



# Balancing Outcomes: Implementing invigilated online exams in an Engineering curriculum

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## ABSTRACT

### CONTEXT

This paper reports on the evaluation of the effectiveness of invigilated online examinations conducted in an Engineering Department of an Australian university, situating it within an emerging tension in the literature on the measures taken to secure the academic integrity of online assessments and student well-being.

### PURPOSE OR GOAL

This study considers that student well-being in remotely invigilated online examinations could be enhanced with the use of low intrusive, familiar technology platforms for invigilation, in supportive, student friendly settings, with no adverse effects for academic integrity. Reduction in extraneous procedure and surveillance would lessen anxiety, increasing students' sense of well-being.

### APPROACH OR METHODOLOGY/METHODS

Subject co-ordinators were surveyed as to their experiences implementing the online invigilated examinations. Respondents completed a questionnaire on their observations of student experience, their own experiences, effects on examination design, perceived effects on academic integrity and effects on student success. High levels of observed student compliance with instructions and low levels of academic intervention during the examination were indicative of low cognitive effect of the examination procedure and supportive preparation, which allowed for conclusions of student well-being. Student success data comparisons across settings, educator observations of student performance across assessments, and their observations of students in the invigilated online examinations allowed for inferences regarding academic integrity.

### ACTUAL OR ANTICIPATED OUTCOMES

Preparation of academic staff and students was crucial to the successful implementation of student friendly invigilated online examinations. Despite academic staff having reservations about maintaining academic integrity in remote online invigilation settings, no breaches were detected. Staff were in favour of better examination question design, instead of enhanced surveillance.

### CONCLUSIONS/RECOMMENDATIONS/SUMMARY

The conclusions of this study align with the findings of other studies in finding no effects for academic integrity in online assessment settings, and that supportive student environments in invigilated online settings were not incompatible with securing academic integrity. Preparation of students for the invigilated online examination process, low intrusive familiar technologies, and harnessing student agency in the process can contribute to student well-being while not affecting student success or jeopardising academic integrity. There may also be opportunities in online examinations to use online affordances to make assessments more engaging and authentic.

**KEYWORDS** : Online examinations, examination invigilation, academic integrity; online meeting tools

# 1. Introduction

During the COVID-19 Pandemic, La Trobe Engineering, a department of La Trobe University, switched its delivery of courses and subjects to online learning. It then trialled conducting remotely invigilated online examinations in some of its subjects in the final examination period of 2021. This paper situates the La Trobe Engineering experience within the context of a literature on invigilated online examinations (IOE) and describes the remotely invigilated online examination process adopted by La Trobe Engineering. It considers the effect of student friendly approaches in the conduct of invigilated online examinations and their implications for academic integrity, making the observation that there was no discernible detrimental effect for academic integrity in invigilated online examination settings in this study, where student well-being was emphasised over the employment of increased technological surveillance. This paper concludes with a reflection and analysis of the La Trobe Engineering experience, drawing conclusions for future directions.

## 1.1. Literature survey

Many academic disciplines need to validate individual student competence and meet accreditation requirements through reliable judgements of student performance and demonstrations of knowledge, at scale. Invigilated examinations are often the only reliable method of satisfying these considerations. The COVID-19 Pandemic saw institutions, globally, switch to delivering teaching and learning, and assessment online. It has been estimated that as many as 50% of tertiary institutions in the United States were using third-party remote invigilation services during 2020 (Balash et al., 2021). Invigilated examinations have two key aims: to authenticate the identity of the candidate, and guarantee the integrity of the examination process. The focus of the literature on invigilated online examinations has been predominantly on the second of these aims, with much attention devoted to preventing, detecting and eliminating misconduct or cheating in the conduct of online assessments, in many cases to the neglect of candidate or student privacy and overall emotional well-being.

