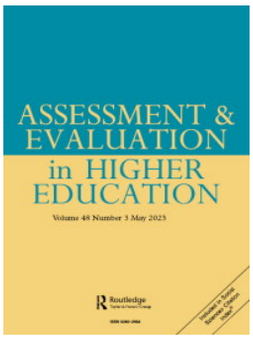

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Online learning and assessment during the Covid-19 pandemic: exploring the impact on undergraduate student well-being

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ABSTRACT

Where traditional learning and assessment approaches have previously been found to negatively impact on student well-being, the Covid-19 pandemic provided a novel opportunity to explore alternative online learning and assessment conditions conducive to student well-being and academic performance as part of a whole university strategy. To this end, the present study employed a mixed-methodological approach using a quantitative survey and 10 focus groups to examine the impact of online learning and assessment on the undergraduate students' well-being. The findings indicate that whilst some students report online learning and assessment to require more effort in comparison to traditional methods, other students value the increased flexibility afforded by online learning and assessment. It is recommended that academic staff scaffold online learning and assessment methods in the curriculum.

KEYWORDS

Covid-19; online; well-being; undergraduates

The rise in student mental health difficulties has been a growing international concern long before the onset of the Covid-19 pandemic (Cuijpers et al. 2019). In the United Kingdom alone, pre-pandemic evidence has consistently identified increasing numbers of students reporting mental distress at university and accessing university mental health services over time (Broglia, Millings, and Barkham 2018), with certain socio-demographic sub-populations experiencing additional mental health challenges and barriers at university, including students from ethnic minorities, lower socio-economic backgrounds and the LGBTQ + community (Office for Students, 2019). Restrictions imposed in response to the Covid-19 pandemic instigated drastic change in the students' daily life, with limitations placed on in-person learning, non-essential activities, and social mixing with other households (Burns, Dagnall, and Holt 2020).

Emergent evidence now shows that, whilst the Covid-19 pandemic had a negative impact on the mental health and well-being of the general population (Pierce et al. 2020; Fluharty et al. 2021), students and young people have been particularly affected by these changes, and have been more likely to report feeling anxious, lonely or hopeless, to experience suicidal thoughts and self-harm than prior to the pandemic (Pierce et al. 2020; Evans et al. 2021) or compared to other demographic groups (Bu, Steptoe, and Fancourt 2020; Fancourt, Steptoe, and Bu 2021). This psychological impact has been experienced disproportionately across the student community (Office for Students, 2020), and is anticipated to persist long-term (Brooks et al. 2020). The implications of Covid-19 have ostensibly compounded pre-existing social, financial and mental

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health challenges and inequalities across the higher education sector (Bu, Steptoe, and Fancourt 2020; Son et al. 2020), whilst simultaneously creating unfamiliar physical and psychological stressors relating to health anxieties, inadequate access to supplies, bereavement, restricted physical exercise and/or recreational activity, and loss of routine (Brooks et al. 2020).

Against this backdrop, sectoral stakeholders have reaffirmed the importance of a whole university approach to student mental health following the Covid-19 pandemic (Hughes and Spanner 2020). Extending beyond the provision of reactive and isolated mental health services and interventions, a whole university approach is inclusive of the needs of the whole student population whilst encapsulating multiple mental health determinants, including academic factors (Hughes and Spanner 2019). Indeed, international evidence found that changes in pedagogic modality, assessment and learning resources during the Covid-19 pandemic contributed to increased stress, anxiety and low mood in a student population (Kecojevic et al. 2020). In explanation, alongside stressors typically associated with academic transitions (Macaskill 2018) and unfamiliar assessment types (Jones et al. 2021), several additional factors have been postulated to contribute to academic distress during the pandemic, including lack of suitable study space, technical difficulties, information overload, loss of interaction with peers and tutors, unavailability of practical pedagogy, increased workload and loss of motivation (Adedoyin and Soykan 2020; Fatoni et al. 2020; Sahu 2020).

