

WP2-A1 Report.

Current Status of Assessment Practices in STEM Remote Learning



REMOTE: Assessing and evaluating remote learning practices in STEM





















Document Title	'Current iı	Status of Assessment Practices n STEM Remote Learning'		
Project title:	REMOTE: Ass in STEM	sessing and evaluating remote learning practices		
Programme:	Erasmus +			
Action type	KA220-HED – Cooperation Partnerships In higher education			
Project Number:	Grant Agreement N°: 2022-1-ES01-KA220-HED-000085829			
Authors and Project partners:	<i>OID</i> E10209101 E10186177 E10209398 E10032297 E10209514 E10262945 E10199535	Organisation Universitat de Girona (UdG) Universitat Internacional de Catalunya (UIC) Politecnico di Torino (PoliTo) Agencia per a la Qualitat del Sistema Universitari de Catalunya (AQU) Universidade Do Minho (UMinho) Agenzia Nazionale di Valutazione del Sistema Universitario e della Ricerca (ANVUR) Agencia De Avaliaçao e Acreditaçao Do Ensino Superior (A3ES)		
Project duration:	36 months: 0	1/11/2022 - 31/10/2025		
Project website:				

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.



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Current Status of Assessment Practices in STEM Remote Learning 2023

Abstract

In 2020, with the announcement of the Covid-19 pandemic, most educational institutions were forced to adopt online classes to avoid the full interruption of the school year with minimal preparation and with programs predominantly designed to be provided face-to-face. With challenges like facilitating group activities and effectively assessing students' learning appearing during the transition, teachers needed to adapt their assessment methodology and plan to the new circumstances. STEM education presented some particular challenges because it relied heavily on laboratory classes and a hands-on approach. Some teachers opted for open-book exams or virtual proctoring, while others preferred group assignments or adopted a completely new format. The use of different assessment methods, students' participation, and the meaning they attach to the assessment process are key variables in looking at its effectiveness. In addition, factors like students' attitudes, emotions, or demographic also affect the remote learning process and their perception of the assessment process. Remote education can be a valid additional support methodology integrating moments of distance learning with activities carried out face-to-face, taking advantage of both modalities and better preparing students for the future.

Keywords

Remote learning, online education, remote assessment, assessment methodologies, STEM

This work has been developed by the partnership of the Erasmus+ co-funded project 'REMOTE: Assessing and evaluating remote learning practices in STEM'

Introduction

Remote learning is interchangeably used with terms like e-learning or online learning and is used to describe the usage of information and communication technology to develop web-based, computer, digital, or online learning, either synchronously or asynchronously (Wang et al., 2021). This form of education has attracted many educators and learners since it provides a more flexible learning environment and is not usually constrained by time or location. With the advances in Information and Communications Technology and the popularization of computers and other digital devices, remote learning has changed the way teachers and learners communicate, interact and behave (Wang et al., 2021). Since remote education is not bound by time or place, it has gained an increasing number of applications in the education field and has a big impact on its development, having been employed to varying degrees by a great number of higher education institutions in a great variety of forms, from video lectures to MOOCs (Massive Open Online Courses) and fully online degrees (Lee et al., 2023).

This large-scale, open online teaching method has been developing rapidly all over the world, playing a major role in the sharing of educational resources and the promotion of educational equity (Wang et al., 2021). With remote learning, universities can increase enrolment and profits, extend the university's reach, reduce infrastructure costs, avoid overcrowded classrooms, and improve retention and graduation rates by allowing students to work at their own pace and learning style in an online program. However, online programs are not ubiguitous, and some fail due to factors such as a lack of online pedagogy, lack of administrative support, the length of the programs, tuition rates, the potentially reduced quality of education, increased staff training costs, faculty resistance, employer bias against online degrees, lack of adequacy of the subject content or the reduced interaction between teacher and student. Students have also expressed concerns including the experienced isolation from peers and professors, mastering new technology and software, and the potentially reduced quality of the courses compared to the face-to-face equivalent (Palvia et al., 2018).

Generally, changes to teaching and learning format and environment have happened gradually, with the advancement of technology, where academics have embraced an active learning approach and universities have increased their investment in digital infrastructure (Eckley et al., 2022). Nevertheless, in 2020, with the announcement of the Covid-19 pandemic, most educational institutions, from primary schools to higher education and posteducation, were forced to adopt online classes to avoid the full interruption of the school year with both teachers and students forced to stay home to mitigate the spread of the disease, with minimal preparation and with programs predominantly designed to be provided face-to-face. Different remote learning modes were adopted, with digital platforms like Zoom, Microsoft Team, Google Classroom, or Blackboard Collaborate, among others, becoming indispensable tools for teachers and students everywhere. These tools enable synchronous learning, allowing teachers and students to meet in virtual classrooms at the same time and have immediate interactions, with access to features such as chatrooms and interactive whiteboards in addition to sound and video feeds. Others were used to host asynchronous courses, where educators could publish course materials, post announcements and instructions, and grade students' work directly, while students were able to access those materials whenever they needed and submit assignments directly on the platforms. However, institutions that offered online classes faced many challenges in determining the methods to assess the student's knowledge, skills, and competence in an online environment (Gupta et al., 2020).

Assessment is an integral aspect of any teaching and learning system and methodologies for assessing learning outcomes are critical for the design and structure of the learning environment. Assessment can be formative -"assessment for learning" – when it takes place throughout the learning process and provides both teachers and students with feedback to improve learning, and summative assessment – "assessment of learning" – usually taking place after a cycle of learning and used to measure the student's achievement of the expected outcomes (Nikou & Economides, 2018). The final assessment is intended to be a cumulative activity that gives an accurate reflection of the learners' ability to attain the set learning outcomes (Gupta et al., 2020).

With the transition to remote education during the Covid-19 pandemic, some of the teachers' biggest challenges were facilitating group activities and effectively assessing students' learning (Sedaghatjou et al., 2021). Because of its reliance on laboratory activity and hands-on learning, online STEM (Science, Technology, Engineering, and Mathematics) education was particularly challenging during this pandemic (Sedaghatjou et al., 2021). With virtual assessments, there are also greater concerns with accessibility, since not all students have access to a laptop or a quiet environment where they can do their schoolwork and assignments, and with academic integrity during assessment since the online environment is more susceptible to cheating, and the temptation is very present especially if it is a high stakes assessment (Hilliger et al., 2022; Sedaghatjou et al., 2021). Thus, accessible, reliable, and valid assessment became indispensable to establish how well a student has learned the material and achieved the desired learning outcomes (Gupta et al., 2020).

