Changing student experiences with online proctored exams: Comparing 2020 and 2023 cohorts

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This article presents a repeated cross-sectional study comparing two independent cohorts of students (2020 and 2023) to examine how experiences with online proctored exams (OPEs) evolved following the COVID-19 pandemic. The study draws on 761 course-level responses from 741 students collected in 2020 and 701 course-level responses from 591 students collected in 2023. Using the same survey instrument across both cohort points, the study examines four constructs: perceived ease of use, confidence, OPE experiences and acceptability and OPE readiness and support. Findings revealed significant improvements across all four constructs in the 2023 cohort, with clustering-adjusted analyses indicating that these differences remained after accounting for demographic characteristics and multiple course-level responses from the same student. However, agreement that students were comfortable being observed or recorded during an OPE was significantly lower in 2023 than in 2020. While the effect size was very small, the findings suggest that concerns about surveillance persisted despite more positive overall experiences. The findings inform policy and practice decisions about the ongoing use of OPEs in higher education, with implications for institutional transparency and student privacy.

Implications for practice or policy:

- Embedding clear guidance and practice for OPEs can sustain usability and confidence.
- Improved acceptance of OPEs should not be taken as evidence that surveillance concerns have been resolved, despite the very small magnitude of the observed effect.
- Clear proctoring and privacy policies are needed to address surveillance concerns.
- Sustained institutional OPE communication and technical support measurably improves student experience.

Keywords: online proctored exams (OPEs), perceived ease of use, student confidence, surveillance and privacy, institutional support

Introduction

The COVID-19 pandemic catalysed a rapid transformation in assessment practices across higher education institutions globally (Selwyn et al., 2023). In response to the sudden shift to remote learning, many universities adopted online remote proctored exams (OPEs) as a substitute for traditional in-person, paper-based exams. A university in New Zealand was among the institutions that implemented OPEs during Semester 1 of 2020 (February – June). The initial study conducted during that period sought to understand students' experiences with this new mode of assessment (Hartnett et al., 2023). Since then, OPEs have continued to be utilised for end-of-course assessment though not without some concerns. Three years later, in 2023, a follow-up study was conducted to determine whether and how students' experiences and perceptions of OPEs had changed. This article presents the findings of the 2023 study

and compares them with the results from 2020, offering a temporal comparison of two independent student cohorts to examine how perceptions of OPEs evolved between 2020 and 2023.

OPEs

In the years following the COVID-19 pandemic, OPEs have evolved from emergency solutions into established assessment practices across many higher education institutions (Makgakga, 2025; Selwyn et al., 2023). The emergence of generative artificial intelligence has brought renewed attention to the need to assure assessment (Dawson et al., 2024) and demand for robust assessment systems (Bearman et al., 2024). As Dawson (2020, p. 264) noted, "there are two components to assessment security: control of circumstances and authentication and both are relevant to restrictions in online examinations". Concerns about academic integrity remain central to the discussion on OPEs. While some studies have suggested that remote exams may increase opportunities for cheating (Comas-Forgas et al., 2021), Dawson (2021) has argued that well-designed proctoring systems and assessment strategies can mitigate these risks. While necessary, such restrictions have implications for students and their experiences of OPEs and the challenge lies in balancing security with student trust and well-being.

Student experience

Research into students' experiences of OPEs reveals mixed responses, shaped by factors such as digital competence (Hartnett et al., 2023), prior experience (Hosseini et al., 2021), and the design of the assessment environment (Dawson, 2020; Henderson et al., 2024). Many students have reported benefits, including increased flexibility, convenience and clarity in expectations (Ali & Al-Dmour, 2021; Hope et al., 2021; Lorenza & Carter, 2021). These considerations are valued by students balancing study with work or caregiving responsibilities and those studying remotely. The ability to type responses, access exams from familiar environment and avoid travel are consistently cited as advantages (Raman et al., 2021; Tan et al., 2021). Furthermore, perceived ease of use has been consistently identified as a key factor shaping students' engagement with digital assessment environments, influencing both confidence and overall attitudes towards online proctoring systems (Raman et al., 2021). However, significant concerns remain around stress, surveillance and digital equity (Hartnett et al., 2023). Technical issues, such as connectivity problems or lack of familiarity with proctoring software (Henderson et al., 2024), can exacerbate stress and undermine confidence (Hosseini et al., 2021), and students from rural areas or with limited digital access can face additional barriers, raising questions about equity (Beaunoyer et al., 2020; Ramsetty & Adams, 2020).