'Most universities adopted uninvigilated, open-book, open-web examinations (meaning students can access resources on the Internet rather than being limited to their own notes) taken over 24 h during the examination period, with papers accessed and scripts submitted online' (Buckley et al. 2021, 127). A comparative cohort study found that students ($n = 78$) conducting open-book examinations during the Covid-19 pandemic recorded poorer well-being outcomes than a previous cohort ($n = 84$) conducting in-class closed-book examinations (Spiegel and Nivette 2021). Whilst the transition to online open-book assessment reduced stress and anxiety for some students due to the increased time period, the comfort of one's own personal space, and the opportunity to take breaks (Buckley et al. 2021), Robertson and de Silva (2020), Tam (2022) and Buckley et al. (2021) reported that some students experienced significant stress and anxiety related to online open book assessment during the pandemic attributable to time constraints and the 24 h time period, increased question difficulty, unclear expectations regarding the standard of work expected, and unfamiliarity and/or technical difficulties with online submission procedures. Available evidence pre-pandemic has generally found that students report better academic performance (Myyry and Joutsenvirta 2015) and experience lower test anxiety in the preparation and completion of open book examinations (Block 2012; Durning et al. 2016) due to preferable examination conditions and time conditions (Bengtsson 2019).

Applying effort-reward imbalance theory (Siegrist 1996), it is postulated that a perceived discrepancy between efforts expended and rewards obtained during online learning and assessment may account for lower well-being among some students, by increasing perceived workload, decreasing motivation, and greater psychological distress (Williams, Dziurawiec, and Heritage 2018). Where a bi-directional relationship has been identified between mental well-being and academic performance (Pascoe, Hetrick, and Parker 2020), it is equally predicted that these stressors will negatively impact academic outcomes (Sahu 2020). Notwithstanding, some critics have proposed that online learning may be associated with beneficial outcomes for some students, due to affordances of additional flexibility, accessibility, independent pacing and immediate feedback (Dhawan 2020; Fatoni et al. 2020). Research suggests that social differences in circumstance, and individual differences in coping strategies and resilience, may predict experience and adjustment to online academic stressors during the pandemic (Cruz et al. 2020; Misca and Thornton 2021; Fluharty et al. 2021).

Where health behaviours are associated with both academic performance (Singleton and Wolfson 2009) and well-being (Peach, Gaultney, and Grey 2016), it has been postulated that the relationship between online learning and mental well-being during the pandemic was

partially mediated by government-enforced restrictions impacting on the students' physical activity, sleep, diet and alcohol consumption (Burns, Dagnall, and Holt 2020). The imposed restrictions on movement were found to have a sustained negative impact on student physical activity in the United Kingdom, with significant associations between time spent sedentary and perceived stress (Savage et al. 2020; 2021). International studies (Son et al. 2020) have also indicated increased sleep disruption in students following the pandemic, although this was not replicated in the U.K. student sample (Evans et al. 2021), whilst disruptions to student dietary patterns and eating behaviours have also been reported (Son et al. 2020). However, whilst alcohol consumption increased across the U.K. general population during national lockdown, Evans et al. (2021) found a reduction in alcohol consumption among the U.K. students. These changes in lifestyle factors as a result of the Covid-19 pandemic have been found to affect mental well-being in both students (Bánhidi and Lacza 2020; Dragun et al. 2020) and members of the general population (Sarris et al. 2020).

The present study

Taken together, these preliminary findings substantiate the imperative for further examination of the factors impacting upon the students' experience of online learning and assessment during the Covid-19 pandemic in the United Kingdom, and the implications for student well-being. Given evidence that traditional pedagogy and assessment methods can negatively impact on student well-being (Durning et al. 2016), the enforced shift to online open-book assessments and extended assessment windows during the pandemic provides a novel opportunity to experiment with alternative forms of learning and assessment to benefit student well-being and academic performance. Such research will be a crucial step in developing evidence-informed strategies to support student well-being and academic performance online as part of a whole university approach.

The primary aim of the present study was to establish the impact of online learning and assessment on undergraduate student well-being. On the basis of the existing literature, three secondary research questions were also posited: to what extent can any impact of online learning and assessment on student well-being be attributed to students: (i) perceived workload; (ii) resilience and (iii) changes in lifestyle? To achieve this, a cross-sectional mixed methods design was selected, consisting of a quantitative survey and 10 focus groups to understand student experiences of online learning and assessment during the Covid-19 pandemic.

