Check for updates

Received: 4 January 2023 | Revised: 21 July 2023 | Accepted: 24 September 2023

DOI: 10.1111/jcal.12888

ORIGINAL ARTICLE

Journal of Computer Assisted Learning WILEY

# Online exams in higher education: Exploring distance learning students' acceptance and satisfaction

Maria Aristeidou[1] | Simon Cross[1] | Klaus-Dieter Rossade[2] | Carlton Wood[3] | Terri Rees[1] | Patrizia Paci[3]

[1]Institute of Educational Technology, The Open University, Milton Keynes, Buckinghamshire, UK

[2]Faculty of Wellbeing, Education and Language Studies, The Open University, Milton Keynes, Buckinghamshire, UK

[3]Faculty of Science, Technology, Engineering & Mathematics, The Open University, Milton Keynes, Buckinghamshire, UK

**Correspondence**
Maria Aristeidou, Institute of Educational Technology, The Open University, Walton Hall, Milton Keynes, Buckinghamshire, MK7 6AA, UK.
Email: maria.aristeidou@open.ac.uk

## Abstract

**Background:** Research into online exams in higher education has grown significantly, especially as they became common practice during the COVID-19 pandemic. However, previous studies focused on understanding individual factors that relate to students' dispositions towards online exams in 'traditional' universities. Moreover, there is little knowledge on university distance learning students' experience of transitioning from in-person to online exams.

**Objectives:** This study investigates the acceptance and satisfaction of university distance learning students in their transitioning from in-person to online exams, through multiple factors.

**Methods:** We employed a mixed-methods study to understand the relationship between assessment and online exam factors (e.g., revision and online exam satisfaction, assessment competencies, invigilation acceptance, exam anxiety and workspace satisfaction). Cluster analysis and interview data contributed to our understanding of students who are 'strongly positive' and 'less positive' towards online exams.

**Results and Conclusions:** Our findings highlight the overall importance of increasing student confidence by building their assessment competencies throughout their studies and familiarising them early with the technologies and formats to be used in the actual exam. We also shed light on particular student characteristics that relate to reduced online exam acceptance, such as students with disabilities, caring responsibilities and mental health issues, or students who lack access to the necessary technology.

**Implications:** The findings and recommendations of this research contribute to the wider agenda of designing fair and trustworthy online assessment, including exams, for the future.

KEYWORDS
distance learning, higher education, online assessment, remote exams, student satisfaction, university exams

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.
© 2023 The Authors. *Journal of Computer Assisted Learning* published by John Wiley & Sons Ltd.

## 1 | INTRODUCTION

Online remote assessment has become increasingly popular across educational contexts, from certification programmes to distance and in-person higher education. Two common approaches include remote auto-graded assessments and peer assessments. Auto-graded assessments (e.g., multiple-choice questions) offer scalability and efficiency in evaluation (Grainger, 2013). Peer assessment allows learners to evaluate and grade each other's work based on predefined rubrics (Bali, 2014). Auto-graded approaches are mainly used in Massive Open Online Courses (MOOCs), which involve large student cohorts. Nevertheless, Costello et al. (2018) highlight the challenge of creating and grading valid auto-graded assessments, emphasising the serious effects of ineffective design on learner outcomes and course trustworthiness.

On some occasions, remote formative and summative assessments are combined with classroom performance and in-person assessment approaches. These hybrid methods can be encountered in courses with fewer students, such as Small Private Online Courses (SPOCs), which offer specialised training to a targeted audience. These hybrid approaches are also utilised in some university classrooms with hybrid provision. According to Kaplan and Haenlein (2016), this hybrid assessment strategy, usually involves interaction with tutors and ensures integrity and validity.

Distance learning universities, catering to small and large cohorts, are well-known for implementing remote assignments, especially for formative assessment purposes. This approach is driven by the diverse characteristics of learners in these institutions, encompassing varying locations and personal circumstances, which pose challenges in organising regular on-site learning and assessment activities. Traditionally, many distance learning universities conducted in-person final exams for summative assessment. However, in response to the COVID-19 pandemic, these institutions, like traditional universities, swiftly shifted to a fully remote assessment model.

According to Dominguez-Figaredo et al. (2022), university distance learning students who experienced a sudden transition from in-person to remote exams reported an overall increase in academic performance. However, Aristeidou and Cross (2021) note how this rapid shift has impacted distance students' assessment-related activities, such as revision, practice quizzes and assignment preparation. These challenges arise from difficulties in managing their workload and the significant influence of personal circumstances on their studies.

Limited research specifically focuses on transitioning from in-person to online exams in distance learning universities (Aristeidou & Cross, 2021; Dominguez-Figaredo et al., 2022). Previous research on online assessment in distance learning primarily examines students' experiences with the existing online assessment model rather than the transition to online exams. **This research gap forms our study's first objective (O1).** Distance learning universities provide accessible and flexible learning opportunities for individuals with diverse educational backgrounds, ages, and career goals who cannot attend traditional universities. Distance learning students previously sat in-person exams, like students in traditional universities, making the shift to online exams a new and potentially unfamiliar experience.

It is important to note that before and during the COVID-19 pandemic, some universities that typically offered in-person education conducted investigations specifically focused on students' satisfaction with the transition to online assessment methods. These investigations have shed light on various factors associated with the transition, providing insights into students' challenges, successes, and overall satisfaction with the shift to online exams.

Pre-pandemic, Topuz and Kinshuk (2021) systematically reviewed 61 papers from 2002 to 2019 to understand students' views on remote assessment. They found that positive orientations included that online exams do not increase anxiety and that students want to use this assessment format in the future—the most prominent negative attitude concerned technical issues during the exam. Cheating and plagiarism produced opposite views, with students splitting between those who perceive the easiness of cheating during remote exams and those who believe the opposite is true. Concerning learning efficacy, students reported that online assessment helps the learning process better.

Post-pandemic studies on transitioning from in-person to online exams align with Topuz and Kinshuk's (2021) identified areas. Online exams have been associated with stress and anxiety among students. Factors such as insufficient exam time, time limits, and the inability to backtrack questions contribute to increased pressure (Bayar & Alimcan, 2021; Novick et al., 2022). The design and format of online exams also play a role, with visible clocks and oral formats causing more stress (Novick et al., 2022). Studies have suggested that exam timing, location, and question order flexibility can reduce student anxiety (Sorensen, 2013; Stowell & Bennett, 2010).

Concerns have arisen about the validity of unsupervised open-book online exams for degree accreditation (Jha et al., 2022). The challenge lies in finding a balance between invigilation technology, preventing cheating, and ensuring a positive student experience (Choi et al., 2020). Invigilation platforms can increase exam intensity and nervousness, especially when accompanied by poor-quality technologies, and invade privacy (Choi et al., 2020; Novick et al., 2022). However, invigilating itself does not necessarily indicate lower academic performance (Kharbat & Abu Daabes, 2021). It is crucial to prioritise academic integrity and consider flexible invigilating solutions that meet security needs while promoting a positive exam environment (Hilliger et al., 2022; Khalil et al., 2022).

Factors related to students' everyday life and circumstances, such as internet access and home environment quality, can create equity issues in online exams (Choi et al., 2020; Elsalem et al., 2020). Field of study and gender have also been found to impact stress levels during online exams (Elsalem et al., 2020). Students may have preferences for certain interface features, such as font type and colour, which should be considered to provide variation and choice (Karim & Shukur, 2016).

Despite the challenges and dissatisfaction with online exams, students' preference across studies was towards online over in-person exams (Topuz & Kinshuk, 2021). **Although students' experiences and**

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

**views show that they appreciate online exams, it is not understood what factors determine this disposition—addressing this gap is the second objective of this study (O2).** Most studies either investigate a single aspect of online exams (Choi et al., 2020) or a few aspects of online exams but not how these aspects relate to each other (Bayar & Alimcan, 2021; Novick et al., 2022). To this end, the current research aims to investigate the factors and student characteristics related to distance learning students' positive dispositions (acceptance and satisfaction) towards online exams. In particular, we aim to answer the following research questions (RQs): (1) What is the relationship among the different assessment and online exam factors (as identified from the literature review and our previous experience in distance learning?) (2) Are there distinct groups (profiles) of students with different views about online exams? If so, what is the relationship between the student profiles and student demographics, characteristics and views?

In this study, we offer the following contributions: (O1) a first study exploring distance learning students' acceptance and satisfaction when transitioning from in-person to online exams, (O2) a mixed-methods approach to explore factors that determine students' dispositions towards online exams. Our findings and recommendations may inform guidelines for designing fair and trustworthy online exam systems that students perceive positively and support them in feeling confident with the technical aspects of online exams.

## 2 | METHODS

### 2.1 | Mixed method explanatory design

This study employed a mixed-method explanatory design in which the qualitative data was built upon the initial quantitative results (Creswell et al., 2003). By employing a mixed method design, the authors complemented and explained quantitative data on students' acceptance and satisfaction with online exams, increasing the robustness of results. The authors followed a two-phase mixed methods design, starting with collecting and analysing quantitative data collected through a survey. The first phase was followed by subsequent collection and analysis of qualitative data through interviews that connected to and followed up the results of the first quantitative phase. The authors identified specific quantitative results that needed further explanation (e.g., differences among student groups) and sought to explain them by collecting qualitative findings.