There are discernible differences in student outcomes and performance in non-invigilated online assessment and invigilated online assessments. An often cited study by Hylton, Levy and Dringus (2016) was replicated in the work of Daffin and Jonas (2018). The original study considered the effects of remotely invigilated online assessments using webcam technology, and compared the performances of invigilated candidates against those of a cohort who did the same online assessment but were not invigilated. Daffin and Jonas (2018) compared the performances of 1645 students across online psychology subjects in 2015-16. Each subject had one invigilated online assessment, with the remainder non-invigilated (Daffin & Jonas, 2018). Both studies yielded similar results, finding that students in non-invigilated online assessments, on average, performed at higher levels of achievement and took longer to complete the assessments, when compared to students in invigilated online assessments who, on average, performed at lower levels of achievement and took less time. While Daffin and Jonas (2018) made recommendations regarding examination question design and better monitoring of student behaviour to prevent cheating, they could not make findings on whether students performed better on non-invigilated examinations due to cheating or lower levels of anxiety (Daffin & Jonas, 2018).

That students might perform better on non-invigilated online assessments due to lower levels of anxiety cannot be dismissed. Andreou et al. (2021) compared the performances of students on the same computer-based examination between an automated remotely invigilated and an in-person invigilated cohort. They found that there was no difference in performance between the two cohorts, but students who participated in the automated remotely invigilated cohort reported experiences of anxiety due to being observed and not knowing what kinds of behaviours might be identified as suspicious by the invigilation software. They also highlighted privacy concerns, which again might have led to levels of anxiety (Andreou et al., 2021).

Studies that focus on third-party invigilation services and platforms provide insight into just how intrusive automated remote invigilation can be for students. Balash et al. (2021) found that 51% of

respondents agreed that the nature of proctoring they had experienced was too intrusive. While respondents felt that lockdown browsers, webcam and screen recordings were necessary to secure the integrity of an online assessment, they still felt high levels of discomfort with being visually monitored (Balash et al., 2021). Importantly, there was a convergence in what respondents saw as unnecessary levels of monitoring and the aspects of the monitoring which they felt most intrusive, such as observations of eye movement. As reported in (Andreou et al., 2021), not knowing what kind of movements could trigger misconduct allegations were a source of noticeable stress for respondents, and could affect performance (Balash et al., 2021).

The tension between academic integrity and student well-being can be mitigated if it is recognised as an issue for invigilated online assessment (Linden & Gonzalez, 2021). A study conducted at an Australian regional university deliberately placed the student experience and well-being at the centre of its plan to construct an invigilated online assessment regime, and found that there was very little if any difference between achievements on invigilated paper-based examinations conducted prior to the COVID-19 pandemic and invigilated online examinations during the pandemic (Linden & Gonzalez, 2021). The study avoided using invigilation software and instead used an online enterprise meeting and web-conferencing platform (Zoom) to remotely invigilate online examinations. Student identities were verified by examination supervisors in breakout rooms, and students logged on to examinations in the institution's Learning Management System. Webcam recordings of students taking the exam were made, but there were no camera sweeps of rooms and no screen recordings. Recordings were centrally logged in case they were needed to examine alleged misconduct, and exams were run through a plagiarism detection tool (Turn-it In) if plagiarism was suspected (Linden & Gonzalez, 2021). In an examination event involving 1728 students over 24 subjects no academic misconduct was detected. As part of supporting student well-being, in preparation for the online assessment experience, students participated in a practice exam based on academic integrity. They were also asked to commit to not using 'unauthorised materials' during the examination before they began the assessment (Linden & Gonzalez, 2021).

In keeping with the assertion in (Cramp et al., 2019) regarding aiming to minimise the cognitive load on students to optimise performance in online assessments, the (Linden & Gonzalez, 2021) study saw staff go through a professional learning program to design pedagogically supported online examinations, which in turn, were quality assured by both discipline academics and education staff (Linden & Gonzalez, 2021). The study by (Cramp et al., 2019) also emphasised staff development, and employed an elaborate approach in ever widening communities of practice as staff assisted each other to plan and implement the invigilated online examination process, as well as design better examination questions. While the (Cramp et al., 2019) study employed an invigilation service, it is instructive that the aim was to produce a process that reduced the amount of extraneous activity for students, and provided clear, coherent and predictable (familiar) examination formats that limited the extent to which students had to attend to aspects of the process other than their responses to the examination. There might very well be a positive correlation between supporting academic staff to implement invigilated online assessments and the student experience in the examination. Staff involvement from setting the examination to assisting students with, and in, the invigilation process reduces the anxiety for students, as well as the need for intrusive methods of invigilation.