Method

Quantitative survey

Participants

Survey participants included 94 undergraduate students who had any experience of in-person learning (i.e. lectures, seminars, laboratory classes) at university prior to the Covid-19 pandemic in any discipline based across the United Kingdom. There were no other exclusion criteria. G*Power analysis revealed that 67 participants were required to obtain a medium sized-effect (r^2= .3) with 80% power and a 5% alpha level (Faul et al. 2009). All participants were recruited online via social media. The mean age of participants was 23 (SD = 4.63, range = 19-53).

- 61 participants were female, 31 were male, 1 identified as non-binary, and 1 preferred not to say.
- A total of 6 participants were in the first year of their undergraduate studies, 17 were in their second year, 53 were in their third year, 15 were in their fourth year, 2 were in

their fifth year and 1 was in their sixth year. Note that in the United Kingdom, a typical undergraduate programme is 3 and 4 years when studied full-time.
- A total of 72% of the samples were home students, 19% were international (EU) students and 9% were international (non-EU) students.
- A total of 34% of participants lived in a rented house-share, 24% lived with their parents/family, 21% lived in a university hall of residence, 10% lived in a private hall of residence, 9% lived in a house alone, 1% lived in supported accommodation and 1% preferred not to say.

Procedure

Participants were invited to complete one session which lasted for 15 min online. The survey was built and hosted on Qualtrics. Ethical approval for this study was granted by the University of Durham School of Education Ethics Committee (Reference: EDU-2021-04-06T16_19_21-pjnw34). Survey data was collected from April 2021 to November 2021 and aimed to examine the participants' experience of online assessments during the Covid-19 pandemic.

Survey measures

Dissatisfaction with online coursework assessments

To measure the participants' level of dissatisfaction with online coursework assessments during the Covid-19 pandemic, an online coursework measure was created by the researchers. This measure was designed on the basis of the literature to assess the students' beliefs regarding the distress caused by online coursework assessments compared to traditional assessments (Buckley et al. 2021), the students' perceptions of the effort required to complete the assessment (Williams, Dziurawiec, and Heritage 2018), and the perceived fairness of online coursework (Dhawan 2020; Fatoni et al. 2020). Participants first indicated if they had completed any online coursework assessments during the Covid-19 pandemic. If a participant responded 'no' to this question, then this measure was skipped (6% of participants skipped). Participants indicated their agreement with 6-statements on a 1 (*strongly disagree*) to 5 *(strongly agree*) Likert scale. Example items included 'Online coursework assessments cause me greater distress than traditional assessments' and 'Completing coursework remotely is more academically challenging than completing coursework assessments before'.

Dissatisfaction with online >24 h examination assessments

To measure the participants' dissatisfaction with online examination assessments that were available for over 24 h, an online >24 h examination measure was created by the researchers. This included items which assessed the perceived distress caused by >24 h versus traditional examinations (Robertson and de Silva 2020), the students' perceptions regarding the number of hours that they are expected to spend completing the assignment and the level of excellence expected by lecturers (Buckley et al. 2021), and the extent to which examinations available for over 24 h are fairer than traditional assessments (Robertson and de Silva 2020). Participants first indicated if they had completed any online examination that was available for over 24 h during the Covid-19 pandemic. If a participant responded 'no' to this question, then the following Likert scale was skipped (25% of participants responded no). Next, participants indicated their agreement with 6-statements on a 1 (*strongly disagree*) to 5 *(strongly agree*) Likert scale. Example items included 'Online exam assessments that are available for over 24-hours cause me greater distress than traditional in-person assessments' and 'Online exam assessments that are available for over 24 h are more academically challenging than shorter in-person exams'.