The project

This report is part of the Erasmus+ project "REMOTE: Assessing and evaluating remote learning practices in STEM" submitted in fulfilment of the activity A1 of the Work Package 2. The project is built on a collaboration between four higher education institutions and three external quality assurance agencies from Italy, Spain, and Portugal.

The main objectives of this project include presenting an understanding of current remote learning and assessment practices in STEM disciplines and providing actionable and user-friendly benchmarks and guidelines for implementing and evaluating successful methodologies in remote assessment. Finally, the project also aims to provide a roadmap and a sustainability plan that directly addresses how to implement normative actions.

Therefore, the purpose of this report is to compile different assessment and evaluation methods employed in remote education of STEM courses (before, during, and after the pandemic) and, when possible, analyse how successful was their application.

Research Methodology

To understand which remote assessment and evaluation methodologies are currently being used by higher education institutions in STEM disciplines all collaborating partners participated in the search and analysis of recent and available documents on the subject. This review consisted of three basic steps – searching, screening, and analysis – with each of the seven partners selecting and analysing a minimum of 5 documents. These documents and analyses were gathered in a shared folder. This resulted in a list of 65 documents in the first screening (Table 2 in Annex 1), a total of 60 were analysed and 23 were found relevant to the research topic and constituted the final selection.

Proposed assessment methods for remote education

In this section, several assessment methodologies implemented in higher education STEM courses will be described (Table 1) and, when possible, the students' perceptions and performance will also be included.

Faculty from Genoa University designed an innovative program with several tools and techniques to be applied in the Geomatics Laboratory, where geomatic classes are taught in several courses. With the COVID-19 pandemic in 2020, the faculty decided to apply and test the program in classes for that year. Some of the tools and techniques introduced included instant polls used at the beginning and end of activities, such as classes, quizzes, glossaries, didactic videos, and team- and problem-based approaches. At the end of the year, the assessment of these novelties seemed to be widely positive with the teambased approach being considered very formative for the students and an incentive for greater involvement during classes. The instant polls, quizzes, and glossaries served to make the teachers more aware of the students' feedback and allowed the students to verify their acquisition of the main concepts, who then became better prepared for the final exams (Botto et al., 2022). In Qatar, the application of a Multi-course Project-based Learning (MPL) approach in an online engineering course, for both senior and capstone students, during the pandemic, had good results in the achievement of student outcomes. In this case, the approach consisted of a series of quizzes and video lectures followed by a project, that consisted of designing a mobile app. When compared to a previous semester, without the threat of the pandemic, a higher number of students obtained better grades when the MPL approach and online assessment were implemented (Khandakar et al., 2022).

In a chemistry course, in Singapore, adapting to online classes due to COVID-19 was a major challenge because of the frequent laboratory classes and consequent changes to the assessment scheme of the institution. So, in addition to having to learn and use new technology tools for their online lessons, teachers had to explore and design new assessments to substitute the written tests. The course faculty decided to try the implementation of concept maps as an assessment tool since concept maps are known to promote deep and meaningful learning and require more customization efforts, thus, being harder to plagiarise. To implement this new assessment method, teachers articulated the task itself, the expected response format, and the grading system. They decided to do a constrained task by providing students with key phrases and concepts for the maps. A three-band grading rubric was developed to grade the validity of core concepts, the extent of connectedness between them, and the

ID	Study	Journal	Country	Timing of implementatio n	Course	Assessment type	Assessment methodology
1	Botto et al., 2022	Applied Geomatics	Italy	During pandemic	Geomatics	Formative	Instant polls, quizzes, glossaries, didactic videos, team- and problem-based approaches
2	Khandakar et al., 2022	Sustainability (Switzerland)	Qatar	During pandemic	Engineering	Formative & Summative	Multi-course project- based approach, quizzes, videos, design of a mobile app
3	Lau et al., 2020	Education Sciences	Singapor e	During pandemic	Chemistry	Formative & Summative	Concept maps, post- laboratory tests, fill-in-the- blank reports, and short final test
4	Vartia, n.d.	NA	USA	During pandemic	Chemistry	Formative	Four research assignments culminating in the creation of a book chapter

 Table 1. Summary of assessment methodologies described.

5	Chans et al., 2022	Sustainability (Switzerland)	Mexico	During pandemic	Chemistry	Formative	Continuous assessment, bibliographic research, problem-solving, at-home experiments, quizzes
6	Usher & Barak, 2018	Assessment and Evaluation in Higher Education	Israel	Before pandemic	Nanotechnol ogy and Nano- sensors	Formative	Quizzes, open-ended assignments, final group project
7	Jeong et al., 2020	Education Sciences	Spain	Before pandemic	Science	Formative	Essays, quizzes, numerical exercises, adaptive assignments, final exam
8	Makokotlela , 2020	International Journal of Information and Communicatio n Technology Education	South Africa	During pandemic	Environment al Education	Formative	E-portfolio
9	Khalaf et al., 2020	Medical Education Online	United Arab Emirates	During pandemic	Dental Medicine	Summative	Multiple choice questions exam, modified essay questions exam, Objective Structured Clinical Examination, oral exam
10	Prigoff et al., 2021	Journal of Surgical Education	USA	During pandemic	Surgical Medicine	Summative	Open-book free response clinical exam, proctored National Board of Medical Examiners exam
11	Al-Zohbi et al., 2022	Frontiers in Psychology	Saudi Arabia	During pandemic	Physics	Formative & Summative	Lab reports, formative tests, final test

sequencing of the presentation. To complete the assessment plan, a set of postlaboratory tests, fill-in-the-blank reports, and a final short test were implemented (Lau et al., 2020).

Due to the newness and cognitive challenge of the elaboration of concept maps, some students reported difficulties in linking concepts together and found concept maps time-consuming and incompatible with their learning style. Students were more comfortable being assessed with familiar tools like written tests and quizzes and felt that concept mapping was unrepresentative of their academic performance. However, 87.7% of the students found the assignment useful and reported that it helped them visually reorganize their learning and to better understand the linkages between the different concepts (Lau et al., 2020).