What emerges from the literature on invigilated online assessments is that there is a clear tension between student well-being and securing the academic integrity of online assessments. Erring too far on the side of academic integrity threatens to lose sight of students as learners, and positions them as potential wrongdoers, leaving them to navigate a network of surveillance to participate in assessments in an optimal way. It is possible, however, to reframe the approach. The work of (Linden & Gonzalez, 2021) demonstrates this, and that approach most corresponds to the one adopted by La Trobe Engineering in its invigilated online assessment.

## **2. Design and Process**

### **2.1. Moving to invigilated online assessment**

With the onset of COVID-19 early in first semester 2020, La Trobe Engineering moved delivery and assessment of all subjects online. Eight subjects which adopted invigilated online examinations are the focus of this study. Transition to online examinations was supported by the higher education regulator, the Tertiary Education Quality and Standards Agency (TEQSA), and the accreditation body, Engineers Australia.

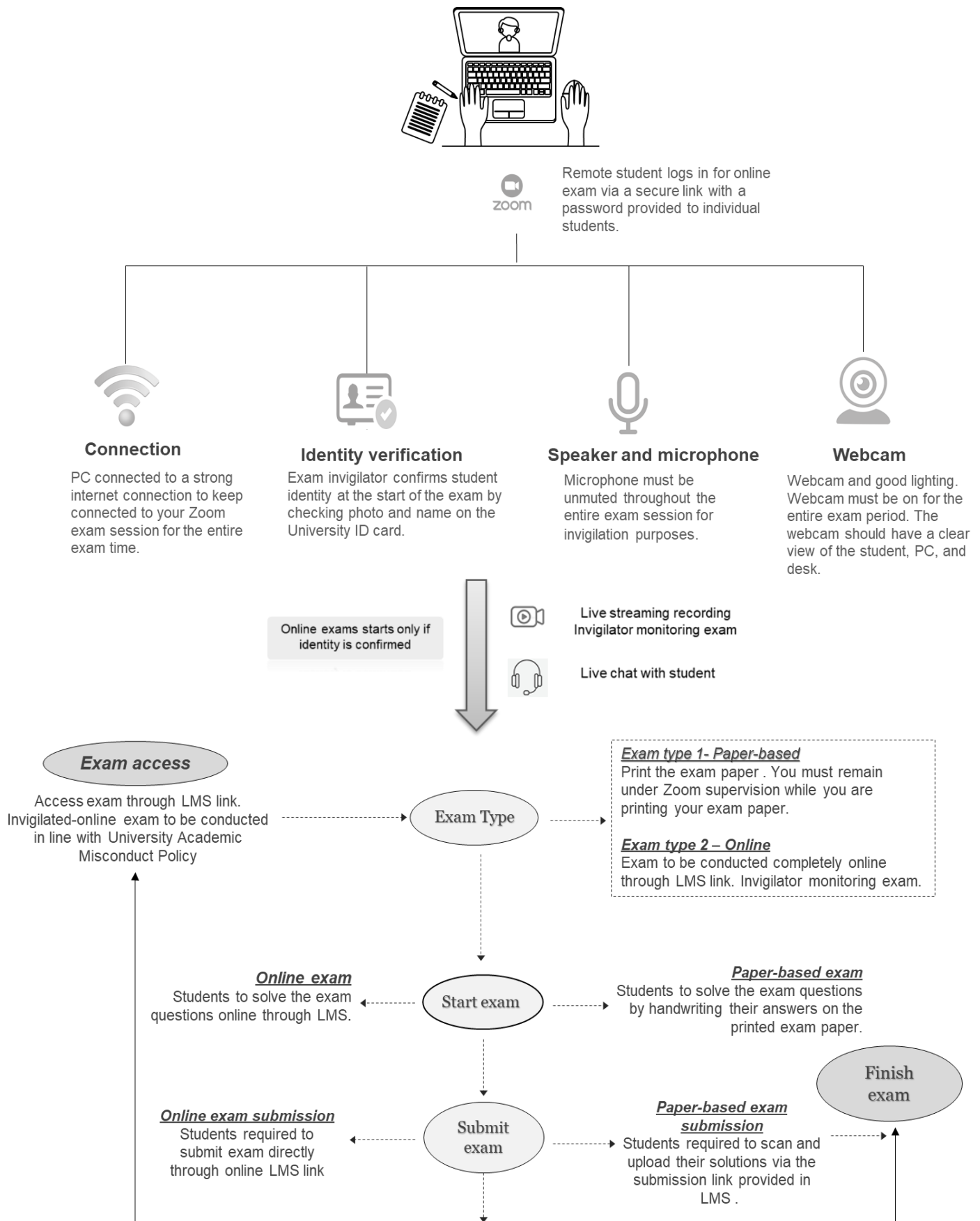
Given the urgency, priority was given to optimising Zoom and Microsoft Teams, the institution-wide online meeting platforms, for use in invigilating the online examinations. Students and staff were familiar with the online meeting tools, and they could be used effectively to secure academic integrity, support students through clear instruction on the invigilated online examination process and allow for a collaborative approach between academic staff in the development of the online invigilation model.