Dissatisfaction with online open-book examination assessments

To measure the participants' dissatisfaction with online open-book examination assessments, an online open-book examination measure was created by the researchers. After reviewing the literature, the researchers determined that the students' attitudes towards open-book examinations are primarily influenced by perceived cognitive demands of open-book versus closed-book examinations; the perceived ambiguity surrounding the task demands, and optimal study approaches to open-book examinations; the level of stress and anxiety experienced when preparing for and completing online open-book assessments; the perceived opportunity for academic misconduct during an open-book examination; and the students' personal preferences (Durning et al. 2016; Robertson and de Silva 2020; Buckley et al. 2021). Dissatisfaction with online >24 h examination assessments and with online open-book examination assessments were operationalised as discrete items to facilitate interrogation of the specific components of online assessment impacting on well-being. Participants indicated if they had completed any online open-book examinations during the Covid-19 pandemic. Participants were informed that an open-book examination referred to an examination in which you were permitted to access your course notes. If a participant responded 'no' to this question, then the following Likert scale was skipped (17% responded no). Next, participants indicated their agreement with 6-statements on a 1 (*strongly disagree*) to 5 *(strongly agree*) Likert scale. Example items included 'Online open-book exams cause me greater distress than traditional in-person closed-book exams' and 'Online open-book exams are more effortful than in-person closed-book exams'.

Lifestyle changes

To measure the extent to which the pandemic had caused any changes to the participants' lifestyle, a lifestyle change measure was created by the researchers. Participants indicated the number of hours on an average weekday that they spent engaged in 12 daily activities before the Covid-19 pandemic, such as 'sleeping at night' and 'revising or studying for university'. Participants were asked to ensure that they reported a total of 24-hours. They were then asked to indicate how happy they felt with those hours on a 1 (Extremely unhappy) to 5 (Extremely happy) Likert scale. Next, participants reported the number of alcohol units consumed, on an average weekday, before the Covid-19 pandemic in a free-text box. Participants were provided with a link to a calculator on the NHS website. These three questions were then repeated in reference to the present time. Lifestyle factors chosen as biological needs (i.e. sleep quality, diet, hygiene and physical activity), engagement in leisure activities (i.e. maintaining relationships with loved ones, screen time, participating in hobbies) and societal duties (i.e. studying, working and volunteering) have previously been shown to have an impact on the undergraduate students' mental health, even prior to the pandemic (Duffy et al. 2020).

Resilience

To measure resilience, the Brief Resilience Scale (BRS) was used (Smith et al. 2008). In this measure, participants indicated their agreement with 6-statements on a 1 (*strongly disagree*) to 5 *(strongly agree*) Likert scale. Items included 'I tend to bounce back quickly after hard times' and 'I usually come through difficult times with little trouble'.

Well-being

To measure well-being, the Warwick-Edinburgh Mental Wellbeing Scale Short-Form was used (Tennant et al. 2007). This contained 7-items which asked participants to describe their

experiences over the last two weeks (e.g. 'I've been feeling useful' on a 1 (*none of the time*) to 5 (*all of the time*) scale. Larger well-being scores indicate greater mental well-being.

Perceived workload

To measure perceived workload, we used the Effort-Reward Imbalance Questionnaire (Li et al. 2010). This questionnaire was chosen as it demonstrated the extent to which participants felt that study effort was suitably rewarded. All references to 'school' and 'teachers' were substituted with 'university' and 'lecturers'. The questionnaire consisted of 19-items measured on a 1 (*strongly disagree*) to 5 *(strongly agree*) Likert scale. Two subscales were included in the questionnaire: effort and reward. Example items included, 'I put a lot of effort into my university assignments, but I don't get the recognition I deserve from my lecturer(s)' and 'I have too many university assignments'.

Data preparation. All scales were averaged to create an index for each of the variables of interest. For the effort-reward imbalance measure, the participants' scores from the effort subscale were divided by their scores from the reward subscale to produce an effort-reward imbalance score. Quantitative data analysis was conducted in MATLAB.

Focus groups

Design

To give additional context and depth to the data collected from the quantitative survey, ten online focus groups were conducted across March and April 2021 using Zoom. These focus groups did not examine online learning and assessment in isolation, but also explored support services, financial conditions and social relationships as part of a wider research project. The data on online learning and assessment is presented in this paper.

Modelled on Student Voice Forums (Piper and Emmanuel 2019), focus groups employed a semi-structured 'future retrospective' creative ideation strategy, which asked students to collectively imagine, on the basis of their lived experience, the ideal approach to student mental health and well-being at university.