In the Bay View Alliance – an international network of research universities exploring strategies to support instructional methods for better learning for all students - several teachers shared their experiences and methods with online assessment during the pandemic. A chemistry teacher from the University of Kansas decided to create a series of four assignments that culminated in a collaborative book chapter created by each student. Each of the four assignments consisted of small research assignments on a particular topic. For the final projects, each student built a comprehensive book chapter on a topic of choice, with much of the base work being done by the whole class via the smaller assignments. The requirements assessed in this final project also included the editing of peer work to create a consistent style along the chapter and the significant supplementation with new information. Through this method students gradually built a large repository of quality information that other students could draw on later and since their work would be seen and used by others, students mentioned being especially preoccupied with doing well on these assignments. Nearly all projects were of good or excellent quality with two being considered exceptional (Vartia, n.d.).

In another adaptation of an introductory laboratory chemistry course to remote learning, with experiments carried out at home with the supervision of an expert, the assessment method included the continuous assessment of the activities carried out, such as bibliographic research, problem-solving, the athome experiments and quizzes involving real cases meant to be solved through argumentative thinking. The results showed a general increase in test scores and a positive attitude of the participants toward the virtual chemistry course (Chans et al., 2022).

A Nanotechnology and Nano-sensors course for advanced undergraduates, that was delivered both on campus and online in 2018, with the same teaching staff, materials, and assessment plan, allowing the comparison

between the student performance in the peer assessment assignments in each of the environments. Three groups of students, 77 on-campus, 110 on a small private online course (SPOC), and 152 in a MOOC environment, participated in the study. The on-campus and SPOC students had similar academic backgrounds and demographics, differing only in the delivery of the course. The MOOC students had a varied background and demographic that was vastly different from both other groups. All students were required to answer weekly quizzes that represented 30% of the course grade, two open-ended assignments that represented 20% of the course grade, and a final group project that represented the final 50% of the course grade. These assignments were designed according to project-based learning (PBL) principles and included a driving question that engaged students in investigating a real-world problem related to the production of nano-sensors; the use of technological tools for the collection, analysis, and visualization of data; a collaborative process that encouraged students to work in small groups of 3 to 4 people in their final project which consisted of a detailed design of a nano-sensor and peer assessment, where students took part in evaluating the quality of their peers' work both grading them and offering feedback (Usher & Barak, 2018).

The grading criteria, based on a five-point scale, and instructions were shared online with all students and after the submission of the projects, each student was randomly and anonymously assigned to assess the project of at least three other groups. Throughout the course, students provided and received peer assessment on a continuous process. The results showed that MOOC students provided more feedback comments, i.e., lengthier and more detailed, while also volunteering to assess more projects than the other groups did. Nevertheless, on-campus students provided higher-quality feedback and their grading was better correlated with the grading of the teachers. The authors suggest that this might be due to the strong academic background of these students which makes them more likely to be critical and more committed to the grading process and that, since their familiarity with their classmates, allows them to pay more attention to detail and conduct the assessment more rigorously. On the other hand, SPOC students awarded their peers with much higher grades than the teachers, possibly due to their feeling of solidarity and the desire to bridge the lack of instructor support. Another advanced possibility is that the online nature of the course did not provide the same incentive to be an accurate reviewer as the on-campus course (Usher & Barak, 2018).

Research on peer assessment has shown it to be a successful learning and assessment strategy helping students to identify their strengths and weaknesses while fostering collaborative learning. Student participation in peer assessment in an online setting can be a good predictor of completion of the course and identify both students who are more engaged in the course as well as students that have better results. The implementation of online peer assessment in higher education is an effective assessment technique that stimulates student performance and facilitates the acquisition of knowledge while encouraging self-awareness and critical thinking and improving the students' cognitive and collaborative skills (Loureiro & Gomes, 2022).

Jeong et al. (2020) refer to the application of an online-based formative assessment interface in a sustainable and flipped STEM course on a general primary education science subject, in a Spanish institution, administered in the 2017/18 academic year, with a sample of 71 students. This was a 150 h course with 5 sections/topics divided into theoretical and lab sessions based on the content and its complexity. The students' interface environment included the assignment, an assignment video, and feedback windows for different lessons, which allow interaction with the teachers. To observe the student performance, various assessments were available, at different moments, on the interface such as essays, quizzes, numerical exercises, teacher feedback, adaptive assignments, and a final exam. With the students' log record on the interface, teachers were able to see which assignments were completed and how long a student took to complete them, and, with that information, understand which assignments each student was having more difficulties with and thus provide an adaptive assignment and feedback. The class assessment consisted of numerical exercises, guizzes, essays, and adaptative assignments, which produced a student's mean class grade. In the lab session, grades were attributed to lab diaries, numerical exercises, and lab reports. The final grade of the course consisted of 70% of the final exam grade and 30% of the class and lab assignments grade. The usage of the interface, along with adaptive assignments and high-quality feedback led to an increase in the students' performance.

In an online Environmental Education course for pre-service teachers based in South Africa, an e-portfolio was used as a learning assessment tool. This course had 9 students and they were required to create an e-portfolio on waste management through recycling as opposed to the traditional method of burning waste. The students visited recycling plants to observe the recycling process and registered their observations. The created e-portfolios had photos taken by the students, with captions aligned with specific sections and supported by textual explanations. The e-portfolio was, in this case, considered a useful alternative method of assessment that helped enhance the students' digital pedagogy skills. However, it was not without its challenges, namely, access to a computer, some students' lower digital skills and an unstable internet connection, some reported difficulties with the compilation of the portfolio due to lack of support, and some instances of cheating, i.e., copying information and pictures directly out of the internet without demonstrating any work done (Makokotlela, 2020).

At the University of Sharjah, United Arab Emirates, the College of Dental Medicine was forced to do the students' final assessment online due to the COVID-19 pandemic. This online assessment was called Exit exam which was used to measure and provide feedback on the student's knowledge, clinical, skills, attitudes, professional qualities, and expertise for safe and competent dental medicine practice at the time of graduation. To pass this exam and graduate, students needed a minimum of 70 points out of 100. The Exit exam was constituted of 4 components taken over a period of 4 days, Multiple Choice Questions (MCQ), Modified Essay Questions (MEQ), Objective Structured Clinical Examination (OSCE), and an oral examination. MCQ, MEQ, and OSCE each represented 30% of the final exam grade with the oral exam representing the other 10%. This Exit exam had a weight of 40% on the students' final graduation average grade (Khalaf et al., 2020).