### 2.2 | Context and settings

We explored university students' acceptance and satisfaction of online remote exams at The Open University (OU), an institution with a long tradition of distance learning in the UK. The OU supports a learning model that involves the delivery of courses via a virtual learning environment (VLE), online tutorials and small tutor groups. Pre-pandemic, courses predominantly comprised two elements: continuous assessment managed via the VLE and a final assessment that was either a face-to-face exam or some form of assignment or project work submitted via the VLE. Approximately 24% of courses ended with a face-to-face exam, but this component was removed during the pandemic and is currently being replaced, mainly with remote open book-style exams, with plans to implement an online exams model.

The current open book-style exam differed among faculties, schools and courses (reported in Cross et al., 2022). The most frequent exam activity for students in the Science, Technology, Engineering and Maths (STEM) faculty was equations and numerical workings, followed by short answer responses, multiple choice questions, and longer answer responses. Faculty of Social Sciences and Humanities (FASS) students engaged mainly in essays. Similarly, in the Faculty of Business and Law (FBL), students engaged in essays, followed by long answer activities, short answer activities and equations/numerical workings. In the Faculty of Wellbeing, Education, and Language Studies (WELS), students engaged in essays followed by answers to multiple-choice questions. Other exam activities involved self-reflection (all faculties), visual outputs such as drawings, photographs, and diagrams (STEM and FASS), recorded or live audios and translation (FASS). Many exam interactions required a 24-h submission window (39%), or they were timed to be completed within 2–4.5 h (37%). Other options were a 7-day or a 3-day submission window. There was no invigilation during the open book-style exams.

In this study, students were presented with the potential types of interactions (as explained above) and invigilation options about a future online exams model. As described previously, potential interactions, involved multiple choice questions, short answers, longer answers, equations or other numerical workings, producing oral outputs, producing visual outputs such as drawings, building a portfolio of work, translation, and self-reflection. Levels of flexibility for starting the exam included everyone in the module starting simultaneously, having the option to start over a 24-h period, and having the option to start over a 3–7-day period. Invigilation options included temporary restrictions such as locking own browsers, verifying identity via facial or voice recognition, verifying identity by showing an identity document and the potential for an invigilator to contact and confirm that the required student is taking the exam.

Students were asked to select their preferred options and complete the research instruments considering these options for a future online exams model. The responses to their preferred options are not recorded in this work; we rather focus on the overall acceptance and satisfaction of students with online exams (as a replacement for face-to-face exams). Students' views are expected to be informed by their previous experiences with online exams at the X university and the proposed future exam model.

### 2.3 | Recruitment

We recruited students of any year and faculty at the OU to participate in an online survey (Appendix A). A review exemption was obtained

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

from the OU's ethics committee, and participation in the survey was voluntary. The survey was administered between 24 February and 22 March 2022 to a random university-wide sample of students (sample: 10,000) and received 562 responses (response rate 5.6%). Such a response rate is similar to other studies with distance learners. Before initiating the analysis process, the dataset was anonymised on 1 April 2022. Students without experience with remote online exams were removed from the dataset resulting in the final sample of 190 participants.

## 2.4 | Survey

### 2.4.1 | Online exams survey scales

The scales for online exam experience, online exam revision experience and assessment competencies used in this study were taken from an existing survey developed by the SEFAR team at the OU (Cross et al., 2016). This survey was first tested in an institutional survey administered in 2015 ($n = 281$). Thirteen follow-up interviews helped validate some items and indicate how others could be revised. Of approximately 100 question items, around 30% were about revision and exams. The question items used in the original survey were, in part, developed from previously tested item constructs (Dermo, 2009; Gibbs & Dunbar-Goddet, 2007; Vattøy et al., 2021) and in part, composed of newly created items designed to probe additional themes such as anxiety (Falchikov & Boud, 2007), exam preparedness (Payne & Brown, 2011), and revision experience (Entwistle & Entwistle, 2003). The experience of revising for an exam is quite distinct from the experience of taking the exam, and the relationship between the two, where it exists at all, is not straightforward (Cross et al., 2016). The SEFAR survey instrument was revised, extended, piloted, and used again in 2020 ($n = 572$) (Cross et al., 2022). In addition to the scales described above, this survey developed an assessment competency (aka assessment literacy) scale of 14-items for a distance learning context drawing. This is built on various research findings (Smith et al., 2013). Internal factor analysis demonstrated that the scale was capable of discerning factors relating to assessment understanding, assessment judgement, and academic literacy. The invigilation acceptance scale was developed specifically for our research, and reliability was internally checked by experts in the research team.

### 2.4.2 | Preferences and personal circumstances

The survey also included questions about students' previous experience with online exams, availability and confidence in using technology, and personal circumstances. Their previous experience with online exams was measured through a 5-point Likert scale (1 = negative and 5 = positive) and then transformed into a binary variable (positive/non-positive). Technology-related responses were collected via a binary approach (yes/no) and related to whether they own a device with a webcam, they own a device with a microphone, they have broadband or 4G-quality internet connection, confidence in setting up and using technology, confidence in dealing with potential technical difficulties during the assessment, and quality or internet connection can be a barrier to online exams. Personal circumstances information was also collected via a binary approach (yes/no) by asking whether specific personal circumstances would be barriers to sitting online exams: these involved mental health issues, childcare responsibilities, other caring responsibilities and employment constraints.

### 2.4.3 | Demographics and characteristics

Further data regarding the survey respondents' demographics and background characteristics were retrieved from the university's database. Demographics included their gender (male/female), age (integer) and race (Black, Asian or Minor Ethnicity/BAME or non-BAME). Other information involved student characteristics such as declared disability (yes/no), faculty (FASS/STEM/WELS/FBL), whether they obtained A Levels (traditional subject-based qualifications that are offered by schools and colleges in the UK and can lead to university or further studies) (yes/no), whether they have a qualification intention (yes/no), and their latest exam scores (integer).

### 2.4.4 | Exploratory factor analysis

The validity of variables (indicators) that measured each scale relating to students' online exam acceptance and satisfaction were selected and evaluated through exploratory factor analysis (EFA).

As factor analysis looks for relationships between variables, we ensured via correlation matrices of the data that there are some moderate-to-high correlations but not multicollinearity (ideally, correlations to score between $r = 0.3$ and $r = 0.8$). For each scale, we used the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity to confirm that factor analysis was appropriate for our dataset. KMO assessed whether the sample size was sufficient for factor analysis, with less than 0.5 indicating the sample was too small. We looked for a significance value of less than 0.05 on Bartlett's test of sphericity to assess whether we have an adequate number of correlations between our variables for factor analysis.

The 'elbow' on scree plots alongside eigenvalues >1 facilitated our decisions on how many factors to extract for each scale. Final factor loadings and communalities are reported for each variable, and meaningful names are given for each extracted factor. Reliability analyses were conducted on the final online exam scales and included in the results. Each scale is described through its mean ($M$) and standard deviation (SD), with skewness and kurtosis testing its distribution for normality.

### 2.4.5 | Clustering

Clustering methods based on person-centred approaches (Malcom-Piqueux, 2015) were used to distinguish common clusters of students

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

based on learners' self-reported acceptance and satisfaction with online exams. Cluster analysis was performed with SPSS. The final scales' results—obtained via EFA—were used to identify the student profiles. Before the clustering, the authors calculated the average scale scores per respondent, by adding all individual item scores per scale and dividing them by the total scale items. The values of the scales were then normalised in the interval [0,1]. The analysis was carried out using *k*-means cluster analysis based on the six final scales (variables): *Revision satisfaction*, *online exam satisfaction*, *assessment competencies*, *invigilation acceptance*, *online exam anxiety* and *workspace satisfaction*.

The potential number of clusters (two to five) was chosen to enable maximum profile variability without very small clusters. The clustering quality was then evaluated by comparing the within-group and between-group sum of squares for each potential number of clusters (Anderberg, 1973). The ideal number of clusters is the one that minimises the within-group sum of squares (the differences between the students and the centre of the cluster to which they belong) while maximising the between-group sum of squares (the differences among the cluster means). The resulting student profiles were validated and described in combination with qualitative (interview) data of the students belonging to each profile.

#### 2.4.6 | Statistical analyses

The degree of association between the final online exam scales was assessed with the Pearson rank correlation. The effect size of significant findings was interpreted based on Cohen's standard (Cohen, 1992). Correlation coefficients between 0.10 and 0.29 represent a small association, coefficients between 0.30 and 0.49 represent a medium association, and coefficients of 0.50 and above represent a large association or relationship, with a positive (+) sign indicating a positive relationship and a negative (−) sign indicating a negative relationship.

Inferential analysis was performed to identify whether the different clusters relate to student groups (as defined by preferences and personal circumstances, demographics and characteristics). Independent-samples *t*-tests were used to explore how the two clusters related to students' age and exam scores, while chi-square tests were performed to explore how the two clusters relate with other characteristics (e.g., gender). An alpha level of 0.05 was used for all analyses.