Participants

Focus groups ranged in size from 5 to 15 participants, with 100 participants in total. Participants were recruited through purposive convenience sampling, using a range of national stakeholder networks. Participants initially included current undergraduate or postgraduate students with and without lived experience of mental health difficulties, from a diversity of institutions across the United Kingdom and different levels of study, age, gender and nationality. For this study, postgraduate ($n = 28$) and the first-year undergraduate ($n = 17$) students were excluded to ensure commensurable experience of online learning and assessment. The final sample included for analysis constituted 55 students from across 23 different U.K. universities; with a range of gender, ethnicity and mental health identifications (see Table 1).

Data preparation

Each focus group lasted approximately 50 min in duration, providing a total of 472 min, which were audio-recorded and manually transcribed. Befitting the tenets of co-production (see Priestley et al. 2022), transcripts were thematically analysed using a grounded theoretical approach, wherein conceptual codes, categories, sub-themes and themes inductively emerged from the

Table 1. Focus group participants' demographic information.

Gender	44% Male
	56% Female
Ethnicity	56% White British/White European/Any Other White Background
	24% Asian/Asian British/Indian/Pakistani/Bangladeshi/ Chinese/Any Other Asian Background
	18% Black/African/Caribbean/Black British/Any Other Black Background
	2% Mixed/Multiple Ethnic Groups
Mental health diagnosis	20% Yes
	73% No
	7% Prefer Not To Say

data to ensure grounding in the student voice and experience (Glaser and Strauss 1967). Coding was conducted collaboratively.

Results

Quantitative results

Demographic characteristics and well-being

It was first examined whether well-being scores were impacted by the participants' demographic characteristics. A one-way independent samples analysis of variance (ANOVA) revealed that there was no significant difference in well-being scores between home students ($M = 3.13$, $SD = .71$), international (EU) students ($M = 3.48$, $SD = .61$) or international (non-EU) students ($M = 2.93$, $SD = .86$), $F(2,91) = 2.3$, $p = .11$, $\eta_p^2 = .05$. There was no significant difference in well-being scores between participants living alone ($M = 2.84$, $SD = .73$), living with parents/family ($M = 3.21$, $SD = .8$), living in private halls of residence ($M = 3.61$, $SD = .48$), living in university halls of residence ($M = 3.32$, $SD = .72$), living in a rented house share ($M = 3.12$, $SD = .63$), or living in other accommodation ($M = 2.82$, $SD = 1.05$), $F(5,88) = 1.29$, $p = .28$, $\eta_p^2 = .07$. Due to the lack of differences between groups, for the remaining analyses, we explored the effect of online assessment during the Covid-19 pandemic on well-being across the whole sample.

The relationship between dissatisfaction with online assessments and well-being

To assess the impact of online assessment on undergraduate student well-being, Pearson's correlations were performed between well-being scores and dissatisfaction with online coursework, online >24 h examination and online open-book examination scores (see Table 2). Dissatisfaction with online open-book examinations demonstrated a significant positive correlation with well-being ($p < .001$; see Figure 1). No other variables correlated significantly with well-being (all $p > .05$).

The relationship between perceived workload and well-being

To investigate to the extent to which the students' well-being is associated with perceived workload, a Pearson's correlation was performed between effort-reward imbalance and well-being scores. There was no significant association $r(93) = .06$, $p = .6$ (see Figure 2).

The relationship between resilience and mental well-being

To establish the extent to which the students' well-being can be linked to resilience, a Pearson's correlation was performed between resilience and well-being scores. A significant positive association was revealed, $r(93) = .46$, $p < .001$ (see Figure 3).

Table 2. Inter-variable correlations between well-being scores and each predictor variable.

	1	2	3	4
1. Well-being				
2. Dissatisfaction with online > 24 h examinations	.13			
3. Dissatisfaction with online open-book examinations	.39**	.67**		
4. Dissatisfaction with online coursework	.06	.41**	.28*	

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed)