The MCQ, MEQ, and OSCE were delivered using Blackboard and Respondus Lockdown Browser. This browser prevents any activity on the computer other than the exam webpage and makes an audio and video recording of the student during the period of the exam. In addition to this browser, students were also required to join Teams meeting with the invigilators to prevent cheating and to support the students in case of disconnection. Each exam started with an approximately 10-minute check-in period comprising a video confirming the student's ID and environment. The oral exam was conducted as an online meeting between the student and the examination panel, constituted of 3 examiners from three different fields of dental medicine, who presented clinical cases for the student to discuss (Khalaf et al., 2020)

After the implementation of the online Exit exam, a group of 65 year-five students and 29 faculty members were surveyed for their level of satisfaction with the methodology and to inquire about possible challenges faced by each group. The results of the surveys show that younger students and those with previous experience with online examinations had higher levels of satisfaction than their peers. The majority of the faculty was very satisfied with the assessment method and the innovative invigilation process. Faculty members also had a higher satisfaction score than the students. In both cases, no differences in the satisfaction scores between genders were observed. The main challenges reported by the students were problems with the internet connectivity, the time allocated for the MEQ exam, and the inability to go back (backtrack) to previous answers in the MCQ exam. Connectivity and other technical issues were also reported by the faculty along with the exam preparation and grading which took more time and effort. However, students also reported that doing the oral examination online reduced their levels of anxiety and praised the availability of the exam team, the training provided for the online delivery of the exam (including the availability of mock exams), and the exams' instructions and information. In the end, this assessment methodology implemented in emergency remote learning was considered successful (Khalaf et al., 2020).

The Vagelos College of Physicians and Surgeons, Columbia University, also saw their usual assessment plan for medical students' learning forced to be adapted to online delivery during the pandemic. In this case, faculty opted to have students take a previously validated free response clinical exam (CSE) at the end of their clerkship as an open-book exam, mainly to eliminate any concern about academic dishonesty, and the final grades were then adjusted based on historic norms. The National Board of Medical Examiners (NBME) exam was, in turn, taken with a virtual proctor. The students whose clerkship was affected by the pandemic were compared to students from previous years. Prior to grade adjustment, the group with the interrupted clerkship scored higher on the CSE and NBME exams and performance evaluations. However, the majority of students surveyed stated that they would have preferred a closedbook CSE exam, citing that the open-book format forced them to change their exam preparation, discouraged them from thinking before simply searching online during the test, and made them second guess their answers. In the end, the open book and the virtually proctored exams were considered reasonable options but, to avoid grade adjustments and student dissatisfaction, the authors recommend virtual proctoring whenever possible (Prigoff et al., 2021).

Gupta et al. (2020) affirm that it is important not only to assess the students' final performance but also to monitor their progress throughout the classes and highlight that many online tools are highly interactive, increasing the students' enjoyment due to their game-based approaches. Short questions, open-ended questions, problem-based questions, oral examinations, and Objective Structured Clinical Examination (OSCE) are considered relevant and effective means to assess the knowledge, skill, and attitude of medical and health sciences students in an online environment.

Al-Zohbi et al. (2022) explored whether the changes to online instructions due to the COVID-19 pandemic affected the performance in a physics course of STEM and non-STEM female freshmen, who until then had only received faceto-face education. The authors compared the scores of lab assignments and formative tests and a final test of both STEM and non-STEM students in the two different modes of education, remote and face-to-face. Results showed that STEM students performed better than non-STEM on lab assignments and that STEM students improved their scores when the tests were administered online instead of face-to-face. Non-STEM students' performance didn't differ significantly with the mode of education both on lab assignments and on tests.

Remote assessment: challenges, perceptions, and recommendations

The abrupt shift to remote education and assessment led to institutions, teachers, and students facing several challenges, including the physical distance between teachers and their students, some teachers' lack of digital literacy leading to difficulties in communication and the adaptation of the material to the online environment, with several teachers just trying to replicate face-to-face conditions instead of an adaptation adequate to remote teaching (Bocanet et al., 2021; Gupta et al., 2020). Institutions also reported challenges due to the absence of appropriate infrastructure for remote education, the students' commitment to submitting their assignments, and academic dishonesty (Guangul et al., 2020).

Bocanet et al. (2021) surveyed several specialists teaching universitygrade mathematics in seven European institutions about their perception of gaps in the assessment of students both before (2019) and during the pandemic (2021). The main gap identified before the pandemic was the fact that automated assessment systems only consider the results of the assessments, disregarding the students' process to get to the answer making it difficult if not impossible to attribute partial points. During the pandemic, the lack of physical contact between teachers and students was the most hard-felt challenge, in addition to the previously identified assessment deficiencies. At the same time, the lack of a well-established, fair, and objective method of assessment that would discourage or make cheating unviable was also a major worry. The results show that most of the gaps identified during the pandemic were present before as well and demonstrate the need to consider technology as a facilitator for assessment instead of trying to replicate in-person contact (Bocanet et al., 2021). During the pandemic, when remote education became the new normal worldwide for numerous students and teachers, assessment practices were often altered and adapted to the new circumstances (Mottiar et al., 2022; Panadero et al., 2022). Some teachers opted to be more flexible with their assessment strategies and lower their criteria or amend grading procedures. In Spanish higher education institutions, for example, group assignments became less frequent, while exams contained more multiple-choice questions and fewer essay questions (Panadero et al., 2022).

To design effective assessment methods for remote education it is important to understand that institutions and teachers are not the only factors influencing distance learning but also the students' attitudes, emotions, and demographics (Acosta-Gonzaga & Walet, 2018; Al-Zohbi et al., 2022; Flores et al., 2022). The use of different assessment methods, students' participation, and the meaning they attach to the assessment process are key variables in looking at its effectiveness (Flores et al., 2022).

Students' emotions, such as tension, overload, worries, social and emotional loneliness, and joy, seem to have a strong connection with their readiness for digital learning, during emergency remote education. Teacher support and availability along with the quality of the material they provided students with were also important factors for a positive adaptation. And while remote assessment was seen as more unfair than face-to-face assessments, when conducted synchronously the satisfaction levels were higher than when they were done asynchronously (Flores et al., 2022).

Gender seems to be a factor leading to some differences in perception and attitude, and to achieve gender equity, a factor that should not be ignored.