While much of the literature on OPEs has focused on usability and academic performance, a growing body of research points to concerns about surveillance, privacy and the power dynamics inherent in proctored assessment. Students have reported discomfort with being observed and recorded, with this concern persisting or intensifying even as overall attitudes towards OPEs improve (Nicola-Richmond et al., 2024; Pokorny et al., 2023). Khalil et al. (2022) have argued that privacy is largely deprioritised in institutional OPE adoption decisions, with cost and usability given precedence over student welfare. Where institutional power structures mean students have no viable means of opting out without academic penalty, actual reported discomfort may under-represent the extent of the problem and should not be interpreted necessarily as acceptance (Mutimukwe et al., 2026). Nevertheless, students do not uniformly reject proctored assessment but weigh privacy and surveillance concerns against the flexibility and convenience that online assessment affords (Mutimukwe et al., 2026).

We conducted a study during the early part of the pandemic that explored students' digital confidence and experiences in undertaking OPEs. The findings revealed relationships between perceived ease of use and confidence, reinforcing the importance of accessible platforms and prior exposure to digital tools (Hartnett et al., 2023).

Conceptual framework

This study draws on four interrelated constructs, namely perceived ease of use, confidence, OPE experiences and acceptability and OPE readiness and support, each of which is grounded in established theoretical and empirical work on technology-mediated assessment. Perceived ease of use, drawn from Davis's (1989) technology acceptance model, has been consistently identified as a predictor of student attitudes towards and acceptance of technology in learning contexts. Confidence, conceptualised as academic self-efficacy in digital assessment environments, is closely linked to perceived ease of use as students who feel competent using a system are more likely to perceive it as accessible and to report positive assessment experiences (Compeau & Higgins, 1995). Our prior work established that perceived ease of use and confidence are meaningfully associated in the OPE context, with both constructs contributing to broader assessment attitudes (Hartnett et al., 2023). Facilitating conditions including access to technical assistance, environmental conditions and institutional communication, further shape how students experience and evaluate proctored assessment (Nicola-Richmond et al., 2024). Together, these constructs reflect a progression from students' experience of the technology through to their broader evaluative judgements about OPEs (i.e., acceptability and readiness), providing a coherent basis for examining population-level change across cohorts surveyed in 2020 and 2023.

Aim of the study

This study builds on earlier research (Hartnett et al., 2023) by comparing two independent cohorts surveyed in 2020 and 2023. The 2023 data set comprised 591 students who provided 701 course-level responses, while the 2020 data set comprised 741 students who provided 761 course-level responses. By using the same instrument at both time points, we examined how student perceptions shifted over time, particularly in relation to confidence, ease of use and experiences of OPEs. Whilst the study does not track the same individuals, the repeated cross-sectional design enables identification of population-level trends and changes in student experience. The research question informing this investigation was: How did the 2023 cohort differ from the 2020 cohort in perceived ease of use, confidence, OPE experiences and acceptability and OPE readiness and support?

Methodology

Research design

This study employed a repeated cross-sectional design, surveying two independent cohorts of students at the same university using the same instrument at two time points: Semester 1, 2020 (during the first wave of COVID-19-related campus closures) and Semester 1, 2023 (after OPEs had become an established practice). The design permitted comparison of population-level trends in student experience but did not track individual students over time. Consequently, observed differences between 2020 and 2023 may reflect temporal change in experiences and attitudes, changes in cohort composition (e.g., ethnicity, mode of study, prior experience) or both. We address this interpretive challenge through descriptive demographic comparison (see Table 3) and covariate-adjusted analyses to examine whether cohort differences remained significant after accounting for demographic variation between groups.

Context of the research

The university where this research was conducted is based in New Zealand and offers both on-campus and online learning options. In 2023, 57% of students were enrolled in online study, while the remaining 43% attended one of the university's physical campuses.

To facilitate OPEs, the university used a commercial cloud-based proctoring service integrated with its Moodle learning management system. The same proctoring system was used in both 2020 and 2023. This live proctoring system required students to verify their identity using photo ID and activate their webcam and microphone. During the exam, the software recorded their screen, video and audio. Students had to complete these authentication steps before beginning the exam. Any handwritten work produced during

the exam had to be scanned and uploaded at the end. Certified proctors reviewed the recordings for any breaches of academic integrity. Support was available via phone from both university staff and the proctoring provider in case students experienced issues during their exam.

Before the exam period, students could complete a practice OPE in Moodle to familiarise themselves with the process and test that their devices met the technical requirements. Students were allowed multiple attempts at the practice test. Online troubleshooting resources were provided, and university staff were available to assist with any issues during this preparation phase.

Exam formats varied by course and included multiple choice, short answer, essay and calculation-based questions. Typically, students downloaded exam files containing the questions and answer templates, completed their responses and uploaded the files before the exam deadline.

Survey

The same online survey that was developed for the 2020 study was used again with a few minor changes (Hartnett et al., 2023). The survey included a broad set of demographic questions alongside items exploring ease of use of technologies employed in OPEs, confidence in using these technologies, experiences of and attitudes towards OPEs and the support students accessed. Demographic data covered age, gender, ethnicity, study location and mode, prior OLE and access to Internet and devices.