Invigilated online examinations were organised for 307 students, across the 8 subjects. The examination weights were within the range of 40-50% of the subjects' overall marks and included a combination of question types including multiple-choice, short and extended responses, and problem-based computational questions.

### **2.2. Invigilated online examination model and student instructions**

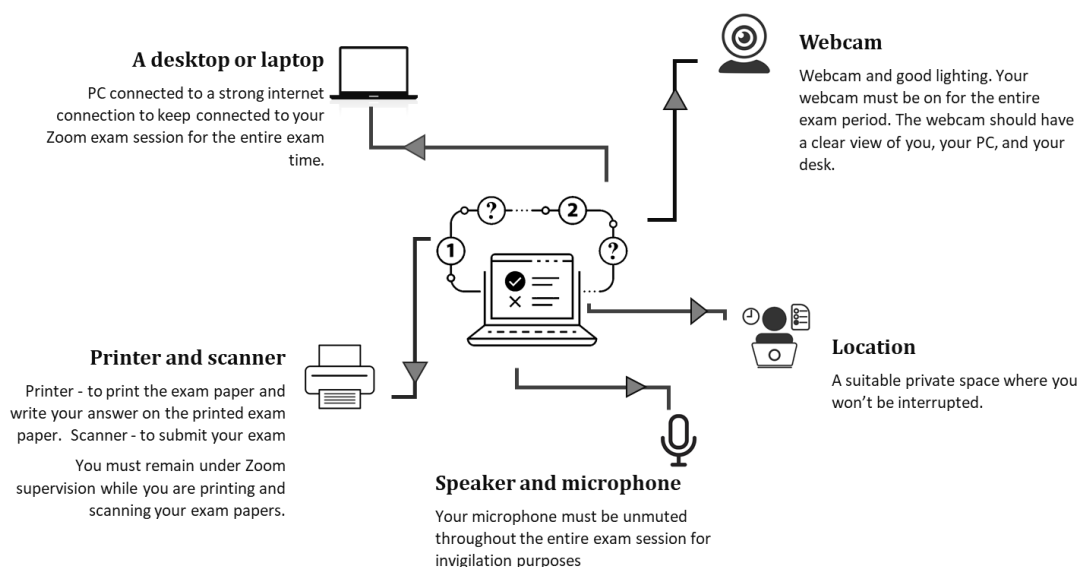
Consideration was given to ensuring students felt supported and prepared for the examinations. Instructions were developed for the invigilated online examinations, and communications were sent to students via email and notifications in the Learning Management System, and provided in information sessions. The instructions passed through a development process, where academic staff agreed on the implementation model and then wrote the instructions accordingly. The instructions were checked by the Department's Learning and Teaching coordinator and a staff member from the Education Services centre, who provided feedback on clarity, expectations, and the practical application of the process in the online environment. All feedback was considered before finalisation. Prior to the examinations, students were briefed during lectures and were provided with the instructions and encouraged to provide feedback. Figure 1 illustrates the online invigilated model adopted by La Trobe Engineering.