Al-Zohbi et al. (2022) showed that both STEM and non-STEM female freshmen enrolled in a physics course, in Saudi Arabia, were resilient to the changes that saw them constrained at home, during the pandemic. In this case, the academic performance of young women is a "relevant issue against inequalities in education and the workforce and particularly relevant in a society in transition from a strictly patriarchal order, which did not grant women autonomy and agency, to one that aspires to meet gender-equity standards" (Al-Zohbi et al., 2022).

Flores et al. (2022) studied the adaptation of Portuguese higher education students to online education with 2718 students participating, mostly female (65.8%). The results showed that although female students revealed significantly higher means in the item related to stress, they also showed higher means in the items related to satisfaction, adaptation, and perception of

academic success. In relation to online teaching and assessment specifically, no statistically significant differences between genders were found, however, male students considered online assessment more unfair than face-to-face and expressed lower satisfaction with online assessment (Flores et al., 2022).

In an online environment, key aspects in the assessment process like the diversity of assessment tools, the issues related to monitoring a student's work, and their participation in the assessment through peer- or self-assessment, become particularly relevant (Flores et al., 2022). In addition, online feedback is also perceived as more enjoyable and useful, with enjoyment being a key factor in the effective design of online assessments (Acosta-Gonzaga & Walet, 2018). Teachers should strive for a balance between summative and formative assessment and provide students with useful feedback regarding their achievement of stated learning objectives (Flores et al., 2022) while combining exercises and feedback that students find enjoyable, and tools perceived as easy to use to motivate the students to effectively use assessment technologies (30). The gamification of assessment can also have a positive effect on a student's outlook and lead to an increase in their enjoyment of the proposed tasks (Acosta-Gonzaga & Walet, 2018) with flexible, diverse, formative, and continuous assessment being especially valued by students (Díez-Gutiérrez & Espinoza, 2021).

Presently, when most of the world has returned to face-to-face education, it is important to evaluate and understand how remote education can be a valuable tool for institutions, teachers, and students, and while 100% virtual education may not be in the near future for many institutions, it can be a valid additional support methodology integrating moments of distance learning with activities carried out face-to-face resulting in Integrated Digital Learning (Capone & Lepore, 2022) - a mix of styles, a fluid flow of knowledge between the physical and virtual classroom - taking advantage of both modalities and better preparing students for the future (West et al., 2021).

Conclusion

The lockdown during the Covid-19 pandemic brought remote education to the forefront of almost every educational system worldwide. This forced transition to the virtual environment was especially difficult for STEM educators in higher education institutions due to the reliance on laboratory classes and hands-on learning (Sedaghatjou et al., 2021).

Teachers and students faced numerous challenges, including how to make a viable, fair, and objective assessment remotely and minimize academic dishonesty, with a great number of teachers opting to change their assessment in some way, be it the method or the grading system (Mottiar et al., 2022; Panadero et al., 2022).

It seems that independently of the assessment method chosen, formative assessments and immediate, high-quality feedback allow students to know their strengths and weaknesses and prepare them for successfully completing the summative assessments. Flexibility, diversity, and continuity were also valuable aspects to consider when preparing assessment plans because of the importance placed on them by the students (Acosta-Gonzaga & Walet, 2018; Díez-Gutiérrez & Espinoza, 2021).

While some students reported difficulties due to the changes made to assessment and the adaptation to new technologies and software, the implemented methodologies described in this report were largely successful in their application and the results obtained by the students were deemed satisfactory if not better than before the pandemic.

Remote education can be a powerful tool and enhance students' learning and the achievement of the set outcomes for a course, especially when allied to face-to-face education, allowing teachers and students to combine and utilize the best of both modalities (Capone & Lepore, 2022; West et al., 2021).

References

- Acosta-Gonzaga, E., & Walet, N. R. (2018). The role of attitudinal factors in mathematical on-line 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
- Al-Zohbi, G., Pilotti, M. A. E., Abdelsalam, H., & Elmoussa, O. (2022). Learning physics online or face-to-face: A case study of STEM and non-STEM students. *Frontiers in Psychology*, 13. https://doi.org/10.3389/fpsyg.2022.1041187
- Bocanet, V. I., Brown, K., Uukkivi, A., Soares, F., Lopes, A. P., Cellmer, A., Serrat, C., Feniser, C., Serdean, F. M., Safiulina, E., Kelly, G., Cymerman, J., Kierkosz, I., Sushch, V., Latõnina, M., Labanova, O., Montserrat Bruguera, M., Pantazi, C., & Rosa Estela, M. (2021). Change in gap perception within current practices in assessing students learning mathematics. *Sustainability (Switzerland)*, *13*(8). https://doi.org/10.3390/su13084495
- Botto, M., Federici, B., Ferrando, I., Gagliolo, S., & Sguerso, D. (2022). Innovations in geomatics teaching during the COVID-19 emergency. *Applied Geomatics*. https://doi.org/10.1007/s12518-022-00416-4
- Capone, R., & Lepore, M. (2022). From Distance Learning to Integrated Digital Learning: A Fuzzy Cognitive Analysis Focused on Engagement, Motivation, and Participation During COVID-19 Pandemic. *Technology, Knowledge and Learning*, *27*(4), 1259–1289. https://doi.org/10.1007/s10758-021-09571-w
- Chans, G. M., Bravo-Gutiérrez, M. E., Orona-Navar, A., & Sánchez-Rodríguez, E. P. (2022). Compilation of Chemistry Experiments for an Online Laboratory Course: Student's Perception and Learning Outcomes in the Context of COVID-19. *Sustainability* (*Switzerland*), 14(5). https://doi.org/10.3390/su14052539
- Díez-Gutiérrez, E., & Espinoza, K. G. (2021). Online assessment in higher education during spanish confinement by covid-19: The view of students. *Journal of University Teaching and Learning Practice*, *18*(5). https://doi.org/10.53761/1.18.5.13
- Eckley, D., Allen, A., Millear, P., & Rune, K. T. (2022). COVID-19's impact on learning processes in Australian university students. *Social Psychology of Education*. https://doi.org/10.1007/s11218-022-09739-x
- Flores, M. A., Barros, A., Simão, A. M. V., Pereira, D., Flores, P., Fernandes, E., Costa, L., & Ferreira, P. C. (2022). Portuguese higher education students' adaptation to online teaching and learning in times of the COVID-19 pandemic: personal and contextual factors. *Higher Education*, 83(6), 1389–1408. https://doi.org/10.1007/s10734-021-00748-x