Students were then asked to reflect on one specific course that included an OPE. Students could repeat the course-related questions for additional courses that included an OPE. Consequently, demographic characteristics are reported at the student level, whereas OPE experience measures are reported at the course-response level. This section used statements adapted from the technology acceptance model to measure perceived ease of use (PEU) (Davis, 1989). The PEU scale, originally developed by Selim (2003), was modified slightly to suit the context and included an additional item about the flexibility of the technology. Responses were recorded on a 7-point Likert scale from *strongly disagree* to *strongly agree*.

Confidence in using the technology was measured using a scale informed by the Compeau and Higgins (1995) computer self-efficacy framework. Students rated their confidence on a sliding scale from 0 (*not at all confident*) to 100 (*completely confident*), with a *not applicable* option available. To explore students' experiences of and attitudes towards OPEs, the survey included a range of statements drawn from assessment literature (Huda et al., 2020; Myyry & Joutsenvirta, 2015; Stödberg, 2012). These were rated using the same 7-point Likert scale and included a *not applicable* option. The final section included an open-ended question asking whether students had accessed support before or during their OPE, and if so, what kind and why.

Ethics and consent

Ethics approval for this study was granted by the University Human Research Ethics Committee (ethics notification 4000027801). Participants accessed an information sheet prior to the online survey, and completion of the survey constituted implied consent. A voluntary prize draw (two vouchers worth $200 each) was administered via a separate form that was not linked to survey responses. All data were analysed anonymously and stored securely with restricted access.

Response rate

All students in courses with a scheduled OPE at the end of Semester 1, 2023, were invited to take part in the anonymous survey in August of 2023. An invitation to complete the student survey (containing a link to the online survey) was successfully sent to 3,340 unique email addresses at the beginning of August 2023. The survey was hosted in Qualtrics. The survey remained open for 1 month, and a total of 661 responses from unique respondents were received, representing a response rate of 19.8% of invited students. Of those, 591 were valid responses (i.e., they had completed more than the demographics section). Students could complete the survey more than once if they were studying multiple courses with

OPEs. This resulted in 701 unique responses about courses with OPEs. Of these, 503 students reported on one OPE, 73 students reported on two OPEs, nine students reported on three OPEs, five students reported on four OPEs and one student reported on five OPEs. This compares to the 2020 data with 761 unique responses about courses with OPEs. Of these, 741 students reported one OPE and 20 students reported two OPEs, yielding 761 course-level responses.

Data analysis

After the data were cleaned for invalid responses, descriptive statistics (frequency counts and percentages) were generated from the full set of 701 course-level responses from 2023 and 761 course-level responses from 2020 relating to courses with OPEs. Because students could contribute responses for more than one course, the primary unit of analysis for OPE experience measures was the course-level response. Blank responses and "not applicable" responses were excluded from the data analysis. Where appropriate, percentages have been rounded to the nearest whole percentage. Measures that use *disagree* (*somewhat disagree*, *disagree* and *strongly disagree*) and *agree* (*somewhat agree*, *agree* and *strongly agree*) scales have been aggregated for ease of interpretation. To investigate participants' responses, mean scores were calculated for PEU, confidence (CONF) and two factors derived from the experiences of and attitudes towards assessment (EATA) scale: OPE experiences and acceptability and OPE readiness and support. Differences between the 2020 and 2023 cohorts were examined using linear mixed models. Initial models included cohort as a fixed effect to examine unadjusted differences between cohorts. Subsequent models incorporated age, gender, ethnicity, study pattern, online learning experience (OLE) and mode of study as covariates to examine whether cohort differences remained after accounting for differences in cohort composition. OLE was included as a three-level categorical variable representing less than 1 year, 1 to 2 years and more than 2 years of OLE. Student identifier was specified as a random effect in all models to account for clustering arising from multiple course-level responses contributed by the same student. Tables 5 through 8 report course-level descriptive results, whereas Tables 4 and 9 report clustering-adjusted inferential analyses.

Cronbach's alpha scores were calculated to investigate the internal consistency of each scale. The PEU scale consisted of 7 items ($\alpha = 0.96$), the CONF scale consisted of 9 items ($\alpha = 0.82$) and the EATA scale consisted of 19 items. No items were removed from the scales apart from EATA where measures indicated removal of three specific items would improve internal consistency ($\alpha = 0.95$). The three items removed were "The OPE was more stressful than an end of course paper-based exam", "It took longer for me to complete the OPE than I was expecting" and "An OPE provided greater opportunities for cheating". Although removal of these items improved internal consistency, it also narrowed the content represented within the EATA scale. The retained items placed greater emphasis on positive evaluations of OPEs, including acceptability, readiness and support, and may under-represent negative aspects of the OPE experience such as stress, completion time and perceived opportunities for cheating.