Figure 1: La Trobe Engineering invigilated online examination model and student instructions



Students were also notified of the devices required to undertake the examinations. Figure 2 illustrates the required devices and the instructions on their use. Students were advised that an invigilated online examination on campus could be arranged, if they did not have access to the required equipment. Students were advised on what to do in the event of technical difficulties, such as taking a screenshot of the problem/error message and the state of the examination, and emailing a brief explanation of the problem to allow the subject coordinator to consider a fair outcome.

Figure 2: Student guidelines and devices required for the online examination.



### 2.3. Ensuring academic integrity during the online examination

All efforts were made to ensure the most appropriate environments were established to foster student support and academic integrity. Prior to the examinations, students were provided with a list of authenticated group links to the individual examinations, allowing only authenticated users to join the meeting. Hosts were required to join the meeting 30 minutes prior to the scheduled start of an examination to check the online settings. Students were asked to join the meeting 15 minutes before the scheduled examination time, to validate their identity and be allocated to a breakout room, where these were available. On joining, students were reminded of the examination process and instructions on how to access the examination, and could have any questions answered.

Student participants in a single invigilated online examination ranged from 21 to a maximum of 60 (Table 1). Depending on the participation size in an examination, breakout rooms were used, and each breakout room had an invigilator. The maximum size for a breakout room was 10 students. Host and co-hosts were able to use all possible functions in the online meeting platform, but students could only use the Chat option to communicate with the invigilator, with all other options for students being disabled. Importantly, the online meeting host had to ensure that the meeting was being recorded so that, if required, the recording of the examination could be reviewed at a later stage.

## 3. Empirical Evaluation of the invigilated online exams

The subject coordinators (academic staff with responsibility for subjects) of the eight subjects managed the invigilation of the examinations and were invited to respond to a questionnaire on the invigilation process following the completion of marking. The questionnaire sought to surface their reflections and insights on four key areas: the student experience of the invigilated online

examination; educator experience of the invigilated online examination; the influence of the invigilated online examination process on the examination format and question design; and the academic integrity of the invigilated online examination.

Table 1: Assessment profile of Engineering subjects using invigilated online assessment. Note: Sub refers to Subject

	Sub 1	Sub 2	Sub 3	Sub 4	Sub 5	Sub 6	Sub 7	Sub 8
<i>Format of the examination response</i>	Paper-based (scanned)	Paper-based (scanned)	Paper-based (scanned)	Paper-based (scanned)	Online		Online	Online
<i>Number of Invigilated students</i>	33	60	60	39	39	21	21	34
<i>Weighting of the invigilated online examination</i>	50%	50%	50%	50%	50%	40%	40%	40%
<i>Weighting of the non-invigilated assessments</i>	Lab report (10%) and two tests (40%)	Lab report (10%) and two tests (40%)	Six quizzes (30%) and two assignments (20%)	Individual test (10%), assignments (10%) and group written reports (30%)	Individual written report (20%) and group written reports (30%)	3 quizzes (10%), individual reports (25%) and group report (25%)	Presentations (10%) and report submissions (50%)	Group report (20%), Presentation (10%) and quizzes (30%)
<i>Writing time for the IOE</i>	2 hours	2 hours	2 hours	2 hours	2 hours	2 hours	2 hours	2 hours

### 3.1. Student experience of the invigilated online exams

Preparing students for an invigilated online examination is considered critical to avoid confusion about the examination process (Cramp et al., 2019; Reedy et al., 2021). Practice examinations (Linden & Gonzalez, 2021) and even mandatory quizzes about the process before an online examination are suggested to limit the occurrence of distracting technical issues and provide systematic instruction to prepare students for the examination process (Cramp et al., 2019). While such arrangements were not made for the subjects in this study, academic staff did provide detailed briefings to students on the examination process in each subject, and it should be noted that 5 out of the 8 subjects had used non-invigilated online assessments (e.g., tests, quizzes) during the semester, providing students with relevant experience for an invigilated online examination, such as accessing the examination questions and submitting solutions via the Learning Management System (LMS)

For the eight subjects in this study, students were typically provided with instructions described in section 2 prior to the examination. Students were encouraged to provide feedback on the instructions, and subject co-ordinators of 4 subjects reported receiving positive feedback from students on the instructions. The subject coordinators of the remaining subjects received neither positive nor negative feedback, or none was provided.