### 2.5 | Semi-structured interviews

Drawing from their expertise, the literature and the quantitative findings, the authors developed an interview guide (Appendix B) with questions to explore aspects of online exams, such as the benefits and drawbacks of this mode, exams anxiety, technology, invigilation, personal circumstances, workspace satisfaction, comparison to face-to-face exams. An experienced interviewer conducted all interviews using the university-provided platform MS Teams. The interviews were recorded for transcription purposes and anonymised before data analysis.

For the data analysis, we employed Braun and Clarke's (2006) approach to thematic analysis to identify, analyse and report themes. The analysis started with authors MA and TR, who familiarised themselves with the data, read two manuscripts independently to generate an initial set of codes and then reviewed the other author's coding. Discussion on the two coding schemes facilitated the development of a common preliminary coding scheme through consensus. Then, all the team members discussed and refined the themes, concluding with defining, naming and describing the themes (Appendix C). This work includes only participants' quotes that facilitate understanding of the quantitative data results.

### 2.6 | Participants

#### 2.6.1 | Survey

The survey respondents were 40.2% male and 59.8% female, and they belong to the following age groups: 10.1% 25 and under, 25.6% 26–35, 22.4% 36–45, 20.6% 46–55, 11.7% 56–65 and 9.4% 66 or over. A large proportion of respondents come from STEM (38.7%) and FASS (33%), with participation from WELS (15.4%), FBL (10.6%) and access students (2.3%). The student sample includes 11% BAME students and 13.7% with a declared disability. Although students selected whether to participate, the final sample size is representative of the university population and therefore, no balancing tests were considered necessary.

About half of the participating students (48%) work or volunteer full-time, and one in five (21%) has significant caring responsibilities. With regards to available space and equipment, 87% agreed that they have a place at home they could use for their online exams, 89% own a laptop or desktop computer, 86% have webcams, 85% have microphones on their devices and 88% have broadband or 4G-quality internet connection.

#### 2.6.2 | Interview

Interview invitations were sent to 30 selected survey respondents to form a representative sample whose responses could help us build upon the quantitative results. Alternative selections were made for the eight respondents who did not accept the interview request. We interviewed 15 male and 15 female survey respondents (50% each group) in the following age groups: two (6.7%) were 25 and under, eight (26.6%) were 26–35, eight (26.6%) were 36–45, five (16.7%) were 46–55, three (10%) were 56–65 and three (10%) were 66 or over. Sixteen interviewees came from STEM (53.3%), nine from FASS (30%), three from WELS (10%) and two from FBL (6.7%). The interview sample included 3 (10%) BAME students, 7 (23.3%) with a declared disability and 5 (16.7%) without A Levels.

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Thirteen (43.4%) interviewees work or volunteer full-time, and eight (26.7%) have significant caring responsibilities. With regards to available space and equipment, 28 (93.3%) agreed that they have a place at home they could use for their online exams, 26 (86.7%) own a laptop or desktop computer, 28 (93.3%) have webcams, 26 (85%) have microphones on their devices, and 26 (86.7%) have a broadband or 4G-quality internet connection.

The interview participant selection ensured that there would be representatives from all the resulting student clusters. Each interview quote is followed by the participant's identifier, gender, white/BAME racial identification, age, acquisition of A Levels, faculty and their resulting profile. For example (R12, Male, White, 42, with A Levels, STEM, Strongly positive).

## 3 | RESULTS

### 3.1 | RQ1 relationship between online exam factors

#### 3.1.1 | Exploratory factor analysis and reliability of online exams scales

To explore the factorial structure of the *online exam experiences* scale, all nine instrument items were subjected to exploratory factor analysis. The KMO value was 0.79, and Bartlett's Test of Sphericity $\chi^2$: 630.40 ($df = 36$; $p < 0.001$). The factors were subjected to a direct oblimin rotation, and the analysis, using both the scree plot and eigenvalues > 1, revealed that the extraction of three factors was appropriate (see Table 1). The variance accounted for by the three factors was 71.43%. Factor 1 was labelled *online exams satisfaction* because it involves items displaying students' satisfaction with exam aspects, such as mark satisfaction, exam enjoyment or a sense of achievement. This factor explained 41.64% of the variance after rotation. Factor 2 was labelled *online exams anxiety* because it includes responses directly or indirectly linked to student anxiety about exams. This factor explained 18.15% of the variance after rotation. Factor 3 was labelled *workspace satisfaction* because it represents student satisfaction with the quality and adequacy of their exam workspace. This factor explained 11.64% of the variance after rotation.

Similarly, the nine items of the *revision satisfaction* scale were subjected to exploratory factor analysis. The KMO value was 0.88, and Bartlett's Test of Sphericity $\chi^2$: 570.35 ($df = 36$; $p < 0.001$). The maximum likelihood factor analysis alongside the scree plot and the eigenvalues yielded a two-factor solution as the best fit for the data, accounting for 58.89% of the variance. Factor 1 explained 47.51% of the variance after rotation and represents *revision satisfaction*, while Factor 2, which focused on *revision anxiety*, explained 11.38% of the variance and involved only one anxiety-related item (Table 2).

For further reduction, the two Factors that related to anxiety, 'online exams anxiety' and 'revision anxiety', were merged into a single scale *online exams anxiety*, with a KMO value of 0.53 and Bartlett's Test of Sphericity $\chi^2$: 30.74 ($df = 3$; $p < 0.001$), explaining 57.29% of the variance.

Exploratory factor analysis for the four-item *assessment competencies* and five-items *invigilation acceptance* scales revealed a one-factor solution for each. *Assessment competencies* had a KMO value of 0.77 and Bartlett's Test of Sphericity $\chi^2$: 946.16 ($df = 10$; $p < 0.001$), explaining 55.41% of the variance. *Invigilation acceptance* had a KMO value of 0.79 and Bartlett's Test of Sphericity $\chi^2$: 820.17 ($df = 6$; $p < 0.001$), explaining 67.07% of the variance.

Table 3 summarises the descriptive statistics and reliability tests of the resulting six online exams scales: revision satisfaction (RevSat); online exams satisfaction (OeSat); assessment competencies (AsCom); invigilation acceptance (InvAcc); online exams anxiety (OeAnx); and workspace satisfaction (WsSat). All metrics were internally reliable, as all$\alpha$ values ranged from 0.72 (satisfactory) to 0.88 (very good). Further, the metrics had sufficiently normal distributions with <2.3 skewness (Lei & Lomax, 2005) and <7.0 kurtosis (Byrne, 2013). All factors loading ranged from 0.74 to 0.85. The final six online exam scales, extracted via EFA, can be found in Appendix D (Tables D1–D6).

Distance learning students with experience of online exams were found to have an overall excellent experience with their workspace ($M = 0.85$); a very good apprehension of invigilation ($M = 0.77$),

**TABLE 1** Exploratory factors analysis of the items of the online exams experience scale.

| Items | 1 | 2 | 3 | Communality |
|---|---|---|---|---|
| The exam questions allowed me to demonstrate what I had learnt | **0.83** | 0.01 | −0.03 | 0.71 |
| I was satisfied with the mark I got | **0.78** | 0.09 | −0.02 | 0.61 |
| Completing the exam gave me a sense of achievement | **0.74** | 0.21 | −0.14 | 0.65 |
| I enjoyed the exam | **0.73** | −0.24 | 0.11 | 0.59 |
| The exam questions were clear | **0.53** | −0.19 | −0.32 | 0.60 |
| I felt anxious when doing the exam | 0.16 | **0.89** | 0.12 | 0.76 |
| The exam was harder than I was expecting | −0.20 | **0.78** | −0.13 | 0.70 |
| I was able to find a quiet space to take the exam | 0.02 | 0.00 | **0.94** | 0.90 |
| I was satisfied with the quality of the space I used at home | 0.05 | −0.01 | **0.94** | 0.91 |

*Note*: Extraction method; maximum likelihood; Rotation method; Oblimin with Kaiser normalisation. Loadings larger than 0.40 are in bold.

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

**TABLE 2** Exploratory factors analysis of the items of the revision satisfaction scale.

| Items | 1 | 2 | Communality |
|---|---|---|---|
| Revising helped me reflect and consolidate what I had learnt earlier in the module | **0.83** | 0.01 | 0.68 |
| I was given adequate revision support by my tutor | **0.81** | −0.01 | 0.66 |
| There was adequate information about how to sit my online exam | **0.76** | 0.01 | 0.57 |
| The TMAs in the module prepared me well for the end of module exam | **0.73** | 0.12 | 0.53 |
| I was clear about what I should revise | **0.72** | 0.02 | 0.51 |
| I enjoyed revising the module materials | **0.71** | −0.08 | 0.52 |
| There was enough time in the module set aside for revision | **0.64** | −0.23 | 0.48 |
| I learnt new things when revising | **0.64** | 0.10 | 0.40 |
| I often felt anxious when revising for my exam | 0.02 | **0.98** | 0.95 |

*Note*: Extraction method; maximum likelihood; Rotation method; Oblimin with Kaiser normalisation. Loadings larger than 0.40 are in bold.