The EATA scale was developed specifically for this study, as no existing validated instrument adequately captured the dimensions of interest. To examine the scale's underlying structure, a principal axis factor analysis with oblimin rotation was conducted on the remaining 16 items using the pooled data ($N = 1,024$). To assess the stability of the factor structure across cohorts, separate exploratory factor analyses were also conducted for the 2020 and 2023 data sets. Both analyses produced the same two-factor solution and a comparable pattern of item loadings, supporting the comparability of the retained factors across cohorts.

A further item ("I felt less stressed knowing that I could restart the OPE") was subsequently removed due to equal cross-loading on both factors, yielding a 15-item solution. The Kaiser–Meyer–Olkin measure confirmed sampling adequacy (KMO = .948) and Bartlett's test of sphericity was significant, $\chi^2(105) = 10,177.69$, $p < .001$. Two factors were retained based on initial eigenvalues exceeding 1.0 (Factor 1 = 8.02; Factor 2 = 1.36) and inspection of the scree plot, together accounting for 57.13% of the variance after extraction. The factors were strongly correlated ($r = .747$), confirming the appropriateness of oblique rotation. Factor 1, OPE experiences and acceptability (8 items), had pattern loadings ranging from .42 to .97 ($\alpha = .925$). Factor 2, OPE readiness and support (7 items), had pattern loadings ranging from .55 to .79

(α = .871). Pattern matrix loadings and communalities are reported in Table 1. Although separate cohort analyses produced comparable factor structures, formal measurement invariance testing was not undertaken. Comparisons between cohorts should therefore be interpreted as comparisons based on a stable and comparable item structure rather than definitive evidence of full measurement equivalence.

Table 1
Pattern matrix and communalities for principal axis factor analysis of the EATA scale pooled data (N = 1,024)

Item	Factor 1	Factor 2	h^2
Factor 1: OPE experiences and acceptability			
I enjoyed being assessed via the OPE	.97		.78
Being assessed via the OPE better prepared me for life/work after study	.86		.65
I believe it was a good idea to use proctoring technology	.84		.76
The OPE was an appropriate way to assess this course	.82		.75
Having an OPE was acceptable to me	.81		.76
I was comfortable being observed/having my performance recorded on camera	.69		.48
I think there was greater flexibility using an OPE	.65		.59
I preferred to type rather than handwrite my responses	.42		.30
Factor 2: OPE readiness and support			
The information provided by the University about the OPE was adequate		.79	.67
The support I was given during the OPE was adequate		.79	.59
The instructions about what resources I could use were clear		.76	.55
I was able to solve any technical issues that arose with the proctoring technology		.72	.46
I had access to appropriate technology to complete the OPE		.58	.35
I was comfortable uploading materials associated with the OPE		.56	.49
The time of day for the OPE was acceptable to me		.55	.40
Eigenvalue	8.02	1.36	
% variance extracted	50.86	6.27	
Cronbach's α	.925	.871	

Note. Extraction method: principal axis factoring. Rotation method: oblimin with Kaiser normalisation. Loadings < .30 are suppressed. h^2 = communality. Factor correlation r = .747.

To determine the most appropriate inferential statistical tests for further analysis, a series of one-sample Kolmogorov-Smirnov (KS) tests were conducted to examine the parametric nature of the data. For all measures, the KS test statistics were significant, indicating that the data were not normally distributed (see Table 2).

Table 2
KS test results

Construct	2020			2023		
	KS	*df*	Sig.	KS	*df*	Sig.
PEU	0.076	659	<.001	0.121	655	<.001
CONF	0.046	617	.004	0.060	597	<.001
OPE experiences and acceptability	0.078	611	<.001	0.082	587	<.001
OPE readiness and support	0.059	607	<.001	0.120	584	<.001

Although KS tests indicated statistically significant departures from normality for all measures across both cohorts, the large sample sizes and robustness of these analyses supported the use of linear mixed models for subsequent analyses (Rana et al., 2016).

Demographics of participants

The demographics of survey participants for 2020 and 2023 are summarised in Table 3.

Table 3
Student-level demographic characteristics of OPEs for 2020 and 2023

			2020			2023	
Variable	Categories	*N*	*n*	%	*N*	*n*	%
Age[a]	25 years or less	741	323	43.6	*590*	*327*	55.4
	26–40 years		287	38.7		203	34.4
	41 years or more		131	17.7		60	10.2
Gender[b]	Male	735	185	25.2	580	190	32.8
	Female		550	74.8		390	67.2
Ethnicity[c, d]	Māori	715	66	9.2	588	48	8.2
	Pacific Peoples		41	5.7		26	4.4
	Asian		196	27.4		119	20.2
	Other		66	9.2		81	13.8
	Pākehā/NZ European		346	48.4		291	49.5
	Prefer not to say					23	3.9
Location[e]	New Zealand	740	662	89.5	589	549	93.2
	Overseas		78	10.5		40	6.8
Community type	City	739	505	68.3	580	390	67.2
	Small town		130	17.6		114	19.7
	Rural area		104	14.1		76	13.1
Study pattern[f]	Full time	731	401	54.9	589	377	64.0
	Part time		330	45.1		212	36.0
Internet access	Broadband	620	545	87.9	458	398	86.9
	Rural Internet		75	12.1		60	13.1
OLE	Inexperienced (<1 year)	740	386	52.2	548	219	40.0
	Some experience (1–2 years)		206	27.8		131	23.9
	Experienced (>2 years)		148	20.0		198	36.1
Mode of study	On campus	741	247	33.3	588	252	42.9
	Online		494	66.7		336	57.1
Exam location	Where I normally live	694	626	90.2	566	481	85.0
	Friend or family member's house		42	6.1		26	4.6
	University campus		26	3.5		59	10.4