Subject coordinators reported that students' questions typically related to the questions on the examination, the format of the examination questions and the technology used during the examinations. Students' inquiries were answered and could be directed to the instructions provided for the examination. When asked, subject coordinators also indicated that students' queries were limited to the questions on the examinations during the invigilated online examination.

The perceptions by academic staff of the student experience of the preparation for the invigilated online examinations is supported by their reports that no concerns were raised by students about the invigilated online examination process and its implementation. These findings might suggest that conveying clear instructions, in planned briefing sessions, where student feedback was encouraged, was adequate in preparing students for the invigilated online examination process.

### **3.2. Educator experience of the invigilated online exams**

Online examinations became more prevalent during the pandemic, as more institutions adopted online approaches to delivering the curriculum (Mishra et al., 2020). This has had the effect of reducing staff resistance to online assessment and improving academics' educational technology skills (Elzainy et al., 2020). Skills such as operating online meetings, employing randomized quiz and test bank questions and developing more authentic questions in setting examination questions became commonplace, as more applications were explored in online Learning Management Systems (LMS).

The eight staff members and student cohorts who participated in this paper's investigation had developed extensive knowledge of the online meeting platforms used to facilitate the invigilated online examinations (i.e., Zoom and Microsoft Teams). They developed expertise in using those platforms over two academic years (since the start of the COVID-19 pandemic) before conducting and participating, respectively, in the invigilated online examinations in late 2021. Furthermore, students also had experience in the online submission of various types of non-invigilated assessments via the Learning Management Systems (LMS) over those two years. These technical skills were essential in achieving the reliable and effective implementation of the invigilated online examinations.

Academic staff who coordinated the invigilation of the examinations and who responded to the questionnaire agreed that they felt confident addressing students' questions on the instructions for the examinations, in applying the agreed invigilation process during the examination and with the use of the specified technology. All the responses received from staff have indicated that there was no need to intervene at any stage during the invigilated online examinations. So while their confidence was not tested in a troubleshooting event, the smooth conduct of the examinations could be testament to their thorough understanding and implementation of the agreed processes and technologies, which would no doubt relate to their familiarity with the online technology, and the Learning Management Systems (LMS).

Studies have found that academic staff need support during the preparation and implementation of online examinations (Frankl & Bitter, 2012), while Cramp et al. (2019) suggest that practice examinations should be required before examinations are conducted. In this study, the eight cases demonstrated that collaborative, inclusive consultations among stakeholders can adequately promote the successful implementation of invigilated online examinations and ensure that the process is uniform across stakeholders.

### **3.3. Examination question design in the invigilated online exams**

Online examinations require more systematic and practical design compared to traditional paper-based examinations, and have to be purposefully designed given the habits of digital consumption and the technical requirements of online technologies (e.g., Böhmer et al., 2018 and Cramp et al., 2019). Reedy et al. (2021) have also asserted the importance of designing practical questions focused on high-order thinking for the digital environment.

While the academic staff in this study were mindful of the technological affordances of the online environment, and some did change their question design to exploit those opportunities, they erred on the side of caution, sticking with question formats they had honed on non-invigilated online tests and quizzes. Table 2 shows academic staff responses to statements on the questionnaire interrogating staff dispositions towards exploiting the affordances of invigilated online assessments. Collectively, staff did not depart very far from traditional on-campus examination formats, and where the technology was exploited, it was to increase the academic integrity of closed response questions. Staff expressed only tentative agreement about employing computer-based tools and software to make their online examinations more authentic assessments of student learning.

Building staff confidence in effectively exploiting the affordances of online assessments will require the kind of professional learning collaboration and support described in (Cramp et al., 2019), and (Linden & Gonzales, 2021). Staff in this study agreed that question design aimed at higher-order



thinking would support the academic integrity of online assessments, and perhaps it is here that increased attention might be better rewarded in the implementation of invigilated online assessments in the future.

