SOLUTIONS AND STRATEGIES TO IMPROVE THE ASSESSMENT AND MONITORING OF STUDENTS' LEARNING: A CASE STUDY AT BIOMEDICAL SCIENCE INSTITUTE DURING THE COVID-19 PANDEMIC

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Abstract: The recent COVID-19 pandemic has largely disrupted the education system worldwide, affecting more than 1.5 billion students and learners. It has impacted teaching and learning and created many challenges for both assessment systems and practices at educational institutions worldwide. Since early 2020, because of the COVID-19 pandemic, Zhejiang University-University of Edinburgh (ZJU-UoE) biomedical science institute has changed the way they deliver teaching and learning activities and used 'hybrid teaching'. The hybrid method of teaching involves a combination of online teaching and face-to-face teaching formats and is a blend of asynchronous (i.e., using recorded videos/material) and synchronous learning. Due to the continuing threat of the COVID-19 pandemic, there are major travel restriction and disruption to education at ZJU-UoE institute. In this article, we describe both alternative and more effective approaches and strategies to monitor and assess students that have been developed at ZJU-UoE institute during the COVID-19 pandemic. These alternative and effective approaches aimed to prioritize effective digital formative assessment, provide lecturers and tutors with extensive guidance and training, develop more creative approaches to enhance effective teacher-student interactions, and provide more support to off-campus students' learning as well as safeguard academic integrity during the COVID-19 pandemic. This study will help with facing various education and learning challenges in a time of crisis.

Keywords: student assessment, student monitoring, formative assessment

Abbreviations

COVID-19: Coronavirus Disease 2019

DFAs: Digital formative assessments

ICT: Information and communication technology

LMS: Learning management system

UNESCO: United Nations Educational, Scientific and Cultural Organization

ZJU-UOE: Zhejiang University-University of Edinburgh joint college of Biomedicine

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Introduction

The recent COVID-19 pandemic is a "Global Event" (Ingram, 2019) that has led to massive cuts in the normal and everyday life of a wide range of universities and academic institutions worldwide. The COVID-19 pandemic has largely disrupted the education system worldwide, affecting more than 1.5 billion students and learners in over 200 countries (Pokhrel and Chhetri, 2021). The cancellation of on-campus events extended to almost all universities (96%) in USA and (97%) in Europe. Similarly, most of the on-campus advisory services and administrative facilities were closed at American (91%) and European (89%) Universities ((Kercher and Plasa, 2020). The pandemic has, therefore, had major implications on both life and work of higher education students, and clearly affected their mental and physical well-being.

At Zhejiang University-University of Edinburgh joint college of Biomedicine (ZJU-UOE institute), we have turned our sights to virtuality to ensure the continuity of our teaching-learning process early in 2020, and then to the hybrid learning in the first semester of the academic year 2020-2021 from September 2020 and till now. Both hybrid and online learning programs at ZJUE-UoE institute are well-developed and well-equipped with clear and efficient mechanisms for lecturers and tutors to evaluate, assess and provide both feedback and formative guidance to ZJU-UoE students.

The Coronavirus Disease 2019 (COVID-19) pandemic has a great impact on teaching and learning and has created many challenges for both assessment systems and practices at educational institutions worldwide (Pokhrel and Chhetri, 2021), including ZJU-UOE institute. These challenges include challenges in maintaining students' achievement and skills, challenges for lectures and tutors and challenges for ZJU-UOE institute.

This article discusses the implications of the COVID-19 pandemic for monitoring and assessment systems and practices at our biomedical research institute (ZJU-UoE), including challenges for students to maintain achievement and learning skills, and challenges for both teachers and ZJU-UoE institute. The article is particularly reflecting on both alternative and more effective approaches and strategies that we have developed at ZJU-UoE institute to effectively monitor and assess students during COVID-19 pandemic.

Purpose of monitoring and assessment of students learning

Assessment of students' learning is a critical process that aim to gather, evaluate, and process information on both students' knowledge and understanding and what teachers and tutors can do to make informed decisions about improving students' education (Clarke, 2012). We have recently reviewed and compared different types of students' assessment methods in biomedical education (El-Hashash, 2019, 2020).

The monitoring and assessment of students' learning can provide teachers with information about students' current knowledge and progress, and they are a mean of encouraging students' involvement, engagement, and participation. Both mentoring and assessing students' learning should take account of students' needs, teaching and learning principals and the environment in which teaching courses will be used (Vaccaro & Sabell, 2018; Zeng *et al*., 2018).