[a]University student population statistics report (2020: 57.5%, 2023: 58.6%) were over 25 years of age.
[b]University 2023 student population statistics report (2020: 64%, 2023: 64.8%) were female.
[c]University 2023 student population statistics report (2020: 11%, 2023: 12.3%) Māori and (2020: 5%, 2023: 5.6%) Pacific. In the survey, respondents could select more than one ethnic group. These responses were prioritised according to Ministry of Education (2020) protocols, where Māori are first priority, followed by Pacific Peoples, Asian, Other and New Zealand European, so that each individual was assigned to one ethnic group category for ease of statistical analysis.
[d]Māori (indigenous people of New Zealand) and Pacific Peoples are identified as priority learners by the New Zealand Ministry of Education (2021).
[e]Overseas locations: China (2020: 29, 2023: 14); Australia (2020: 15, 2023: 10); UK (2023: 4); UAE (2023: 2); Vietnam (2023: 2); and 1 each in Fiji, Korea, Kuwait, Malaysia, Norway, Qatar, Singapore, Taiwan, and Uruguay (2020); and Egypt, Germany, Singapore and South Africa (2023). Four did not specify their location.
[f]University 2023 student population statistics report (2020: 39%, 2023: 38.9%) full-time and (2020: 61%, 2023: 61.1%) part-time.

Results

The following section presents the key findings from the 2023 phase of the study and compares them with those from 2020 to explore how students' experiences with OPEs differed between the two time points. Detailed findings from the 2020 study have been reported elsewhere (Hartnett et al., 2023). The analysis focuses on differences in students' CONF, PEU of the proctoring technology, their OPE experiences and acceptability and OPE readiness and support (see Table 4).

Table 4
Comparison of OPE-related course-level measures between 2020 and 2023

Construct	2020 mean	2023 mean	*F*	*df*	Sig.	Cohen's *d*
PEU	4.293	4.644	13.890	(1, 1216.668)	<.001	.22
CONF	56.390	60.543	7.666	(1, 1121.675)	.006	.19
OPE experiences and acceptability	4.002	4.349	11.591	(1, 1106.587)	<.001	.22
OPE readiness and support	4.702	5.233	42.459	(1, 1101.876)	<.001	.38

Linear mixed model analyses indicated that students in 2023 reported significantly higher PEU, CONF, *OPE experiences and acceptability* and *OPE readiness and support* than students in 2020 (Table 4). Effect sizes were small for PEU (*d* = 0.22), CONF (*d* = 0.19) and *OPE experiences and acceptability* (*d* = 0.22), and small-to-moderate for OPE readiness and support (*d* = 0.38). To further explore the nature of these differences, Tables 5–8 present the distribution of responses for individual items within each construct.

PEU

Comparing PEU results from 2020 and 2023 (see Table 5) showed an increase in the number of respondents who agreed that the proctoring technology was easy to use, clear and understandable, convenient to access, easy to get the information needed and was easy to access from their chosen location.

Table 5
PEU course-level descriptive comparison for 2020 and 2023

Item	Year	Disagree	Neutral	Agree	*n*
Using the proctoring technology for the OPE was easy for me	2020	36.0%	15.3%	48.6%	658
	2023	29.0%	5.5%	65.5%	655
It was easy for me to get the proctoring technology for the OPE to do what I wanted it to do	2020	31.2%	16.0%	52.8%	648
	2023	26.9%	6.2%	67.0%	648
I found the proctoring technology for the OPE easy to use	2020	33.6%	14.8%	51.5%	648
	2023	29.1%	6.2%	64.8%	647
I found the proctoring technology for the OPE flexible to interact with	2020	38.1%	21.1%	40.8%	645
	2023	32.0%	14.9%	53.1%	646
My interaction with the proctoring technology for the OPE was clear and understandable	2020	32.0%	17.5%	50.5%	646
	2023	25.6%	10.4%	64.0%	645
I found it easy to get the information I needed about the proctoring technology for the OPE	2020	27.8%	16.1%	56.1%	644
	2023	26.2%	10.4%	63.5%	646
It was convenient to access the proctoring technology for the OPE from my chosen location	2020	24.1%	17.3%	58.5%	646
	2023	24.8%	9.9%	65.3%	645

CONF

Comparing CONF levels from 2020 and 2023 (see Table 6) showed that the number of respondents who rated themselves as highly confident increased and the number of respondents who rated themselves as having minimal CONF decreased across most items.