Table 2: Questionnaire statements about IOE question design

	Staff level of agreement with the statements
I used the affordances of the invigilated online examination to ask different questions compared to traditional examinations.	70%
I expected students to use computer-based tools in their responses to questions in the examination.	51%
I felt I could make the assessment more authentic by getting students to use software or online tools that they might use in the workplace/"real world".	65%

### 3.4. Academic integrity and the invigilated online exams

Reedy et al. (2021) explored the perceptions of 73 academic staff and 1175 students at three Australian universities about student cheating in online examinations and other online assessments. They found that academic staff believed students could cheat more easily in online examinations than in traditional, in-person invigilated examinations. There might be a disproportionate difference, however, between perceptions of cheating and actual rates of cheating online, and little reason to believe that cheating is more prevalent in online than in traditional settings (Daffin & Jonas, 2018).

As in the (Linden & Gonzales, 2021) study, academic staff who invigilated the online examinations discussed in this paper agreed that there was no reason to suspect any breaches of academic integrity during the invigilated online examinations, or after marking students' submissions. This was validated against student performance in non-invigilated assessments, as well as with comparisons against past in-person invigilated examinations (Table 4). Academic staff indicated that they had no cause to intervene during the examinations, and agreed or strongly agreed that overall students complied with instructions (85% level of agreement) and that they were confident with the academic integrity (84% level of agreement) of the results (Table 3).

Despite this, academic staff agreed to a lesser extent that invigilated online examinations provided the same level of cheating prevention as in-person invigilated examinations (72% level of agreement). Interestingly, there was only tentative agreement (65%) that academic integrity in invigilated online assessments could be further enhanced by further technological intervention, given their experience.

While there was no reason to suspect cheating, staff in this study still did not feel as confident that online invigilation, generally, was as good at preventing cheating as in-person invigilation. They did not, however, feel that even more reliance on technology to prevent cheating would improve their levels of confidence in online invigilation. They demonstrated higher levels of agreement (86%) that question design that encouraged students' higher-order thinking might be more profitable in combating cheating online, or at least providing higher levels of assurance to assessors.

Table 3: Questionnaire statements about academic integrity in IOEs.

	Staff level of agreement with the statements
Statement 1: Overall, students complied with the instructions for the invigilated online examination.	85%
Statement 2: The settings applied in the invigilated online examination were adequate to prevent cheating.	79%
Statement 3: With appropriate settings, invigilated online examinations provide the same level of cheating prevention as the traditional invigilated exams.	72%
Statement 4: Effective question design focused on high-order thinking is essential for maintaining academic integrity.	86%
Statement 5: The use of function resisting assessment practices (e.g., online proctoring, locking down browsers) can further maintain academic integrity.	65%
Statement 6: After marking the examination submissions, I am confident academic integrity was maintained in the invigilated online examination.	84%

### 3.5. Impact of invigilated online exams on students' success

Along with reporting on staff reflections on their and students' experiences conducting and participating, respectively, in invigilated online examinations, the authors explored if the switch to invigilated online examinations from in-person invigilated examinations affected student performance. Table 4 compares the average marks of the final in-person invigilated examinations taken on campus in 2019, with the results from the invigilated online examinations conducted in 2021, by subject. The teaching staff for seven subjects, over both periods, were the same, except for Subject 3, which experienced the biggest percentage change in average marks across the two examinations. It was not possible to make the comparison for one subject (Subject 7) as it was not offered in 2019. Based on comparisons for the 6 remaining subjects, students' results were not significantly impacted by varying the examination environment from in-person invigilation to the invigilated online examination model. The percentage change ranged from 1.06 to 10.3 percent, with an average change of 3.89 percent for the 6 subjects. This finding is in keeping with (Linden & Gonzalez, 2021), that there was little change in student results between in-person invigilated examinations and invigilated online assessments conducted over two different examination periods, and with (Andreou et al., 2021) who found no difference in performance between in-person and remotely (automated) invigilated examinations. There is little risk then, for student success, in employing online invigilation, and in following the lead of Linden and Gonzalez (2021) and making the process supportive and student friendly.