Proper monitoring and assessment can help students to get the most benefit from teaching courses. This can be achieved by both careful observation of students' learning and suggesting changes to the courses and the way they are run (Vaccaro & Sabell, 2018; Zeng *et al*., 2018). There are several types of students monitoring and assessments: including observation of learning, diagnostic assessment, students' self-assessment, and short-term achievement assessment. The observation of learning helps to determine whether changes are needed to the learning activities. This can encourage students and be achieved by observing students' lab book and their small group discussions. The diagnostic assessment can help to identify the gaps in students' knowledge, what goes into a course, and how to improve the course, while in students' self-assessment, students normally work with scales or checklists to describe their areas of strength or weakness. Notably, separating students' subjective concerns from objective judgments is often difficult in this type of self-assessments. Furthermore, short-term achievement assessments can motivate students and determine whether they are making a short-term progress (Vaccaro & Sabell, 2018; Zeng *et al*., 2018).

At ZJU-UOE institute, we use both in-course assessments and examinations to generate the final mark for the course like other institutions. Assessments are either formative or summative. A formative assessment does not contribute to students' final course mark, while a summative assessment contributes to students' final course mark at ZJU-UoE institute. We use formative assessments as a way of determining and monitoring students' understanding, learning and skills. Different types of formative assessments provide feedback to students that help them to improve their understanding, skills, and future learning performance. Meanwhile, summative assessments have a high point value and contribute to the final course mark of students at ZJU-UoE institute. They can determine whether students have achieved the learning outcomes of the courses and provide both a mark and feedback that helps students to improve their future work performance.

Pandemic's implications for monitoring /assessment systems and practices at ZJU-UoE institute

Prior to Coronavirus (COVID-19) pandemic, almost all modalities of learning assessments mostly depended on students' physical presence at ZJU-UOE institute and other institutions worldwide. Like other universities and education systems worldwide, the pandemic has pushed ZJU-UoE institute to conduct digital teaching and learning. However, this was challenging since it was difficult to monitor students' learning, know how they are learning, and whether there is a gap between the expected progress and actual learning.

The COVID-19 pandemic has impacted teaching and learning and created challenges for both assessment systems and practices at ZJU-UoE institute, as in other institutions worldwide (Pokhrel and Chhetri, 2021). These challenges include challenges in maintaining students' achievement and skills, challenges for lectures and tutors and challenges for ZJU-UoE institute.

Challenges for students to maintain achievement and learning skills at ZJU-UOE institute

The information and communication technology (ICT)-based technologies are now widely used, leading to converting the entire teaching pedagogy to a student- centered pedagogy. The skills of using ICT technology are, therefore, the most essential qualifications for educators, lecturers, tutors, and students (Bordoloi *et al*., 2021).

During the pandemic or other crises such ad natural disaster or war, online/blended or hybrid learning could meet the academic need of students at different institutions. However, providing online/blended or hybrid learning was also challenging at many institutes in different countries, particularly during and in post-COVID-19 pandemic (Bordoloi *et al*., 2021).

At ZJU-UOE institute, shifting to remote learning has created several challenges, like other institutions, since it requires students to pre-develop both skills of using ICT technology and a degree of autonomy for self-learning and self-motivation. Pre-developing these skills and autonomy was difficult for many students, particularly freshman students, who may not yet have developed sufficient ICT technology skills and/or autonomy for self-learning. In addition, many students have endured varying isolation and stress' levels and increasing the engagement of off-campus students was a major challenge during COVID-19 pandemic. Furthermore, both undergraduate and postgraduate students could not complete their research projects since this kind of practices is dependent on access to research laboratories and cannot be replaced by online learning during COVID-19 pandemic at ZJU-UOE institute.

Challenges for tutors and lecturers at ZJU-UoE institute

Like other institutions, the shift in the courses' delivery has created several challenges to lecturers and tutors at ZJU-UoE institute. For example, remote online delivery and assessment were novel experiences for junior faculty at ZJU-UoE institute. In addition, new protocols for hybrid and blended learning require lecturers and tutors to have specific digital competences and more experience in the implementation of students' monitoring and assessment practices. Indeed, several lectures, particularly junior faculty, did not have such competences and experience. Furthermore, these new hybrid and blended learning protocols require lecturers to rapidly change their practices, daily tasks, and responsibilities, and be capable of developing new alternative approaches to facilitate the monitoring of students learning, which were major challenges for many lectures during COVID-19 pandemic.