**TABLE 3** Descriptive statistics and reliability for each metric.

| Metrics | *N* | Mean (range 0–1) | SD | Skewness | Kurtosis | No. of items | $\alpha$ value |
|---|---|---|---|---|---|---|---|
| RevSat | 190 | 0.75 | 0.17 | −1.46 | 3.78 | 8 | 0.88 |
| OeSat | 186 | 0.68 | 0.19 | −1.01 | 1.76 | 5 | 0.83 |
| AsCom | 190 | 0.57 | 0.21 | −0.18 | 0.11 | 4 | 0.82 |
| InvAcc | 190 | 0.77 | 0.26 | −1.01 | −0.03 | 5 | 0.81 |
| OeAnx | 189 | 0.62 | 0.23 | −0.39 | −0.34 | 3 | 0.72 |
| WsSat | 183 | 0.85 | 0.20 | −1.82 | 4.23 | 2 | 0.91 |

*Note*: AsCom, assessment competencies; InvAcc, invigilation acceptance; OeAnx, online exam anxiety; OeSat, online exam satisfaction; RevSat, revision satisfaction; WsSat, workspace satisfaction.

revision ($M = 0.75$) and exam ($M = 0.68$) experience; some significant level of anxiety ($M = 0.62$); and relatively low confidence with their *assessment competencies* ($M = 0.57$).

### 3.1.2 | Correlations among online exam scale

Correlations were computed among the six metrics for the 190 students who had an experience with online exams (Table 4). The Pearson correlation suggests that some of the metrics were significantly related. The *online exams satisfaction* has a strong significant positive association with *revision satisfaction* ($r(190) = 0.72$, $p < 0.001$), a moderate positive association with *workspace satisfaction* ($r(183) = 0.52$, $p < 0.001$), a weak positive association with *assessment competencies* ($r(186) = 0.34$, $p < 0.001$), and a very weak negative association with *online exams anxiety* ($r(186) = -0.22$, $p = 0.002$). *Revision satisfaction* has a moderate significant positive association with *workspace satisfaction* ($r(183) = 0.57$, $p < 0.001$) and a very weak positive association with *assessment competencies* ($r(190) = 0.29$, $p < 0.001$). Finally, *assessment competencies* has very weak significant positive associations with *invigilation acceptance* ($r(190) = 0.24$, $p = 0.001$) and *workspace satisfaction* ($r(183) = 0.21$, $p = 0.005$), and a very weak significant negative association with *online exams anxiety* ($r(189) = -0.25$, $p = 0.001$).

**TABLE 4** Correlations among metrics.

| Metrics | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. RevSat | - | | | | | |
| 2. OeSat | 0.72** | - | | | | |
| 3. AsCom | 0.29** | 0.34** | - | | | |
| 4. InvAcc | 0.08 | 0.06 | 0.24** | - | | |
| 5. OeAnx | −0.02 | −0.22** | −0.25** | −0.11 | - | |
| 6. WsSat | 0.57** | 0.52** | 0.21** | −0.05 | 0.03 | - |

*Note*: AsCom, assessment competencies; InvAcc, invigilation acceptance; OeAnx, online exams anxiety; OeSat, online exams satisfaction; RevSat, revision satisfaction; WsSat, workspace satisfaction.
**$p < 0.01$.

## 3.2 | RQ2 online exams student profiles

### 3.2.1 | Group identification

We identified two distinct unique engagement student profiles related to students' acceptance and satisfaction with online exams. Profile 1 represents the 'strongly positive' towards online exams student profile ($n = 126$), and profile 2 the 'less positive' profile ($n = 57$). Figure 1 shows a comparative chart with the scales' average for each profile.

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Overall, the 'strongly positive' student profile demonstrated higher levels of *revision satisfaction*, online exams satisfaction, assessment competencies, invigilation acceptance and workspace satisfaction, and lower anxiety levels. Cluster differences (Table 5) were even more significant for the *assessment competencies* and the *revision satisfaction*, with the 'strongly positive' profile displaying higher levels in both and lower for the anxiety levels.

The interview responses from students who were 'strongly positive' towards exams highlighted, for example, the importance of mock and practice online exams during revision for feeling prepared and more satisfied with the online exam:

> '[…]. And once we had the mock exam, it gave you an idea of the sort of scope of the questions they'd ask, you know, the amount of information or detail you'd need to give, and the sort of areas they were looking for. And that's what I did, basically. I mean, I looked at the mock exam and actually was quite confident because I did relatively well'.
> *(R11, Male, White, 42, With A Levels, STEM, Strongly positive)*

> 'But once I sat the practice exam—or the practice version that was available online a couple of weeks beforehand, and that seemed to go fairly smoothly, and I actually found the actual exam less stressful than the traditional [face-to-face] one'.
> *(R27, Male, White, 40, with A Levels, STEM, Strongly positive)*

Assessment competencies and feeling confident with sitting exams were also emphasised by 'strongly positive' students, adding to the reasons that could make the revision and exam experience more attractive, as indicated in Table 6.

> 'I feel quite confident with exams because in my professional career I was a chartered accountant so I seem to have done nothing but exams throughout my life'.
> *(R29, Female, White, 27, with A Levels, WELS, Strongly positive)*

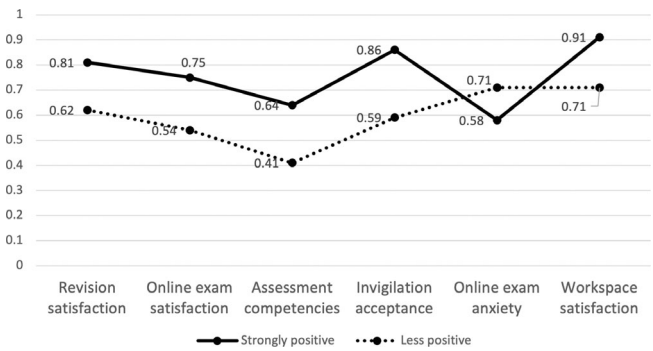


**FIGURE 1** Average levels of online exams scales by student profile (range 0–1).

As opposed to the 'strongly positive' respondents, students who were 'less positive' pointed to reasons that made their revision less pleasant that may not be directly related to their studies. They also explained that having a good exam experience may be difficult with any exam type, but that it could make the overall experience less stressful, especially when it comes to working from your comfort and own workspace, as indicated in Table 6.

> 'Well, at the personal level, it [revision] was [stressful], because I was mixed up with a bit of work, I was trying to balance, so it was, the time was a bit, not on my side, it was a bit limited'.
> *(R30, Male, Black, 42, with A Levels, FBL, Less positive)*

> 'It was [online exams] a stressful experience but I think it was much more comfortable in your own environment, less pressure in that way, than what it is attending somewhere. If I had to attend and sit in a big room like I did in school that would have more anxiety and worry than what I am doing it in my own home where I'm in my own headspace'.
> *(R21, Female, White, 32, D, Without A Levels, WELS, Less positive)*

The workspace satisfaction was further emphasised by 'strongly positive' students in connection to their preferences towards online exams, as opposed to face-to-face. The notions of travelling to exam centres and the added stress of sitting exams in an unfamiliar space were also mentioned:

> 'The online thing just was much more relaxed. And of course, it was my own home. And I'm very lucky, I live in a house that's quiet. I understand how difficult it must be for people who don't have a quiet working space'.
> *(R9, Female, White, 50, with A Levels, FASS, Strongly positive)*

**TABLE 5** Cluster differences per metric using *t*-tests.

| | Strongly positive | | Less positive | | |
|---|---|---|---|---|---|
| | *M* | SD | *M* | SD | *t*-test |
| RevSat | 0.81 | 0.11 | 0.62 | 0.21 | −6.57** |
| OeSat | 0.75 | 0.14 | 0.54 | 0.19 | −8.45** |
| AsCom | 0.64 | 0.16 | 0.41 | 0.18 | −8.49** |
| InvAcc | 0.86 | 0.19 | 0.59 | 0.28 | −6.55** |
| OeAnx | 0.58 | 0.23 | 0.71 | 0.22 | 3.49** |
| WsSat | 0.91 | 0.13 | 0.71 | 0.26 | −5.61** |

*Note*: AsCom, assessment competencies; InvAcc, invigilation acceptance; OeAnx, online exams anxiety; OeSat, online exams satisfaction; RevSat, revision satisfaction; WsSat, workspace satisfaction; Normalised metric ranges from 0 (low) to 1 (high).
**$p < 0.01$.