- Guangul, F. M., Suhail, A. H., Khalit, M. I., & Khidhir, B. A. (2020). Challenges of remote assessment in higher education in the context of COVID-19: a case study of Middle East College. *Educational Assessment, Evaluation and Accountability*, *32*(4), 519–535. https://doi.org/10.1007/s11092-020-09340-w
- Gupta, M. M., Jankie, S., Pancholi, S. S., Talukdar, D., Sahu, P. K., & Sa, B. (2020). Asynchronous environment assessment: A pertinent option for medical and allied health profession education during the covid-19 pandemic. In *Education Sciences* (Vol. 10, Issue 12, pp. 1–14). MDPI AG. https://doi.org/10.3390/educsci10120352
- Hilliger, I., Ruipérez-Valiente, J. A., Alexandron, G., & Gašević, D. (2022). Trustworthy remote assessments: A typology of pedagogical and technological strategies. In *Journal of Computer Assisted Learning* (Vol. 38, Issue 6, pp. 1507–1520). John Wiley and Sons Inc. https://doi.org/10.1111/jcal.12755
- Jeong, J. S., González-Gómez, D., & Prieto, F. Y. (2020). Sustainable and flipped stem education: Formative assessment online interface for observing pre-service teachers' performance and motivation. *Education Sciences*, *10*(10), 1–14. https://doi.org/10.3390/educsci10100283
- Khalaf, K., El-Kishawi, M., Moufti, M. A., & Al Kawas, S. (2020). Introducing a comprehensive high-stake online exam to final-year dental students during the COVID-19 pandemic and evaluation of its effectiveness. *Medical Education Online*, 25(1). https://doi.org/10.1080/10872981.2020.1826861
- Khandakar, A., Chowdhury, M. E. H., Khalid, M. S., & Zorba, N. (2022). Case Study of Multi-Course Project-Based Learning and Online Assessment in Electrical Engineering Courses during COVID-19 Pandemic. *Sustainability (Switzerland)*, 14(9). https://doi.org/10.3390/su14095056
- Lau, P. N., Chua, Y. T., Teow, Y., & Xue, X. (2020). Implementing alternative assessment strategies in chemistry amidst COVID-19: Tensions and reflections. *Education Sciences*, *10*(11), 1–15. https://doi.org/10.3390/educsci10110323
- Lee, A., Lee, J. Y., & Jung, E. (2023). University students' experience of online space while engaging in synchronous learning via videoconferencing amidst the pandemic. *Frontiers in Psychology*, 14. https://doi.org/10.3389/fpsyg.2023.1083754
- Loureiro, P., & Gomes, M. J. (2022, July). The Impact of Online Peer Assessment on Student Learning in Higher Education: A Systematic Review of Literature. *EDULEARN22 Proceedings of 14th International Conference on Education and New Learning Technologies*.
- Makokotlela, M. V. (2020). An e-portfolio as an assessment strategy in an open distance learning context. *International Journal of Information and Communication Technology Education*, *16*(4), 122–134. https://doi.org/10.4018/IJICTE.2020100109

- Mottiar, Z., Byrne, G., Gorham, G., & Robinson, E. (2022). An examination of the impact of COVID-19 on assessment practices in higher education. *European Journal of Higher Education*. https://doi.org/10.1080/21568235.2022.2125422
- Nikou, S. A., & Economides, A. A. (2018). Mobile-based assessment: A literature review of publications in major referred journals from 2009 to 2018. *Computers and Education*, *125*, 101–119. https://doi.org/10.1016/j.compedu.2018.06.006
- Palvia, S., Aeron, P., Gupta, P., Mahapatra, D., Parida, R., Rosner, R., & Sindhi, S. (2018). Online Education: Worldwide Status, Challenges, Trends, and Implications. In *Journal* of Global Information Technology Management (Vol. 21, Issue 4, pp. 233–241). Taylor and Francis Inc. https://doi.org/10.1080/1097198X.2018.1542262
- Panadero, E., Fraile, J., Pinedo, L., Rodríguez-Hernández, C., & Díez, F. (2022). Changes in classroom assessment practices during emergency remote teaching due to COVID-19. Assessment in Education: Principles, Policy and Practice, 29(3), 361–382. https://doi.org/10.1080/0969594X.2022.2067123
- Prigoff, J., Hunter, M., & Nowygrod, R. (2021). Medical Student Assessment in the Time of COVID-19. *Journal of Surgical Education*, *78*(2), 370–374. https://doi.org/10.1016/j.jsurg.2020.07.040
- Sedaghatjou, M., Hughes, J., Liu, M., Ferrara, F., Howard, J., & Mammana, M. F. (2021). Teaching STEM online at the tertiary level during the COVID-19 pandemic. *International Journal of Mathematical Education in Science and Technology*. https://doi.org/10.1080/0020739X.2021.1954251
- Usher, M., & Barak, M. (2018). Peer assessment in a project-based engineering course: comparing between on-campus and online learning environments. *Assessment and Evaluation in Higher Education*, *43*(5), 745–759. https://doi.org/10.1080/02602938.2017.1405238
- Vartia, D. (n.d.). *Collaborative Book Chapter*. Bay View Alliance. Retrieved March 12, 2023, from https://bayviewalliance.org/projects/resources-for-assessing-student-learning-online/collaborative-book-chapter/.
- Wang, C. Y., Zhang, Y. Y., & Chen, S. C. (2021). The Empirical Study of College Students' E-Learning Effectiveness and Its Antecedents Toward the COVID-19 Epidemic Environment. *Frontiers in Psychology*, 12. https://doi.org/10.3389/fpsyg.2021.573590
- West, R. E., Sansom, R., Nielson, J., Wright, G., Turley, R. S., Jensen, J., & Johnson, M. (2021). Ideas for supporting student-centered stem learning through remote labs: a response. *Educational Technology Research and Development*, 69(1), 263–268. https://doi.org/10.1007/s11423-020-09905-y

ANNEXES

Annex 1: Documents submitted

Annex 1: Doccuments submited

In this annex all the documents submitted by all partner organisation are listed in the following tables.