Other challenges for lectures and tutors included reduced amount of time that is allocated to teacher-directed learning by focusing on more students' self-learning in some courses, and limited data of large-scale assessments that affected the process of monitoring students' performance. It was also difficult for lectures and tutors to determine whether their students are making the expected progress, measure and evaluate this progress. Another big concern for lectures and tutors was on how they can determine whether there is a gap between learning expectations and actual learning of their students during the COVID-19 pandemic. In addition, there were limited relevant resources and training on digital learning platforms for lectures and tutors who worked from home. Moreover, research faculty could not supervise the research projects of both undergraduate and postgraduate students or run their own research during the COVID-19 pandemic.

Challenges for ZJU-UoE institute

During the COVID-19 pandemic, changes in learning and education were rapid at our institute and other institutions worldwide (Kercher & Plasa, 2020; Reimers *et al*., 2020; Gamage *et al*., 2020; Goris, 2020; Barron *et al*., 2021; Mok *et al*., 2021). The major shifts in learning and assessment culture for students and teachers create several challenges at ZJU-UoE institute, like other institutes.

These challenges include those related to the evaluation of students' progress, and the need to develop resources for students' learning and assessment through non-traditional channels such digital platforms. In addition, COVID-19 pandemic has had an impact on the international/overseas student mobility and learning at ZJU-UoE institute, like other institutes (Goris, 2020; Kercher and Plasa, 2020). Since learning equity between students is critical (ECD, 2008; Sammons, 2010), the pandemic-related pressures to deliver different types of assessments and examinations must not set aside equity considerations between students. Therefore, more equity considerations in learning and assessment between on-campus and off-campus students were needed at ZJU-UoE institute during the pandemic.

Furthermore, it is well established that invigilated assessments and examinations are more secure, but they were not an option in the time of COVID-19 pandemic. The shift to online instructions creates challenges in detecting cheating during online delivery at academic institutions worldwide and, therefore, it may affect both the safeguarding of academic integrity and assessment security.

Learning solutions, strategies, and approaches to face the pandemic challenges at ZJU-UoE Institute

COVID-19 pandemic has a remarkable impact on students' learning and assessment worldwide (Pokhrel & Chhetri, 2021). This necessitates the development of both alternative and more effective approaches and strategies to monitor and assess students at ZJU-UoE institute. These alternative and more effective approaches were used to assess students' learning and practice during the pandemic and aimed to prioritize effective digital formative assessment, provide teachers with the required guidance and training, facilitate more effective student-teacher interactions, and provide more support to off-campus student learning. These approaches will be discussed in detail below.

Prioritize effective digital formative assessment

Establishing and understanding the points that students have already reached in their learning represent the primary goal of learning assessments (Masters, 2015). Formative assessments can help with both guiding the learning processes and improving the learning outcomes of students (Black & Wiliam, 1998; Bennett, 2011; Van der Kleij *et al.*, 2015; Schildkamp *et al.*, 2020). Formative assessments have the potential to enhance students' learning (Black & Wiliam, 1998), are great classroom practices for lectures/tutors (Torrance, 2012) and, therefore, are policy pillar of educational significance" (Van der Kleij *et al.*, 2018).

In the digital or information age, students should have ICT skills that enable them to work with a range of digital assessments and data systems (Mandinach & Gummer, 2011, 2013, 2016; Beck & Nunnaley, 2020 a,b). Recent research studies have provided evidence that digital formative assessments (DFAs) have great promises and potential for empowering and supporting students' learning (Looney, 2019; Pozzoni *et al.*, 2019; Reynolds *et al.*, 2020). According to the Assess@Learning Literature review (Looney, 2019) and perspective by Pozzoni *et al.* (2019), DFAs are used by lectures to adapt next steps in students' learning process and include a range of learning approaches, features, and steerages of the digital learning environment, including social media (Wikis, blogs, etc), e-textbooks, personalized learning platforms, mobile learning, dashboard and monitoring tools and digital diaries. DFAs should have all digital learning environment's features which help with supporting the assessment of students' progress and providing feedback that can modify students'

teaching/learning activities (Looney, 2019). If appropriately used, DFA-related analytics can help with identifying the learning gaps of students, informing lectures of their instructional materials' quality, and revealing students' motivation levels (Looney, 2019; Pozzoni *et al*., 2019; Reynolds *et al*., 2020).