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

**TABLE 6** Student groups—Descriptive summary of main features.

| Feature/student group Metrics | Profile 1: Strongly positive | | Profile 2: Less positive | |
|---|---|---|---|---|
| | Description | Mean [0–1] | Description | Mean [0–1] |
| Revision satisfaction | High | 0.81 | Moderate | 0.62 |
| Online exam satisfaction | High | 0.75 | Moderate | 0.54 |
| Assessment competencies | Moderate | 0.64 | Low | 0.41 |
| Invigilation acceptance | Very high | 0.86 | Low | 0.59 |
| Online exam anxiety | Moderate | 0.58 | Moderate | 0.71 |
| Workspace satisfaction | Very high | 0.91 | Moderate | 0.71 |
| ***Exams-related*** | **Description** | **Value** | **Description** | **Value** |
| Previous experience of online exams | Very good | 0.85 [0–1] | Moderate | 0.57 [0–1] |
| Exam score performance | Good | 73.83/100 | Moderate | 66.88/100 |
| *Demographics and study characteristics* | | | | |
| Age | Older | 44.18 years | Younger | 39.04 years |
| Gender | No difference | - | No difference | - |
| Race | No difference | - | No difference | - |
| With declared disability | Less likely | 44.4% | More likely | 55.6% |
| Faculty | No difference | - | No difference | - |
| With A levels | More likely | 77.6% | Less likely | 26.6% |
| With qualification intention | No difference | - | No difference | - |
| *Technology* | | | | |
| Owns device with a webcam | More likely | 73.6% | Less likely | 26.4% |
| Owns device with a microphone | More likely | 74.2% | Less likely | 25.8% |
| Has broadband or 4G-quality internet connection | More likely | 72% | Less likely | 28% |
| No issues with reliability or quality of internet connection | More likely | 73.1% | Less likely | 26.9% |
| With confidence in setting up and using technology | No difference | - | No difference | - |
| With confidence in dealing with potential technical difficulties | No difference | - | No difference | - |
| *Personal circumstances* | | | | |
| With childcare responsibilities | No difference | - | No difference | - |
| With other caring responsibilities | Less likely | 37.5% | More likely | 62.5% |
| With employment constraints | No difference | - | No difference | - |
| With mental health | Less likely | 30.8% | More likely | 69.2% |

'I would say it's [online exams] probably less stressful doing it in the comfort in your own home than it is rushing to get somewhere that's unfamiliar, you know […] I've had to go somewhere for an exam is worrying I'll get there on time, worrying I'll remember everything, worrying that I'll go to the right room, you know, all that kind of things'.

*(R11, Male, White, 42, With A Levels, STEM, Strongly positive)*

However, 'less positive' students explained that regardless of exam type, they will still feel stressed, with the most mentioned factor relating to online exams anxiety being the technology involved:

'[Exams] It's always stressful in whatever format. […] I make sure I prepare very well. For example, I was stressed about the technology in the four-and-a-half-hour exam,

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

so I had backup plans, and backup plans for my backup plans'.

*(R3, Female, White, 47, Without A Levels, STEM, Less positive)*

Finally, there was a contradiction between how 'strongly positive' and 'less positive' students reacted to the idea of exam invigilation. The 'strongly positive' came across as more confident with invigilation, discussing further options and how invigilation could be more effective. 'Less positive' students appeared more sceptical about invigilation disrupting their privacy.

'I think if you wanted to be really, gosh, almost Orwellian about this you need to have access to the camera so that they're looking at you and… Not all the time but they've got the opportunity to look at you through the camera, I think that's the way to do it, and then you can't be mistaken'.

*(R4, Male, White, 69, With A Levels, FBL, Strongly positive)*

'Blocking the browser is a bad thing for me because at the end of the day for me it's a form of control of a student, and for me that's not good because it's civil rights and all that kind of stuff, but I think with a medium ground it wouldn't be necessarily'.

(R20, Male, White, 44, D, With A Levels, STEM, Less positive)

### 3.2.2 | Students groups vs. demographics and characteristics

The independent *t*-tests showed that the 'strongly positive' students, compared to the 'less positive', were more likely to have a better previous experience with online exams ($\chi^2$ [1, $N = 183$] $= 11.40$, $p < 0.001$). Further, the 'strongly positive' ($M = 73.83$, $SD = 19.74$), compared to the 'less positive' ($M = 66.88$, $SD = 19.74$) were shown to have a better exam score performance ($t$[117.46] $= 2.34$, $p = 0.02$).

## 3.3 | Demographics and background characteristics

The tests further showed differences between the demographics and characteristics of the two groups. 'Strongly positive' compared to 'less positive' were less likely to have a declared disability ($\chi^2$ [1, $N = 183$] $= 8.80$, $p = 0.003$) and more likely to have A Levels ($\chi^2$ [1, $N = 183$] $= 7.66$, $p = 0.006$). The former group ($M = 44.18$, $SD = 13.96$) compared to the latter ($M = 39.04$, $SD = 13.98$) were more likely to be of older age ($t$[108.11] $= 2.31$, $p = 0.02$). There were no differences among students of different gender, race, qualification intention and faculty, with $\chi^2$ (1, $N = 183$) $= 0.86$, $p > 0.05$, $\chi^2$ (1, $N = 183$) $= 1.85$, $p > 0.05$, $\chi^2$ (1, $N = 183$) $= 1.30$, $p > 0.05$ and $\chi^2$ (2, $N = 171$) $= 2.98$, $p > 0.05$, respectively.

Students at the interview acknowledged that it would be easier for students with mobility issues to take online exams, but also stressed the importance of designing online exams that consider students with additional needs and responsibilities:

'It's much more accessible for people with mobility issues who would struggle to get to an exam hall'.

*(R5, Male, White, 52, With A Levels, D, WELS, Strongly positive)*

'I think it's okay to have generic [online exam] formats how they've laid it out, but they should take more consideration into those students who do have additional needs or disabilities. They should have something separate, so it prevents their learning being at a disadvantage…'

*(R21, Female, White, 22, Without A Levels, D, WELS, Less positive)*

## 3.4 | Technology and workspace

The tests also revealed differences between the technology owned by the two groups. The 'strongly positive', compared to the 'less positive', were more likely to own a laptop, desktop, tablet or smartphone with a webcam ($\chi^2$ [1, $N = 183$] $= 12.66$, $p < 0.001$) or with a microphone ($\chi^2$ [1, $N = 183$] $= 13.48$, $p < 0.001$) and to have a broadband or 4G-quality internet connection ($\chi^2$ [1, $N = 183$] $= 7.07$, $p = 0.008$). Moreover, the tests showed a borderline difference, with the 'strongly positive' group being less likely to report reliability or quality of internet connection as a barrier to online exams ($\chi^2$ [1, $N = 183$] $= 3.74$, $p = 0.053$). There was no difference among students with and without confidence in setting up and using technology ($\chi^2$ [1, $N = 183$] $= 0.15$, $p > 0.05$) nor among students with and without confidence in dealing with potential technical difficulties during assessment ($\chi^2$ [1, $N = 183$] $= 0.52$, $p > 0.05$).

Interviewees discussed issues with technology during the exams that may affect their stress levels and their ability to sit the exam.

'I can't control. I can control how much revision I do or whether I've maybe done my best to understand the work but something that's outside of my control like the technology is what stresses me'.

*(R14, Female, White, 58, With A levels, FASS, strongly positive)*

'But with the online I've got my broadband; if something goes wrong that day beyond my control and the connectivity is poor what happens? So, will I be compensated, will I be asked to re-sit it, what happens if

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

the broadband comes on later or if it doesn't? So, this is something that maybe the university has to assure us, "If you are doing this in case this happens you will be compensated this way". If those things are put in place, then everything will be fine, yeah'.

*(R26, Male, Black, 54, With A Levels, STEM, Strongly positive)*

### 3.5 | Personal circumstances

Finally, the two groups had some differences in their personal circumstances. 'Strongly positive' were less likely to have mental health issues ($\chi^2$ [1, $N = 183$] = 9.46, $p = 0.002$) or caring responsibilities ($\chi^2$ [1, $N = 183$] = 8.80, $p = 0.003$). There were no differences among students with childcare responsibilities or employment constraints and those without, between the two groups, with $\chi^2$ (1, $N = 183$) = 1.62, $p > 0.05$ and $\chi^2$ (1, $N = 183$) = 1.55, $p > 0.05$, respectively.

Students in the interview explained how their household circumstances could be facilitators or barriers to sitting exams at home, pointing to their workspaces and 'exam' environment.

'Doing it [the exams] online from home, because I work from home predominantly anyway, I've got kind of an office. It's certainly an area of the house where, you know, everything here is where I know it is, and I can shut the door and the children won't annoy me or bother me or interrupt me or anything like that'.

*(R11, Male, White, 42, With A Levels, STEM, Strongly positive)*

'I mean when I do online exams, I essentially tell my family to leave the house for the best part of six hours and they go off and do which is not always an easy thing to do'.

*(R7, Male, White, 35, With A Levels, FBL, Less positive)*

Table 6 describes the main features of each student profile.

## 4 | DISCUSSION

The main aim of this study was to investigate the factors and student characteristics related to distance learning university students' acceptance and satisfaction with the transition to online exams.

### 4.1 | Relationship between online exam factors

We explored students' *revision satisfaction*, *online exam satisfaction*, *assessment competencies*, *invigilation acceptance*, *anxiety*, and *workspace satisfaction*. Distance learning students were found to have an overall excellent experience with their workspace, which may not align with the research results of traditional university students. The latter reveals more unpreparedness concerning the home environment, accessing the internet and even owning a device (Choi et al., 2020; Elsalem et al., 2020), while distance learning students tend to have their workspace arranged for their online study activities. However, our interview findings showed us that even in distance learning settings, the existing environment and workspace for a few students might not be ideal for sitting exams, for example, students with children at home.