ID	Title	Authors	Document Type	Submitted by
1	Designing Your Course for Online Instruction: Principles and Tips	Harvard university (US)	Guidelines	ANVUR/PoliTO
2	Innovations in geomatics teaching during the COVID-19 emergency	Botto, M., Federici, B., Ferrando, I., et al.	Journal article	ANVUR/PoliTO
3	From Distance Learning to Integrated Digital Learning: A Fuzzy Cognitive Analysis Focused on Engagement, Motivation, and Participation During COVID-19 Pandemic	Capone, R., Lepore, M.	Journal article	ANVUR/PoliTO
4	Design Guidelines and Empirical Case Study for Scaling Authentic Inquiry-based Science Learning via Open Online Courses and Interactive Biology Cloud Labs	Hossain, Z., Bumbacher, E., Brauneis, A., Diaz, M., Saltarelli, A., Blikstein, P., Riedel-Kruse, I.H.	Journal article	ANVUR/PoliTO
5	Ideas for supporting student-centered stem learning through remote labs: a response	West, R.E., Sansom, R., Nielson, J. et al.	Journal article	ANVUR/PoliTO
6	Active learning-based STEM education for in-person and online learning	Sandrone, S., Scott, G., Anderson, W.J., Musunuru, K.	Journal article	ANVUR/PoliTO
7	Teaching in a Time of Crisis: Editorial Perspectives on Adjusting STEM Education to the "New Normal" during the COVID-19 Pandemic	Brancaccio-Taras, L., Mawn, M.V., Premo, J., Ramachandran, R.	Journal article	ANVUR/PoliTO

ID	Title	Authors	Document Type	Submitted by
8	Online education in the post-COVID era	Lockee, B.B.	Journal commentary	ANVUR/PoliTO
9	The changes we need: Education post COVID-19	Zhao, Y., Watterston, J.	Journal article	ANVUR/PoliTO
10	Changes in classroom assessment practices during emergency remote teaching due to COVID-19. Assessment in Education Principles Policy and Practice	Panadero, E., Fraile, J., Pinedo, L., Rodríguez-Hernández, C.F., Díez, F.	Journal article	ANVUR/PoliTO
11	Case Study of Multi-Course Project-Based Learning and Online Assessment in Electrical Engineering Courses during COVID-19 Pandemic	Khandakar, A., Chowdhury, M.E.H., Khalid, S., Zorba, N.	Journal article	ANVUR/PoliTO
12	Compilation of Chemistry Experiments for an Online Laboratory Course: Student's Perception and Learning Outcomes in the Context of COVID-19	Chans, G.M., Bravo-Gutiérrez, M.E., Orona-Navar, A., Sanchéz- Rodríguez, E.P.	Journal article	ANVUR/PoliTO
13	Online assessment in higher education during Spanish confinement by COVID-19: The view of students	Diéz-Gutiérrez, E., Gajardo Espinoza, K.	Journal article	ANVUR/PoliTO
14	Emergency remote teaching and students' academic performance in higher education during the COVID-19 pandemic: A case study	Higlesias-Pradas, S., Hernández- García, Á., Chaparro-Peláez, J., Luis- Prieto, J.	Journal article	ANVUR/PoliTO
15	Enriching Traditional Higher STEM Education with Online Teaching and Learning Practices: Students' Perspective	Skliarova, I., Meireles, I., Martins, N., Tchemisova, T., Cação I.	Journal article	ANVUR/PoliTO
16	Online assessment styles and approaches	Smith, D.P.	Guidelines (Royal Society of Biology)	ANVUR/PoliTO
17	Resources for Assessing Student Learning Online	Bay View Alliance	Website	ANVUR/PoliTO

ID	Title	Authors	Document Type	Submitted by
18	Responding to the COVID-19 emergency: student and academic staff perceptions of academic integrity in the transition to online exams at three Australian universities	Reedy, A., Pfitzner, D., Rook, L., Ellis, L.	Journal article	ANVUR/PoliTO
19	Learning physics online or face-to-face: A case study of STEM and non-STEM students	Al-Zohbi, G., Pilotti M.A.E., Abdelsalam, H., Elmoussa, O.	Journal article	ANVUR/PoliTO
20	An examination of the impact of COVID-19 on assessment practices in higher education	Mottiar, Z., Byrne, G., Gorham, G., Robinson E.	Journal article	ANVUR/PoliTO
21	Asynchronous Environment Assessment: A Pertinent Option for Medical and Allied Health Profession Education During the COVID- 19 Pandemic	Gupta, M.M, Jankie, S., Pancholi, S.S., Talukdar, D., Sahu, P.K., Sa, B.	Journal article	UMinho
22	Challenges of remote assessment in higher education in the context of COVID-19: a case study of Middle East College	Guangul, F.M., Suhail, A.H., Khalit, M.I., Khidhir, B.A.	Journal article	UMinho
23	Enriching Traditional Higher STEM Education with Online Teaching and Learning Practices: Students' Perspective	Skliarova, I., Meireles, I., Martins, N., Tchemisova, T., Cação, I.	Journal article	UMinho
24	Implementing Alternative Assessment Strategies in Chemistry Amidst COVID-19: Tensions and Reflections	Lau, P.N., Chua, Y.T., Teow, Y., Xue, X.	Journal article	UMinho
25	Improving Teacher Effectiveness: Designing Better Assessment Tools in Learning Management Systems	Kruger, D., Inman, S., Ding, Z., Kang, Y., Kuna, P., Liu, Y., Lu, X., Oro, S., Wang, Y.	Journal article	UMinho
26	Integrating and Evaluating Interdisciplinary Sustainability and STEM Curriculum in Geographical Education: A Case of Three Teaching Modalities	Gilbertz, S., Wood, B., Craig, C., Karabas, I., Sayers, E.P., McCormick, B.	Journal article	UMinho

ID	Title	Authors	Document Type	Submitted by
27	Peer assessment in a project-based engineering course: comparing between on-campus and online learning environments	Usher, M., Barak, M.	Journal article	UMinho
28	Teaching STEM online at the tertiary level during the COVID-19 pandemic	Sedaghatjou, M., Hughes, J., Liu, M., Ferrara, F., Howard, J., Mammana, M.F.	Journal article	UMinho
29	The Impact of Online Peer Assessment on Student Learning in Higher Education: A Systematic Review of Literature	Loureiro, P., Gomes, M.J.	Conference Proceedings (EDULEARN22)	UMinho
30	The role of attitudinal factors in mathematical online assessments: a study of undergraduate STEM students	Acosta-Gonzaga, E., Walet, N.R.	Journal article	UMinho
31	The Self-assessment in E-learning and Personalized Feedback Education	Xiaochun, G., Yiwei, W., Jingming, Z.	Conference Proceedings (ICETC2017)	UMinho
32	Change in Gap Perception within Current Practices in Assessing Students Learning Mathematics	Bocanet, V.I., et al.	Journal article	UMinho
33	Rhetorical relationships with students A higher education case study of perceptions of online assessment in mathematics	Brown, K., Lally, V.	Journal article	UMinho
34	Medical Student Assessment in the Time of COVID-19	Prigoff, J., Hunter, M., Nowygrod, R.	Journal article	UMinho