Like other institutions, DFAs were particularly critical at ZJU-UoE institute during COVID-19 pandemic due to limited face to face classes and many challenges in evaluating students' progress in pandemic. Other challenges that necessitated the use of DFAs include the difficulty of self-learning methods with few teacher' interactions to many freshman students at ZJU-UoE institute and other institutions in pandemic. Furthermore, DFAs can capture all forms of learning and learning's outcomes and, therefore, promote the 21st century students' learning and skills (Care & Kim, 2018).

At ZJU-UoE institute, we have integrated more effective DFA components through online platforms, and effectively used DFAs as a tool to manage students' progress. In addition, we have used well-known communication tools such as Zoom and Microsoft Teams and learning management system (LMS), including Moodle as centralized platforms to facilitate student-lecturer interactions and collaborations. Moreover, we have used both synchronous and asynchronous methods of DFAs to determine students' progress via assignments, feedback, and quizzes. Importantly, we have ensured that DFAs are valid, constructive, timely, and specific to the learning needs of our biomedical science students.

Provide teachers and students with the required guidance and training at ZJU-UoE institute

Continuous support of tutors and lectures is essential for the success of educational process. Support of teachers is particularly critical during COVID-19 pandemic (Reimers *et al*., 2020; Barron *et al*., 2021). ZJU-UoE institute has provided a wide range of training and guidance to the lecturers and tutors. These training and guidance aim to develop teacher's digital competences to enable them to function in several well-known learning environments, including online, hybrid and blended learning. Some of these education training and guidance at ZJU-UoE institute have been carried out through training and virtual workshops that aimed to develop the assessment competences of lecturers and tutors, including workshops on assessments' marking and moderation.

Digital skills training and development is essential for students and learners in the 21st century. Training on digital skills is also a major task for students at ZJU-UoE institute. Indeed, digital skills have been embedded across the curriculum so that both undergraduate and postgraduate students at ZJU-UoE institute are familiar with online and virtual learning modalities and the related assessment methods.

Facilitate more effective teacher-student interactions at ZJU-UoE institute

The student-teacher interactions play a key role in the success of student learning and education. According to Englehart (2009) and UKEssays (2018) articles on teacher–student interactions, positive and continuous interactions between teachers and their students can create a successful learning environment that is fundamental for meeting the emotional, developmental, and educational needs of students. In addition, well-established and positive teacher-student interactions and relationships can support social, cognitive, and emotional growth of students and increase their mental well-being

(Brazelton & Greenspan, 2000). These positive interactions can also enhance students' independence and confidence in learning (Birch & Ladd, 1997; Klem & Connell, 2004). Remarkably, these positive interactions are particularly important for freshman and junior students since they influence students' skills to change to university required skills, and improve both students' learning at the at university, and relations to peers (Pianta, 1999; UKEssays, 2018).

At ZJU-UoE institute, we have facilitated more effective and regular teacher-student interactions during COVID-19 pandemic through both face to face and virtual meetings (through Microsoft Team or Zoom) as well as by e-mails and text notes. We have effectively used Blackboard Learn, which is a well-established course management system and virtual learning environment. This Web-based server software is easy to use and install on computers or other devices to enhance students' learning and education.

We have created discussion boards for each course and assessment on Blackboard Learn to promote communication and interactions between students and their teachers at ZJU-UoE institute. All students of the course can access and share information on the discussion board that enhance their interactions together and with teachers. These boards and tools are supportive to lectures and tutors to effectively share their evaluations, feedback, and comments with their students at ZJU-UoE institute.

Notably, in response to the COVID-19 pandemic-presented challenges on students learning, we have run weekly "student hours" on WebEx on Friday every week where students can drop in and ask questions to their teachers, course organizers and program director at ZJU-UoE institute. Although attending these "student hours" is not compulsory, it is highly welcomed by students, teachers, and course organizers. The recordings and chatlogs of these "student hours" are regularly posted on Blackboard Learn afterwards, so that students who did not attend do not miss out on interesting questions being asked. Student feedbacks and comments on this 'student hours' approach are positive.

Provide more support to off-campus student learning during the COVID-19 pandemic

The COVID-19 pandemic has remarkably reduced international/overseas student mobility. In addition, the pandemic has led to massive cuts in the normal and everyday life of a wide range of universities and academic institutions and their internationalization activities worldwide. According to the UNESCO report (Goris, 2020) and other reports (Kercher & Plasa, 2020), international/overseas' student mobility has been severely affected by the international travel restrictions and the closure of many attendance programs at universities worldwide. Consequently, high proportion of USA and European universities have a decline in the international/ overseas students' number during the COVID-19 pandemic (Kercher & Plasa, 2020). Therefore, the flow of international academic mobility has been significantly disrupted due to the pandemic.