Table 6
CONF course-level descriptive comparison for 2020 and 2023

Year	Minimal confidence (0–25)	Low confidence (26–50)	Reasonable confidence (51–75)	High confidence (76–100)
2020	28.2%	17.5%	19.1%	35.2%
2023	25.3%	12.1%	20.5%	42.1%

OPE experiences and acceptability

Agreement with most OPE experiences and acceptability items was higher in the 2023 cohort than in 2020 (see Table 7). The largest differences were for flexibility (2020: 46%, 2023: 61.5%) and preference for typing over handwriting (2020: 49%, 2023: 68%). Acceptability (2020: 54%, 2023: 60%) and appropriateness (2020: 53%, 2023: 58.5%) of the OPE were also higher in 2023, as was perceived value for life and work preparation (2020: 31.7%, 2023: 38.7%). The exception was comfort with being observed or recorded, where agreement was lower in the 2023 cohort (2020: 46%, 2023: 40%). A clustering-adjusted analysis of this item indicated that the difference between cohorts was statistically significant ($F(1, 1062.286) = 6.620$, $p = .01$, $f^2 = .006$), although the effect was very small in magnitude. In other words, the 2023 cohort were less comfortable being observed or recorded during an OPE than the 2020 cohort. Enjoyment of OPE assessment remained the lowest-rated item in both cohorts, with fewer than 40% of respondents in agreement at either time point.

Table 7
OPE experiences and acceptability course-level descriptive comparison for 2020 and 2023

Item	Year	Disagree	Neutral	Agree	*n*
Having an OPE was acceptable to me	2020	38.9%	7.4%	53.6%	606
	2023	30.9%	9.5%	59.7%	580
The OPE was an appropriate way to assess this course	2020	37.6%	9.1%	53.3%	604
	2023	32.4%	9.1%	58.5%	581
I enjoyed being assessed via the OPE	2020	48.7%	14.6%	36.8%	604
	2023	44.6%	17.7%	37.7%	576
Being assessed via the OPE better prepared me for life/work after study than a paper-based exam	2020	47.1%	21.2%	31.7%	599
	2023	36.5%	24.8%	38.7%	564
I believe it was a good idea to use the proctoring technology for the OPE	2020	36.6%	17.2%	46.2%	587
	2023	35.9%	14.0%	50.1%	579
I think there was greater flexibility using an OPE than a paper-based exam	2020	41.4%	12.7%	46.0%	607
	2023	23.7%	14.8%	61.5%	561
I preferred to type rather than handwrite my responses to the OPE	2020	38.5%	12.6%	48.8%	602
	2023	18.6%	13.3%	68.1%	555
I was comfortable being observed/having my performance recorded on camera for the OPE	2020	39.0%	15.3%	45.7%	567
	2023	47.3%	12.8%	39.9%	579

OPE readiness and support

Agreement with all OPE readiness and support items was higher in the 2023 cohort than in 2020 (see Table 8). The largest difference was for time of day acceptability (2020: 57%, 2023:75%). Comfort with uploading materials (2020: 52%, 2023: 62%) and adequacy of information provided by the University (2020: 58%, 2023: 66%) also showed notable differences. Access to appropriate technology was the

highest-rated item in both cohorts (2020: 77.5%, 2023: 79%), with minimal difference between years. Adequacy of support during the OPE showed the smallest difference (2020: 56%, 2023: 58%). Overall, the 2023 cohort reported more positive perceptions across all contextual and support dimensions.

Table 8
OPE readiness and support course-level descriptive comparison for 2020 and 2023

Item	Year	Disagree	Neutral	Agree	*n*
I was comfortable uploading materials associated with the OPE if necessary	2020	35.6%	12.3%	52.1%	570
	2023	24.7%	13.1%	62.2%	502
The information provided by the University about the OPE was adequate	2020	25.6%	16.4%	58.0%	598
	2023	20.7%	13.0%	66.3%	575
The support I was given during the OPE was adequate	2020	25.1%	18.9%	55.9%	549
	2023	22.4%	19.5%	58.1%	518
I had access to appropriate technology to complete the OPE	2020	13.7%	8.8%	77.5%	600
	2023	15.0%	6.0%	79.0%	566
I was able to solve any technical issues that arose with the proctoring technology for the OPE	2020	27.7%	16.8%	55.6%	531
	2023	19.0%	19.0%	61.9%	473
The time of day for the OPE was acceptable to me	2020	33.2%	9.9%	56.8%	593
	2023	12.8%	11.7%	75.4%	562
The instructions about what resources I could use during the OPE were clear	2020	23.1%	9.2%	67.7%	589
	2023	20.4%	6.0%	73.6%	569

Adjusted cohort differences in OPE constructs

Further analysis was undertaken to examine whether cohort differences in PEU, CONF, *OPE experiences and acceptability* and *OPE readiness and support* remained significant after controlling for demographic differences between the 2020 and 2023 cohorts. Because some students contributed responses for more than one course containing an OPE, adjusted analyses were conducted using linear mixed models with student identifier specified as a random effect. Cohort was included as a fixed effect, while age, gender, ethnicity, study pattern, OLE and mode of study were included as covariates. This approach simultaneously accounts for demographic differences between cohorts and clustering arising from multiple course-level responses contributed by the same student (see Table 9).

