internet access is a critical infrastructure for online teaching. IT support team is an essential resource during the transition from traditional to online teaching in many HEIs. Educator readiness refers to educator's acceptance and 'buy-in' when changing to online teaching and learning that include

taking up training for teaching methods, assessment and online applications.^{12,13}

Cheating practices

Evidence³⁴⁻³⁶ shows distinctive cheating practices during online examination such as impersonation, forbidden aids, peeking, peer collaboration, outside assistance and student-staff collusion.³⁶ The common possible cheating practices during the mock online examination include screen sharing among candidates, using multiple monitors, using a mobile phone, using Bluetooth technology headset, impersonation, taking a screenshot and sending to friends, and traditional ways such as notes on their palms or attached notes to computer monitors. The various countermeasures for those cheating practices were using biometry, mingling, shuffling, random drawing, sequencing, broadcasting methods³⁶ and physical screens parting candidates.¹⁰ We recommended affordable and straightforward ways to minimise possible cheating attempts among candidates in low resource settings. The strategies are to check the identity of the candidate, check examination room and setting, record both audio and video throughout the examination, and closely observe on candidate's computer screen or monitor. Nonetheless, we recognise that there is no cheat-proof online and paper-based examinations. In the rapidly shifting situation of COVID-19 pandemic and uncertainties globally, educators in HEIs must explore the best approaches to curtail disruptions on students teaching and learning, and assessment.

Student diversity

There are various types of diversity existed among students in the context of online learning that include: socioeconomic status; access to devices; stability of internet connection; racial and cultural differences; learners with special education needs; and second-language English speakers. Therefore, educators must consider diversity when selecting online assessment methods. Some students may not have internet access and computers for web-based assessments, however able to use mobile for text-based assessments, however able to use mobile for text-based collaborative tools (messaging, WhatsApp). Students with physical and learning impairments may use assistive devices. Students who have English as a second language may utilise technology tools with listening and speaking functions to accommodate diversity in the assessment.^{13,37}

CONCLUSION

Students and educators accept online learning during COVID-19 pandemic that considerably helps to lessen disruptions in teaching, learning and assessment.

This paper has highlighted online assessment methods and recommended reliable and practical approaches that educators can utilise for online learning at HEIs during COVID-19 pandemic. The psychometric theory offers a conceptual framework when designing valid and reliable online assessment methods for online learning, particularly in medical education. The typical online assessment methods used at HEIs include online quizzes, continuous feedback, multiple-choice questions, simulated clinical skills, clinical examinations or viva-voce using real-time communication technology and automated assessment for essays. The online tools for formative assessment in higher education include feedback, self-test quiz, discussion forums and e-portfolios. Educators must consider alternative online assessment and the potential problems before embarking on online examination in HEIs. The critical strategies recommended managing online examination involve setting up online questions using freely available software and utilising free video conferencing tool as CCTV on mobile phones for invigilation purposes. Educators must consider readiness among students and teachers, cheating practices and student diversity when employing online assessment at HEIs. The affordable and straightforward countermeasures for cheating practices among students in low resource settings during online examination include identification of candidate, scan examination room and setting through video conferencing tool and close observation of candidate's computer screen or monitor.

In facing uncertainties of the global pandemic such as COVID-19, educators must familiarise with process, procedures and freely available technology for online learning and assessment. Also, educators must evaluate the methods and their impact on students' learning outcomes.

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