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32	Change in Gap Perception within Current Practices in Assessing Students Learning Mathematics	Bocanet, V.I., et al.	Journal article	UMinho
33	Rhetorical relationships with students A higher education case study of perceptions of online assessment in mathematics	Brown, K., Lally, V.	Journal article	UMinho
34	Medical Student Assessment in the Time of COVID-19	Prigoff, J., Hunter, M., Nowygrod, R.	Journal article	UMinho
35	The challenges of distance education in higher education	A3ES	A3ES Conference Proceedings	A3ES
36	Self-regulated learning in online learning environments: strategies for remote learning	Carter Jr, R.A., Rice, M., Yang, S., Jackson, H.A., Fitter, N.T.	Journal Article	A3ES
37	Are We There Yet? Comparing Remote Learning Technologies in the University Classroom	Fetter, N. et al	Journal Article	A3ES
38	Developing student connectedness under remote learning using digital resources: A systematic review	Hehir, E., Zeller, M., Lockhurst, J., Chandler, T.	Journal article	A3ES
39	Portuguese higher education students' adaptation to online teaching and learning in times of the COVID-19 pandemic: personal and contextual factors	Assunção, M.	Journal Article	A3ES
40	A wake-up call for b-learning in Portuguese higher education	Dias, A., Gomes, M.	Conference Proceedings	A3ES
41	Students' perceptions on distance education: A multinational study	Fidalgo, P. et al.	Journal article	A3ES

ID	Title	Authors	Document Type	Submitted by
42	Course Assessment for Skill Transfer: A Framework for Evaluating Skill Transfer in Online Courses	Fischer, H.A., Preston, K., Status, N., Storksdieck, M.	Journal article	UIC
43	The interaction of collaboration, note-taking completeness, and performance over 10 weeks of an online course	Costley, J., Matthew, C., Fanguy, M.	Journal article	UIC
44	Active Student Engagement in Online STEM Classes: Approaches and Recommendations	Prince, M., Felder, R., Brent, R.	Journal article	UIC
45	Sustainable and flipped stem education: Formative assessment online interface for observing pre-service teachers' performance and motivation	Jeong, J.S., González-Gómez, D., Prieto, F.Y.	Journal article	UIC
46	Contract cheating by STEM students through a file sharing website: a Covid-19 pandemic perspective	Lancaster, T., Cotarlan, C.	Journal article	UIC
47	Evaluating the Online Learning Experience at Higher Education Institutions	Abdel-Salam, AS.G., Hazaa, K., Abu- Shanab, E.A.	Journal article	UIC
48	Exploring design elements for online STEM courses: Active learning, engagement & assessment design	Chen, B., Bastedo, K., Howard, W.	Journal article	UIC
49	Online STEM Education During COVID-19 Period: A Systematic Review of Perceptions in Higher Education	Alangari, T.S.	Journal article	UIC
50	Considerations For Quality Assurance Of E-Learning Provision	Huertas, E., Biscan, I., Ejsing, C., Kerber, L., Kozlowska, L., Ortega, S.M., Lauri, L., Risse, M., Schörg, K., Seppmann, G.	Guideline	AQU

ID	Title	Authors	Document Type	Submitted by
51	Guidelines For Quality Assurance for Online Learning Providers in Malta	Malta Further and Higher Education Authority (Mfhea)	Guideline	AQU
52	Quality Assessment For E-Learning: A Benchmarking Approach	Coordinated By Eadtu	Guideline	AQU
53	Quality Assurance of Online Learning Toolkit	Asia-Pacific Economic Cooperation (Apec)	Guideline	AQU
54	Statutory Quality Assurance Guidelines for Providers of Blended Learning Programmes	Quality and Qualifications Ireland (Qqi)	Guideline	AQU
55	Tesla Framework for The Quality Assurance of E-Assessment	Foerster, M., Gourdin, A., Huertas, E., Möhren, J., Ranne, P., Roca, R.	Guideline	AQU
56	An E-Portfolio as an Assessment Strategy in an Open Distance Learning Context	Makokotlela, M.	Journal article	UDG
57	Blended Learning Tools and Practices: A Comprehensive Analysis	Kumar, A., Krishnamurthi, R., Bhatia, S., Kaushik, K., Ahuja, N., Nayyar, A., Masud, M.	Journal article	UDG
58	Contextualizing Lecturer Performance Indicators to Online Teaching and Learning Activities: Insights for Application During the Covid-19 Pandemic and Beyond	Maulana, A., Arli, D.	Journal article	UDG
59	Evaluating The Effectiveness of Distance Learning in Higher Education During Covid19 Global Crisis UAE Educators Perspectives	Al-Karaki, J., Ababneh, N., Hamid, Y., Gawanmeh, A.	Journal article	UDG

ID	Title	Authors	Document Type	Submitted by
60	Introducing a Comprehensive High-Stake Online Exam to Final-Year Dental Students During T Download to get the language pack the Covid-19 Pandemic and Evaluation of Its Effectiveness	Khalaf, K., El-Kishawi, M., Moufti, M. A., Al Kawas, S.	Journal article	UDG
61	Mobile-Based Assessment: A Literature Review of Publications in Major Referred Journals From 2009 To 2018	Nikou, S. A., Economides, A.A.	Journal article	UDG
62	Model of Faculty Experience in e-Learning Student Satisfaction	Tawafak, R., Alfarsi, G., Alnuaimi, M., Eldow, A., Malik, S., Shakir, M.	Journal article	UDG
63	On The Necessity or Lack Thereof of Digital Proctoring Drawbacks Perceptions and Alternatives	Duncan, A., Joyner, D.	Journal article	UDG
64	Predicting Student Satisfaction of Emergency Remote Learning in Higher Education During Covid-19 Using Machine Learning Techniques	Ho, I.M.K., Cheong, K.Y., Weldon, A.	Journal article	UDG
65	Theoretical Model of Investigating Determinants for A Successful Electronic Assessment System EAS In Higher Education	Mo, D., Tang, Y., Wu, E., Tang, V.	Journal article	UDG