Table 9
Covariate-adjusted linear mixed model results for OPE constructs

Construct	Estimated mean difference	SE	*F*	*df*	*p*	f^2
PEU	-.496	.107	21.34	(1, 1052.10)	<.001	.020
CONF	-5.134	1.685	9.29	(1, 967.16)	.002	.010
OPE experiences and acceptability	-.578	.114	25.89	(1, 957.08)	<.001	.027
OPE readiness and support	-.703	.091	59.72	(1, 956.41)	<.001	.063

Note. Mean differences represent the estimated adjusted difference between the 2020 and 2023 cohorts (2020 minus 2023) after adjustment for age, gender, ethnicity, study pattern, OLE and mode of study. Negative values therefore indicate higher adjusted scores in 2023. Models were estimated using linear mixed models with student identifier specified as a random effect to account for clustering of course-level responses within students. Effect sizes are reported as Cohen's f^2. Unlike Table 4, which reports Cohen's *d* for unadjusted cohort comparisons, Table 9 reports Cohen's f^2 derived from the covariate-adjusted linear mixed models.

Cohort differences remained significant across all four constructs after adjustment for demographic characteristics and clustering of responses within students (Table 9). The largest adjusted difference was observed for *OPE readiness and support* (mean difference = -0.703, $F(1, 956.41) = 59.72$, $p < .001$, $f^2 = .063$), followed by *OPE experiences and acceptability* (mean difference = -0.578, $F(1, 957.08) = 25.89$, $p <$

.001, f^2 = .027). Smaller differences were observed for PEU (f^2 = .020) and CONF (f^2 = .010). Across all constructs, 2023 students reported more positive ratings than 2020 students after controlling for age, gender, ethnicity, study pattern, OLE, mode of study and clustering within students. Effect sizes were generally small, although the effect for OPE readiness and support was small-to-moderate (f^2 = .063).

The persistence of cohort differences after adjustment for demographic characteristics and clustering within students suggests that the more positive ratings observed in 2023 were not explained solely by differences in cohort composition.

University support

An analysis of the qualitative data from an open-ended question asking whether students had accessed support before or during their OPE, and if so, what kind and why, expands on the results of the *OPE readiness and support factor*. Comparisons between students' perceptions of university support for OPEs for 2020 and 2023 highlight several differences (see Table 10). In terms of the type of support sought, more than two thirds of students (69%) asked for help related specifically to their OPE exam in 2020, whereas this was lower at 22% in 2023 when more than one third of students (35.5%) indicated that they did not require support. The primary reasons for seeking support were similar in 2020 and 2023, with the most notable differences being a greater percentage of time expiration problems in 2020 compared to 2023, and more ID orlogin problems and Internet connection problems in 2023 compared with three years earlier.

Student satisfaction with the support received was broadly similar across cohorts. However, responses shifted modestly from 52% negative or unresolved experiences in 2020 to 52% positive or resolved experiences in 2023.

Table 10
Comparison between students' perceptions of university support for OPEs for 2020 and 2023

Theme	Sub-theme	2020 Frequency count	*n*	2023 Frequency count	*n*
Type of support		132	132	197	197
	Exam support	91 (69%)		43 (22%)	
	Proctoring technology support	18 (13.5%)		33 (17%)	
	Other support resources	9 (7%)		6 (3%)	
	Not specified or not clear	7 (5%)		27 (13.5%)	
	Lecturer or course administrator	6 (4.5%)		18 (9%)	
	Support not required	1 (1%)		70 (35.5%)	
Reason for seeking support		216	216	120	120
	Time expired	45 (21%)		3 (2.5%)	
	Clarify instructions or set up exam	40 (18.5%)		21 (17.5%)	
	Submission process other than time expired	37 (17%)		3 (2%)	
	Proctoring technology problem	35 (16%)		25 (21%)	
	Software problem other than proctoring technology	21 (10%)		14 (12%)	
	Internet connection or system responsiveness	13 (6%)		18 (15%)	
	ID or login problem	11 (5%)		21 (17.5%)	
	Hardware problem	9 (4.2%)		8 (6.5%)	
	Technical problem unspecified	5 (2.3%)		7 (6%)	
Satisfaction with support		67	67	54	54
	Positive, or problem resolved	32 (48%)		28 (52%)	
	Negative, or problem unresolved	35 (52%)		26 (48%)	

Discussion

The findings from this repeated cross-sectional study provide evidence of how student experiences with OPEs differed between two independent cohorts surveyed at one university in 2020 and 2023. Taken together, these findings suggest that improvements in student experience were driven by a combination of greater familiarity with the technology and a more developed institutional infrastructure for supporting OPE delivery.