Further, contrary to the notion that invigilation can make the exam intense and the students nervous (Choi et al., 2020), this study showed good acceptance of invigilation for online exams. This finding, however, may be explained by the fact that this study's participants have not yet experienced invigilation in their online open book-style exams, and therefore have not yet developed strong opinions about particular invigilation systems and relevant processes. Another explanation for the good acceptance of invigilation in online exams may be the difference from their current experience with invigilation in in-person exams—their typical exam model before the pandemic. Students' approval of the invigilation in online exams has implications for online exam system design; invigilation functions that provide assessment quality assurance can become part of the assessment strategy and delivery and still ensure student satisfaction. There is a (weak) positive association between *invigilation acceptance* and *assessment competencies* indicating that the latter may help improve the former. This would open potential avenues for the design of teaching and learning at a distance: the more students encounter online assessments similar to the online exam during their studies, the greater their familiarity with exam technology and how to answer specific question types. Such learning designs that use assessment to cultivate students' confidence in performing well in exams should be encouraged.

The participants reported some good revision and exam experience, which may be connected again to the specific non-invigilated open book-style exam format during 2020 and 2021. This format covers a range of exam activities, from timed exams, which in previous research were stressful (Novick et al., 2022), to other less time-intensive activities, such as essays with a 7-days submission window. However, the strong association between the revision and exam satisfaction indicators, combined with our interview findings, explain how structured revision and exam preparation activities, as part of the programme's learning strategy, may contribute to increasing students' *online exam satisfaction*. For instance, the participants highlighted how mock and practice exams prepared them for the online exam type and lowered their stress.

Our findings also showed that distance learning students, like students in traditional universities (Bayar & Alimcan, 2021; Novick et al., 2022), experience significant anxiety levels. The explanation may be two-fold: First, our qualitative data pointed to areas of anxiety, such as having to deal with technical issues during the exam and the university's role and reaction if that happens. Second, participants reported that any exam would have given them anxiety, and this anxiety is not specific to the online exams model. This second explanation can also be viewed through the (weak) negative association that

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

student anxiety has with student confidence in their assessment competencies. The negative association between *assessment competencies* and *anxiety* and *online exam satisfaction* raises questions about whether there is a need for more assessment-related study skills activities (e.g., self-assessing their work) embedded early in their study journey.

### 4.2 | Online exam student profiles

The key objective for mapping students' dispositions towards online exams was to detect which aspects can be supported or eliminated when designing online exam activities and technologies. The results in this study showed that two profiles had been identified—more than two-thirds (69%) of the students belong to the 'strongly positive' towards online exams profile and the rest to the 'less positive'. The 'strongly positive' profile includes students with better satisfaction, better experiences with online exams, and lower anxiety levels. The most considerable differences between the two groups were in *assessment competencies* and *revision satisfaction*.

Interview results have enriched the student profiles, providing information about the reasons for being positive or 'less positive' about online exams. Understanding these reasons is essential for supporting and designing online exams. For instance, the 'strongly positive' students describe how having mock and practice exams makes them more confident and the actual exam less stressful. This continuous practice was reported to have happened externally for some students through their professional careers, for example, chartered accountant certificates; however, continuous practice could arguably be embedded by default into university programmes by familiarising students with online exam elements (activity type and technology) throughout their studies.

'Less positive' students in this study perceive exams as stressful; nevertheless, their perception is not specific to online exams only. Moreover, as with previous research (Bayar & Alimcan, 2021), participants still prefer online to in-person exams because of the comfort of their own space. 'Less positive' students also explain that dealing with technology issues during the exam can contribute to their stress (as identified in Topuz & Kinshuk, 2021), but it is mainly linked to timed exams. This repeats findings from previous research (Novick et al., 2022) that highlight how the design and type of the online exam can play an essential role in students' anxiety. Early communication with students about the scope and type of exams could help, as could testing the equipment needed for the online exams (e.g., using a specimen exam paper to practice uploading answers). 'Less positive' students have also commented on how particular invigilation formats, such as lockdown browsers, may feel like an invasion of privacy (as identified by Choi et al., 2020), emphasising the need to design flexible invigilation platforms that enable specific features depending on course, qualification and quality assurance requirements.

In agreement with Choi et al. (2020) and Elsalem et al. (2020), there were differences in the demographics, student characteristics and personal circumstances of the students in the two profiles. In particular, students without A-Levels (and therefore potentially less experienced with exams) and students with declared disabilities were more likely to be 'less positive' with online exams. Interview data indicated the need for designing for students' particular needs and disabilities to maintain equity in their learning. The design may include variety and choice for the student in the online exam interface that could facilitate and enhance their experience. For instance, providing options as to how many questions per page they could view, allowing for font type and colours (Karim & Shukur, 2016), or whether they would like to view a countdown timer (Novick et al., 2022). Owning a good internet connection and devices with the required functions was another element that triggered a positive disposition towards online exams. However, even the 'strongly positive' participants need to be assured about processes and who would be accountable in case of technology failure. Students with mental health issues or caring responsibilities were also more reluctant with online exams, pointing again to designing flexible online exam systems to ensure fairness. Interview data also highlighted issues with suitable environments for exams.

The lack of a suitable environment, alongside student concerns (e.g., unreliable internet connection) and circumstances (e.g., children at home), may require establishing some exceptional in-person exams for those who need them.

### 4.3 | Limitations

While the sample in this study represents the university's demographics, it is essential to interpret the results with caution. The study has only investigated the acceptance and satisfaction of students with experience of online exams, and consequently, our sample size was limited, encompassing a smaller number of students, who self-selected to take part. Therefore, the findings may not fully capture the preferences and experiences of students in schools and programmes that do not have final exams, those who have yet to undergo an online exam, or those who have deliberately chosen not to participate in exams through their course selection.

Our study focused on the overall experience of distance learning students with online exams, seeking to understand factors, student characteristics, and personal circumstances that may relate to this model's online and remote aspects. Further studies, which consider particular types of online exams, will need to be undertaken to provide further knowledge on how the different designs may affect student experience and acceptance.

## 5 | CONCLUSIONS

This study enhances our understanding of distance learning student experiences and expectations of online exams, adding new knowledge to current literature on online assessment. Our research underlines the importance of student preparation, which may reduce exam and technology anxiety. Student preparation could occur throughout

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

students' studies through early communication of the required software and hardware for the exam, frequent testing of the exam equipment, and practice exams. Student confidence in sitting online exams, or any other exams, could also be enhanced by building assessment competencies throughout students' studies; for instance, self-assessing their work or getting familiarised with different exam activities.

Distance learning student experiences are comparable to traditional university students at many levels, including feeling stressed about certain types of exams, submission windows, invigilation options, technical issues and owning suitable devices. Distance learning students showcase confidence and satisfaction with their workspace, yet this study sheds light on student characteristics and personal circumstances to consider when designing inclusive online exams. For instance, increasing accessibility by supporting alternative formats for students with disabilities and organising exceptional in-person exams for those without a suitable environment or other needs that cannot be mitigated.

Our insights contribute to the future of designing assessments in distance learning settings, including exams. JISC reports (2020) emphasise the need for 'student-centred and personalised' assessment that can be taken 'anywhere', not tied to physical exam halls or university buildings. Recently, the case for future assessment and feedback includes two relevant principles: engaging learners with the requirements and performance criteria for each task, and supporting learners' personalised needs with accessibility, inclusivity and compassion (JISC, 2022). This study provides universities with guidance on addressing concerns of students positively disposed towards online exams and helping those less positively disposed to develop assessment competencies and exam confidence for success.

Considering some of the comments by participants and the resulting suggestions proposed in this paper, exam design then becomes a matter not just of assessing the achievement of learning outcomes, but also of how to prepare students for such assessment as an integral part of the teaching and learning design at universities. If learning is indeed to become hybrid in the future, this will not just affect current distance education students, but students across the higher education sector.

## ACKNOWLEDGEMENTS

The authors would like to thank Kristein Reid, Helen Kaye, Tim Coughlan and Emma Worth for their insights early in the project and all the students who took part in this study.

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

## PEER REVIEW

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/jcal.12888.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## ETHICS STATEMENT

'Online exams' was considered a low-risk study that meets The Open University Human Research Ethics Committee (HREC) criteria for exemption from formal review (reference number: HREC/4262/Aristeidou), http://www.open.ac.uk/research/ethics/.

## ORCID

*Maria Aristeidou* https://orcid.org/0000-0001-5877-7267

## REFERENCES

Anderberg, M. R. (1973). The broad view of cluster analysis. *Cluster Analysis for Applications*, *1*(1), 1–9.

Aristeidou, M., & Cross, S. (2021). Disrupted distance learning: The impact of COVID-19 on study habits of distance learning university students. *Open Learning: The Journal of Open, Distance and e-Learning*, *36*(3), 263–282. https://doi.org/10.1080/02680513.2021.1973400

Bali, M. (2014). MOOC pedagogy: Gleaning good practice from existing MOOCs. *Journal of Online Learning and Teaching*, *10*(1), 44.