Beside reducing international/overseas student mobility significantly, the COVID-19 pandemic has shifted the mobility flow of international and other students. For example, in China, a very recent study has shown that a significantly higher proportion of Chinese students (84%) have no interest to study abroad after the COVID-19 pandemic (Mok *et al*., 2021). Chinese students who are still interested to study abroad prefer Asian countries/regions such as Japan, Taiwan and Hong Kong (Mok *et al*., 2021).

At ZJU-UoE institute, we have turned our sights to virtuality to ensure the continuity of our teaching-learning process early in 2020, and then to the hybrid learning in the first semester of the academic year 2020-2021 from September 2020 and till now. Hybrid learning programs at ZJUE-UoE institute is well-developed and well-equipped with more efficient mechanisms for teachers to evaluate, assess and provide both feedback and formative guidance to ZJU-UoE students. Off-campus students are both international/overseas students and local students who could not move to our university campus due to travel restrictions during the COVID-19 pandemic.

To minimize the pandemic-related impact on the disruption of international academic mobility and off-campus students' learning, ZJU-UoE institute has applied several approaches to support off-campus students. For example, ZJU-UoE institute has provided continuous and effective supports, engagements and follow up to all off-campus students through the ssenior academic tutor, and both academic advisors and tutors who look after off-campus students.

Achieving significant equity through equalization of both educational and learning opportunities for all students is essential and clearly linked to both educational and learning effectiveness (ECD, 2008; Sammons, 2010). Equity in education and learning can be achieved by offering individualized support to students, which addresses many barriers and crisis. Equity in learning and education was challenging during the COVID-19 pandemic. Nevertheless, ZJU-UoE institute has ensured equity in education and learning between on-campus and off-campus students by sharing live and recorded lecture, tutorial and practical classes and teaching materials and providing individualized supports to off-campus students' learning. In addition, equity between on- and off-campus students was critical to decisions on alternative assessment methods at ZJU-UoE institute. For instance, summative assessments that are a crucial part of educational culture, were designed to ensure equity between on- and off-campus students during the COVID-19 pandemic. These equity considerations and supports have received positive comment, evaluation, and appreciation from off-campus students.

Safeguarding Academic Integrity during COVID-19 pandemic

The International Center for Academic Integrity (ICAI) defines the academic integrity as "a commitment, even in the face of adversity, to six fundamental values: honesty, trust, fairness, respect, responsibility, and courage" (ICAI, 2014). Online/remote learning and teaching have a remarkable effect on higher education during the pandemic, including the pressure on students to complete their study curricula and prepare for both benchmark and final or the year-end examinations in a short period of time (Gamage *et al*., 2020). Other major challenges during the pandemic were both arranging for examinations and maintaining the academic integrity. Examinations require strict and well-controlled invigilation and, therefore, cannot be conducted online, and it was difficult to maintain academic integrity when students are not physically in their classrooms (Gamage *et al*., 2020).

To face and overcome these challenges and maintain academic integrity during the pandemic, ZJU-UoE institute has applied rigid and successful practices for both detecting cheating/anomalies among students and safeguarding academic integrity in digital domain. These practices include the use of both "high-technology" tools to detect academic misconducts and well-known online software(s) to detect plagiarism. For example, we use the web-based plagiarism prevention system, Turnitin, to support academic work integrity at ZJU-UoE institute by helping to check for any plagiarism. Other

practices at ZJU-UoE institute include the dissemination of information to lectures and tutors on academic integrity policy, design of "low-stake" assessment tasks, and application of innovative assessment design strategies, which can mitigate any academic misconduct during online/remote delivery. These innovative assessments are flexible, novel, and adaptable to different approaches and contexts. They integrate a variety of techniques and methods that can help with overcoming the pandemic impact on student learning.

Conclusion

The COVID-19 pandemic has impacted teaching and learning and created many challenges for both assessment systems and practices at our ZJU-UoE Biomedical science institute, like other educational institutions worldwide. This has necessitated the development of both alternative and more effective approaches and strategies to monitor and assess students at ZJU-UoE institute. The alternative and effective approaches that we have used to assess students' learning and practice during the pandemic aim to prioritize effective digital formative assessment, provide teachers with the required guidance and training, facilitate more effective student-teacher interactions, and provide more support to off-campus student learning as well as safeguard academic Integrity. The feedbacks and comments from both students and teachers on these effective approaches and strategies are highly encouraging and positive.

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