Table 4: Examination outcomes for IOEs and on-campus examinations. Note: Sub refers to Subject

	Sub 1	Sub 2	Sub 3	Sub 4	Sub 5	Sub 6	Sub 7	Sub 8
Average Final Exam Marks – 2019	70.98%	69.32%	71.00%	62.37%	61.00%	68.27%	Subject not offered	69.51%
Average Final Exam Marks – 2021 (using IOE)	70.23%	66.57%	50.00%	65.58%	61.66%	69.50%	70.75%	62.35%
Percentage Change	1.06%	3.97%	29.58%	5.15%	1.08%	1.80%	-	10.30%

## 4. Conclusion

This study found that invigilated online examinations are a valid way of assessing student learning and can be conducted with minimal effect on student well-being, while securing the academic integrity of the assessments. Achieving this balance requires an investment of time in working with academic staff to develop the procedures for implementation, employing only the amount of surveillance relevant to securing the integrity of the examination process, and ensuring that students are well aware of the examination expectations and procedures, and familiar with the technology that will be employed in the examination process. Invigilating remotely with supervisors who are familiar to students, using online platforms that are part of students' everyday learning and assessment experiences and which are unintrusive, and making students partners in the academic integrity process can be effective ways of reducing student anxiety, benefiting their emotional well-being during the assessment process and securing the academic integrity of invigilated online examinations.

While, in line with other studies, academic staff in this study remained unconvinced that invigilated online examinations were as effective at deterring and detecting misconduct as in-person invigilation, they favoured better question design over technology-based solutions to make online assessments more secure. This sentiment provides some indication for where emphasis might be placed the future, making better assessment design, that takes advantage of online affordances, a priority in improving online assessment environments.

While the findings of this study are closely aligned with others in the literature, especially the work of Linden and Gonzalez (2021), it does have the limitations of scale, and that much of its data relied solely on the observations and perceptions of staff participating in the study. In future, it would look to broaden the sample of subjects and student cohorts, and include the perspectives of students. The latter would be particularly beneficial to any research investigating links between staff development and involvement in invigilated online assessments and student well-being. There might also be an opportunity to conduct longitudinal analyses, which might provide insights into the possibility of variations in student behaviour overtime in relation to academic integrity, as they become more accustomed to invigilated online examination settings.

## 5. References

- Andreou, V., Peters, S., Eggermont, J., Wens, J., & Schoenmakers, B. (2021). Remote versus on-site proctored exam: comparing student results in a cross-sectional study. *BMC Medical Education*, 21(1), 1-9.
- Balash, D. G., Kim, D., Shaibekova, D., Fainchtein, R. A., Sherr, M., & Aviv, A. J. (2021). Examining the examiners: Students' privacy and security perceptions of online proctoring services. Seventeenth Symposium on Usable Privacy and Security (SOUPS 2021),
- Böhmer, C., Feldmann, N., & Ibsen, M. (2018). E-exams in engineering education—online testing of engineering competencies: Experiences and lessons learned. 2018 IEEE global engineering education conference (EDUCON),
- Cramp, J., Medlin, J. F., Lake, P., & Sharp, C. (2019). Lessons learned from implementing remotely invigilated online exams. *Journal of University Teaching & Learning Practice*, 16(1), 10.
- Elzainy, A., El Sadik, A., & Al Abdulmonem, W. (2020). Experience of e-learning and online assessment during the COVID-19 pandemic at the College of Medicine, Qassim University. *Journal of Taibah University Medical Sciences*, 15(6), 456-462.
- Frankl, G., & Bitter, S. (2012). Online exams: practical implications and future directions. Proceedings of the European Conference on e-Learning,
- Hylton, K., Levy, Y., & Dringus, L. P. (2016). Utilizing webcam-based proctoring to deter misconduct in online exams. *Computers & Education*, 92, 53-63.
- Linden, K., & Gonzalez, P. (2021). Zoom invigilated exams: A protocol for rapid adoption to remote examinations. *British Journal of Educational Technology*, 52(4), 1323-1337.

Mishra, L., Gupta, T., & Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *International Journal of Educational Research Open*, 1, 100012.

Reedy, A., Pfitzner, D., Rook, L., & Ellis, L. (2021). Responding to the COVID-19 emergency: student and academic staff perceptions of academic integrity in the transition to online exams at three Australian universities. *International Journal for Educational Integrity*, 17(1), 1-32.

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