Bayar, A., & Alimcan, D. (2021). The perspectives of Amasya University students about distance education application during the coronavirus (COVID-19) process. *ie: Inquiry in Education*, *13*(2), 11.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Byrne, B. M. (2013). *Structural equation modeling with Mplus: Basic concepts, applications, and programming*. Routledge.

Choi, B. Y., Song, S., & Zaman, R. (2020). Smart education: Opportunities and challenges induced by COVID-19 pandemic. *2020 IEEE Intern Smart Cities Conf (ISC2)* (pp. 1–8). https://doi.org/10.1109/ISC251055.2020.9239063

Cohen, J. (1992). Statistical power analysis. *Current Directions in Psychological Science*, *1*(3), 98–101.

Costello, E., Holland, J., & Kirwan, C. (2018). The future of online testing and assessment: Question quality in MOOCs. *International Journal of Educational Technology in Higher Education*, *15*(1), 1–14.

Creswell, J. W., Plano Clark, V. L., Gutmann, M., & Hanson, W. (2003). Advanced mixed methods research designs. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 209–240). Sage.

Cross, S., Aristeidou, M., Rossade, K. D., Wood, C., & Brasher, A. (2022). The impact of online exams on the quality of distance learners' exam and exam revision experience? Perspectives from The Open University UK. *Online Learning*, *27*(2), 27–45. https://doi.org/10.24059/olj.v27i2.3761

Cross, S. S., Whitelock, D., & Mittelmeier, J. (2016). Does the quality and quantity of exam revision impact on student satisfaction and performance in the exam itself? Perspectives from undergraduate distance learners. *EDULEARN Proceedings* (pp. 5052–5061). https://doi.org/10.21125/edulearn.2016.2197

Dermo, J. (2009). e-Assessment and the student learning experience: A survey of student perceptions of e-assessment. *British Journal of Educational Technology*, *40*(2), 203–214. https://doi.org/10.1111/j.1467-8535.2008.00915.x

Dominguez-Figaredo, D., Gil-Jaurena, I., & Marentin-Encine, J. (2022). The impact of rapid adoption of online assessment on students' performance and perceptions: Evidence from a distance learning university. *Electronic Journal of e-Learning*, *20*(3), 224–241. https://doi.org/10.34190/ejel.20.3.2399

Elsalem, L., Al-Azzam, N., Jum'ah, A. A., Obeidat, N., Sindiani, A. M., & Kheirallah, K. A. (2020). Stress and behavioral changes with remote E-exams during the COVID-19 pandemic: A cross-sectional study among undergraduates of medical sciences. *Annals of Medicine and Surgery*, *60*, 271–279. https://doi.org/10.1016/j.amsu.2020.10.058

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Entwistle, N., & Entwistle, D. (2003). Preparing for examinations: The interplay of memorizing and understanding, and the development of knowledge objects. *Higher Education Research and Development*, *22*(1), 19–41. https://doi.org/10.1080/0729436032000056562

Falchikov, N., & Boud, D. (2007). Assessment and emotion, the impact of being assessed. In D. Boud & N. Falchikov (Eds.), *Rethinking assessment in higher education, learning for the longer term* (pp. 144–156). Routledge.

Gibbs, G., & Dunbar-Goddet, H. (2007). *The effects of programme assessment environments on student learning*. Higher Education Academy.

Grainger, B. (2013). *Massive open online course (MOOC) report 2013*. University of London.

Hilliger, I., Ruipérez-Valiente, J. A., Alexandron, G., & Gašević, D. (2022). Trustworthy remote assessments: A typology of pedagogical and technological strategies. *Journal of Computer Assisted Learning*, *38*(6), 1507–1520.

Jha, M., Leemans, S. J. J., Berretta, R., Bilgin, A. A., Jayarathna, L., & Sheard, J. (2022). Online assessment and COVID: Opportunities and challenges. *ACI'22: Australian Computing Education Conference* (pp. 27–35). https://doi.org/10.1145/3511861.3511865

JISC. (2020). *Assessment rebooted. From 2020's quick fixes to future transformation, JISC and emerge education*. https://repository.jisc.ac.uk/7854/1/assessment-rebooted-report.pdf

JISC. (2022). *Principles of good assessment and feedback*. https://www.jisc.ac.uk/guides/principles-of-good-assessment-and-feedback

Kaplan, A. M., & Haenlein, M. (2016). Higher education and the digital revolution: About MOOCs, SPOCs, social media, and the cookie monster. *Business Horizons*, *59*(4), 441–450. https://doi.org/10.1016/j.bushor.2016.03.008

Karim, N. A., & Shukur, Z. (2016). Proposed features of an online examination interface design and its optimal values. *Computers in Human Behavior*, *64*, 414–422. https://doi.org/10.1016/j.chb.2016.07.013

Khalil, M., Prinsloo, P., & Slade, S. (2022). In the nexus of integrity and surveillance: Proctoring (re) considered. *Journal of Computer Assisted Learning*, *38*(6), 1589–1602.

Kharbat, F. F., & Abu Daabes, A. S. (2021). E-proctored exams during the COVID-19 pandemic: A close understanding. *Education and Information Tehnologies*, *26*(6), 6589–6605. https://doi.org/10.1007/s10639-021-10458-7

Lei, M., & Lomax, R. G. (2005). The effect of varying degrees of nonnormality in structural equation modeling. *Structural Equation Modeling*, *12*(1), 1–27. https://doi.org/10.1207/s15328007sem1201_1

Malcom-Piqueux, L. (2015). Application of person-centered approaches to critical quantitative research: Exploring inequities in college financing strategies. *New Directions for Institutional Research*, *2014*(163), 59–73. https://doi.org/10.1002/ir.20086

Novick, P. A., Lee, J., Wei, S., Mundorff, E. C., Santangelo, J. R., & Sonbuchner, T. M. (2022). Maximizing academic integrity while minimizing stress in the virtual classroom. *Journal of Microbiology & Biology Education*, *23*(1), 1–11. https://doi.org/10.1128/jmbe.00292-21

Payne, E., & Brown, G. (2011). Communication and practice with examination criteria. Does this influence performance in examinations? *Assessment and Evaluation in Higher Education*, *36*(6), 619–626. https://doi.org/10.1080/02602931003632373

Smith, C. D., Worsfold, K., Davies, L., Fisher, R., & McPhail, R. (2013). Assessment literacy and student learning: The case for explicitly developing students 'assessment literacy'. *Assessment and Evaluation in Higher Education*, *38*(1), 44–60. https://doi.org/10.1080/02602938.2011.598636

Sorensen, E. (2013). Implementation and student perceptions of e-assessment in a chemical engineering module. *European Journal of Engineering Education*, *38*(2), 172–185. https://doi.org/10.1080/03043797.2012.760533

Stowell, J. R., & Bennett, D. (2010). Effects of online testing on student exam performance and test anxiety. *Journal of Educational Computing Research*, *42*(2), 161–171. https://doi.org/10.2190/EC.42.2.b

Topuz, A. C., & Kinshuk, S. (2021). A review of literature to understand student's perceptions regarding online assessments. In Y. Wen, Y.-J. Wu, G. Qi, S.-C. Guo, J. M. Spector, S. Chelliah, S. Kinshuk, & Y.-L. Lan (Eds.), *Expanding global horizons through technology enhanced language learning. Lectures notes in educational technology* (pp. 49–72). Springer. https://doi.org/10.1007/978-981-15-7579-2_4

Vattøy, K.-D., Gamlem, S. M., & Rogne, W. M. (2021). Examining students' feedback engagement and assessment experiences: A mixed study. *Studies in Higher Education*, *46*(11), 2325–2337. https://doi.org/10.1080/03075079.2020.1723523

**How to cite this article:** Aristeidou, M., Cross, S., Rossade, K.-D., Wood, C., Rees, T., & Paci, P. (2023). Online exams in higher education: Exploring distance learning students' acceptance and satisfaction. *Journal of Computer Assisted Learning*, 1–18. https://doi.org/10.1111/jcal.12888

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

## APPENDIX A: SURVEY QUESTIONS

1. What assessment activities did the exam(s) you took at home consist of? (End of module exams, not emTMAs/EMAs/TMAs/iCMAs) (please select all that apply).

| |
|---|
| Multiple choice questions |
| Writing short answers of a paragraph or less |
| Writing longer answers of more than a paragraph but less than a page |
| Writing more than a page (e.g., an essay) |
| Equations or other numerical workings |
| Producing audio output such as speaking (either recording or live) |
| Producing visual output (such drawing, photographs, diagrams) |
| Translation |
| Self-reflection |

2. What was the duration of the exam? (If you had more than one remote exam select all that apply).

| |
|---|
| The exam had a 7-day or more submission window |
| The exam had a 3-day submission window |
| The exam had a 24-h submission window |
| The exam was a timed exam and had to be completed within 2–4.5 h |