Across all four constructs, the pattern of improvement is consistent and mutually reinforcing. PEU, CONF, OPE experiences and acceptability and OPE readiness and support were all significantly higher among 2023 students, and are consistent with the broader narrative that OPEs became more familiar, better supported and better understood between the two cohort time points. Improvements in the information provided to students, the availability of practice exams and troubleshooting resources are likely contributors to higher PEU scores (Cramp et al., 2019; Heidari et al., 2021; Jaap et al., 2021), while the normalisation of digital assessment practices over time may account for the increase in CONF and overall acceptance (Ali & Al-Dmour, 2021; Lorenza & Carter, 2021; Raman et al., 2021). OPE readiness and support showed the largest adjusted cohort difference of all four constructs, and while causal relationships cannot be established, this finding is consistent with institutional improvements to resources, technical support, and access implemented between 2020 and 2023.

However, discomfort with surveillance was more pronounced among the 2023 cohort, even after accounting for clustering within students ($F(1, 1062.29) = 6.62$, $p = .01$, $f^2 = .006$), although the magnitude of this effect was very small. This finding stands in contrast to the generally more positive ratings reported for OPE experiences and acceptability overall. One possible interpretation is that, as OPEs have become more routine, students became more attentive to the privacy implications of proctoring systems and the collection and storage of assessment data. That this discomfort coexists with broadly positive attitudes is consistent with the trade-off identified by Mutimukwe et al. (2026), where students weighed privacy concerns against flexibility and convenience rather than rejecting OPEs outright. It highlights an important distinction that acceptance does not necessarily mean satisfaction. The increase in surveillance discomfort between cohorts points to a need for greater transparency about how proctoring data is managed and more deliberate attention to student privacy in OPE policy and practice.

The persistence of significant cohort differences across all four constructs after controlling for age, gender, ethnicity, study pattern, OLE, and mode of study is an important finding. It confirms that the improvements observed between 2020 and 2023 cannot be attributed simply to the differing demographic composition of the two groups. This is notable given that OLE and mode of study were themselves significant predictors of PEU, CONF and OPE readiness and support, consistent with prior research demonstrating that students with greater OLE and those studying fully online tend to report more positive technology-mediated OPE experiences (Hartnett et al., 2023; Henderson et al., 2024). That the cohort effect persisted after these factors were controlled suggests that something beyond accumulated experience and study context was driving the improvement. The 2020 cohort encountered OPEs for the first time during the disruption of the COVID-19 pandemic, when online assessment was new, institutional processes were still developing and student anxiety was high. The more positive responses of the 2023 cohort likely reflect not only demographic differences but also the considerably more stable conditions under which that cohort was assessed.

Conclusion

The findings from this study document meaningful differences in student experiences with OPEs between 2020 and 2023, with improvements observed across PEU, CONF, OPE experiences and acceptability and OPE readiness and support. Covariate-adjusted analyses indicated that these differences remained after accounting for demographic characteristics and clustering within students and were therefore not solely an artefact of demographic composition, most plausibly reflecting a combination of institutional maturation in OPE delivery, broader normalisation of proctored assessment, and the more stable

conditions under which the 2023 cohort was assessed compared with the disruption of the COVID-19 pandemic. The one notable exception to the pattern of improvement is increased discomfort with surveillance among 2023 students, although the magnitude of this effect was very small. This may reflect greater awareness of the privacy implications of proctoring technology even as overall attitudes were more positive.

As with all research, limitations must be acknowledged. The student sample is not fully representative, and the reliance on self-reported data may introduce bias. The repeated cross-sectional design limits the ability to establish individual-level change or causal relationships between variables. In addition, although separate cohort analyses supported the comparability of the factor structure across cohorts, formal measurement invariance testing was not undertaken. Despite these limitations, the study provides valuable insight into population-level trends in student experiences with OPEs during a period of significant institutional and sectoral change. The findings inform policy and practice decisions about the ongoing use of OPEs in higher education and underscore the importance of continuous evaluation particularly regarding student privacy and institutional transparency of proctored assessment.

Author contributions

Maggie Hartnett: Conceptualisation, Investigation, Writing – original draft, Writing – review and editing; **Peter Rawlins**: Investigation, Formal analysis, Writing – review and editing; **Philippa Butler**: Investigation, Data curation, Formal analysis, Writing – review and editing.

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Please cite as: Hartnett, M., Rawlins, P., Butler, P. (2026). Changing student experiences with online proctored exams: Comparing 2020 and 2023 cohorts. *Australasian Journal of Educational Technology*, 42(5), 147–161. https://doi.org/10.14742/ajet.11439