3. How was your online exam preparation and revision experience? Please read each statement carefully and select the extent to which you agree with each statement [1 = strongly disagree, 5 = strongly agree].

| |
|---|
| I was clear about what I should revise |
| Revising helped me reflect and consolidate what I had learnt earlier in the module |
| I learnt new things when revising |
| There was adequate information about how to sit my exam remotely |
| I enjoyed revising the module materials |
| I was given adequate revision support by my tutor |
| There was enough time in the module set aside for revision |
| I often felt anxious when revising for my exam |
| The TMAs in the module prepared me well for the end of module exam |
| I was confident in setting up everything I needed to take the exam at home |

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

4. How was your online exam experience? Please read each statement carefully and select the extent to which you agree with each statement [1 = strongly disagree, 5 = strongly agree].

| |
|---|
| [Immediately before starting the exam] I felt well prepared |
| The exam questions were clear |
| The exam questions allowed me to demonstrate what I had learnt |
| I was satisfied with the mark I got |
| The exam was harder than I was expecting |
| I enjoyed the exam |
| I felt anxious when doing the exam |
| Completing the exam gave me a sense of achievement |
| I was able to find a quiet space to take the exam |
| I was satisfied with the quality of the space I used at home |

5. [Overall], How would you describe your online exams experience? [1 = very poor, 5 = very good]
6. Please rate your confidence in the following [1 = Not at all confident, 4 = Very confident]

| |
|---|
| Knowing how to answer an exam question |
| Assessing the quality of my own work |
| Performing well in examinations |
| Using academic terms and language |

7. What stipulations or controls would you accept or reject if you had to take an exam at home (assuming all legal data projection protocols are in place)? [1 = reject, 2 = accept with some apprehension, 3 = accept]

| |
|---|
| Temporary restrictions on how you can use your computer (such as locking down browsers) |
| Verifying your identity with facial recognition (via a webcam) |
| Verifying your identity with voice recognition (via a microphone) |
| Verifying your identity by showing an identity document |
| Potential for invigilator to contact you to check you are taking the exam |

8. Which of the following do you consider could be potentially insurmountable (impossible to solve) barriers to you being able to take an online exam at home? [Yes/No]

| |
|---|
| Childcare responsibilities |
| Other caring responsibilities |
| Mental health issues |
| Employment commitments or constraints |
| Access to a laptop, desktop, tablet or smartphone with a webcam |
| Access to a laptop, desktop, tablet or smartphone with a microphone |
| Confidence in setting up and using technology |
| I have a broadband or 4G quality internet connection |
| Confidence dealing with potential technical difficulties during assessment |
| Reliability or quality of internet connection |

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

9. Reflect on your answers to the previous questions. Overall, how do you feel about the prospect of taking online/remote exams? [1 = negative, 2 = somewhat negative, 3 = undecided, 4 = somewhat positive, 5 = positive]

## APPENDIX B: INTERVIEW QUESTIONS

1. What are your experiences of exams at The Open University?
2. Have you sat an online or face-to-face exam, or both?
3. Would you say that you are overall confident in sitting exams? For example, do you know whether you are prepared, do you think you know how to answer the exam question?
   [prompt]: What kind of activity did you do for the exams? e.g.:
   - Multiple choice exams. Multiple choice questions usually include a phrase or stem followed by three to five options
   - Problem or case-based exams
   - Oral exams.
   - Essay exams.

   [prompt]: Do you think your online exams should have been of a different format? Why?
   [prompt]: How did you prepare for the exams?
   [prompt]: How did you revise the module material before the exam?
   [prompt]: Have you faced any challenges during your revision? Would you say you had enough time?
   [prompt]: Did you face any challenges during the exam? Did technology work fine for you?
   [prompt]: Would you say that sitting the exams was or wasn't a stressful experience? How did you manage your stress?
4. How would you compare your online and face-to-face exams?
   [prompt]: How would you compare the two types (online and face-to-face)? Which one would you say you prefer? Why?
   [prompt]: Did you revise for the exam in the same manner (or for the same amount of time) for the face-to-face and the online exams? Were there any challenges when revising for the exam?
   [prompt]: Would you say that sitting exams (face-to-face or online) was or wasn't a stressful experience? Why?
   [prompt]: How would you compare your stress? Are there particular reasons for you to get stressed more for face-to-face or online exams?
   [prompt] What do you think are the good and bad things of having an online exam instead of a face-to-face one? (or vice versa)
5. What do you think about invigilated online exams?
   [prompt]: What do you think about timed exams via assessment software? What are the positive and negative elements, if any?
   [prompt]: What do you think about invigilation overall in exams (both face-to-face and online)?
   [prompt]: How would you perceive invigilation in online exams? For example, blocking access to your browser, or having your face or voice recognised?
6. How would you feel about online exams replacing all of your face-to-face exams, beyond the pandemic?
   [prompt]: Do you see any benefits or problems with that?
   [prompt]: Would you have a different opinion if there was no pandemic?

## APPENDIX C: INTERVIEW CODEBOOK—INTERVIEW THEMES, CODES AND DESCRIPTION

| Main themes | Codes | Description |
|---|---|---|
| Benefits of online exams | Convenience | Avoiding travel, time and parking related inconveniences |
| | Anxiety | Tackling mental health related issues and in person anxiety |
| | Accessibility | Benefits for people with mobility issues |
| | Flexibility | Taking the exam wherever and sometimes whenever they want |
| | Distractions | Controlling the environment in which they take the exam |
| | Other commitments | Catering childcare or employment commitments |

(Continues)

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

| Main themes | Codes | Description |
|---|---|---|
| Changing nature of exam | Exam types | Commenting on the different exam types (e.g., multiple choice, open book) and their pros and cons. |
| | Technology concerns | Expressing concerns about poor broadband connection, equipment, failure in using hardware, or software issues |
| | Comparisons with formative assessment | Spotting similarities and differences with formative exam types and discussing their necessity |
| Academic misconduct | Cheating | Expressing different opinions about whether or why students would cheat (pointless or easy to cheat, differences between exam types, individual attitudes) |
| | Invigilation | Supporting or expressing doubts about different invigilation approaches, their effectiveness and their acceptance. |
| Worth of exams and qualification validity | Experiential value | Focusing on how the exam centre environment contributes to accomplishment feelings |
| | Validity and worth of degree | Expressing concerns about a reduction in academic standards, devaluation of exams and issues with potential employers |

## APPENDIX D: ONLINE EXAM SCALES

**TABLE D1** Revision satisfaction.

| | *M* | SD |
|---|---|---|
| I was clear about what I should revise | 4.05 | 0.97 |
| Revising helped me reflect and consolidate what I had learnt earlier in the module | 4.28 | 0.87 |
| I learnt new things when revising | 3.66 | 1.02 |
| There was adequate information about how to sit my exam remotely | 4.40 | 0.83 |
| I enjoyed revising the module materials | 3.84 | 0.98 |
| I was given adequate revision support by my tutor | 3.80 | 1.04 |
| There was enough time in the module set aside for revision | 3.92 | 1.02 |
| The TMAs in the module prepared me well for the end of module exam | 3.79 | 1.13 |

**TABLE D2** Online exam satisfaction (range 1–5).

| | *M* | SD |
|---|---|---|
| The exam questions were clear | 3.96 | 0.94 |
| The exam questions allowed me to demonstrate what I had learnt | 3.93 | 0.95 |
| I was satisfied with the mark I got | 3.87 | 1.10 |
| I enjoyed the exam | 3.03 | 1.06 |
| Completing the exam gave me a sense of achievement | 4.04 | 1.01 |

**TABLE D3** Assessment competencies (range 1–5).

| | *M* | SD |
|---|---|---|
| Knowing how to answer an exam question | 2.88 | 0.76 |
| Assessing the quality of my own work | 2.72 | 0.75 |
| Performing well in examinations | 2.43 | 0.79 |
| Using academic terms and language | 2.80 | 0.73 |

**TABLE D4** Invigilation acceptance (range 1–5).

| | *M* | SD |
|---|---|---|
| Temporary restrictions on how you can use your computer (such as locking down browsers) | 2.30 | 0.78 |
| Verifying your identity with facial recognition (via a webcam) | 2.54 | 0.70 |
| Verifying your identity with voice recognition (via a microphone) | 2.50 | 0.75 |
| Verifying your identity by showing an identity document | 2.72 | 0.57 |
| Potential for invigilator to contact you to check you are taking the exam | 2.63 | 0.62 |

**TABLE D5** Online exam anxiety (range 1–5).

| | *M* | SD |
|---|---|---|
| I often felt anxious when revising for my exam | 3.34 | 1.23 |
| The exam was harder than I was expecting | 3.48 | 1.07 |
| I felt anxious when doing the exam | 3.51 | 1.12 |

**TABLE D6** Workspace satisfaction (range 1–5).

| | *M* | SD |
|---|---|---|
| I was able to find a quiet space to take the exam | 4.36 | 0.88 |
| I was satisfied with the quality of the space I used at home | 4.41 | 0.83 |

13652729, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jcal.12888 by The Open University, Wiley Online Library on [03/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License