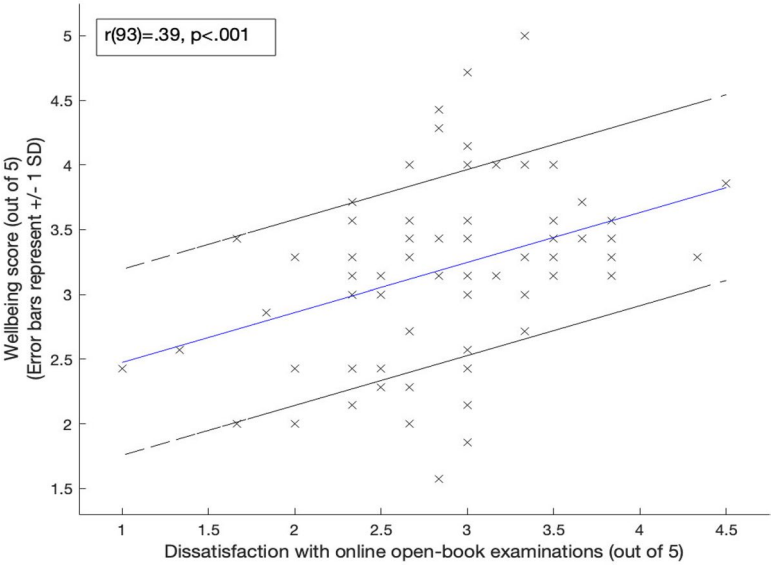

Figure 1. Well-being scores plotted against dissatisfaction with online open-book examinations. Note: Error bars represent +/- 1 standard deviation.

Lifestyle changes before versus after the beginning of the covid-19 pandemic

Paired samples *t*-tests were performed to determine whether there was a significant difference in the number of hours that participants spent completing 12 daily activities on an average weekday after the start of the Covid-19 pandemic (see Figure 4). It was found that, in comparison to before the pandemic, there was no significant change in the number of hours spent sleeping at night, maintaining personal hygiene, preparing and consuming meals, completing life administration tasks (i.e. completing errands/chores), maintaining relationships with friends and family, revising or studying for university assessments, undertaking paid or voluntary work, or consuming entertainment (i.e. shopping, reading, watching Netflix, etc) (all $p > .05$). However, participants did report spending significantly more hours using their mobile phone, $t(93) = -3.95$, $p < .001$. In addition, participants reported spending significantly less hours travelling, engaging in hobby activities and attending university commitments (such as lectures and seminars) (all $p < .001$). Participants also reported a significant reduction in the number of alcohol units consumed after the beginning of the pandemic ($M = 3.34$, $SD = 15.74$; $M = 4.6$, $SD = 20.99$ and $t(93) = 2.05$, $p = .04$). Despite the reported impact of the pandemic on the participants' daily activities, there was no significant difference in the participants' self-reported satisfaction with the hours spent on each daily activity before ($M = 3.44$, $SD = 1.03$) and after the pandemic started ($M = 3.32$, $SD = 1.11$), $t(93) = .88$, $p = .38$.

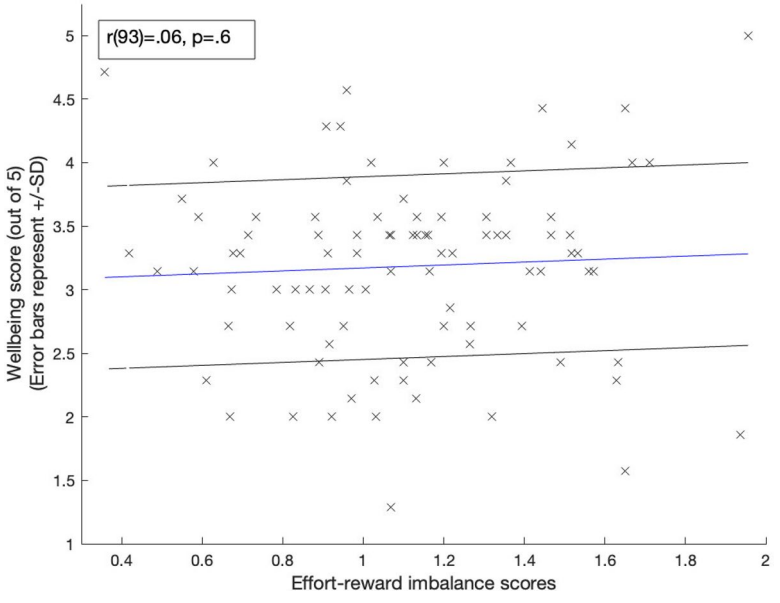

Figure 2. Reward-effort imbalance scores plotted against well-being scores. Note: Error bars represent +/- 1 standard deviation.

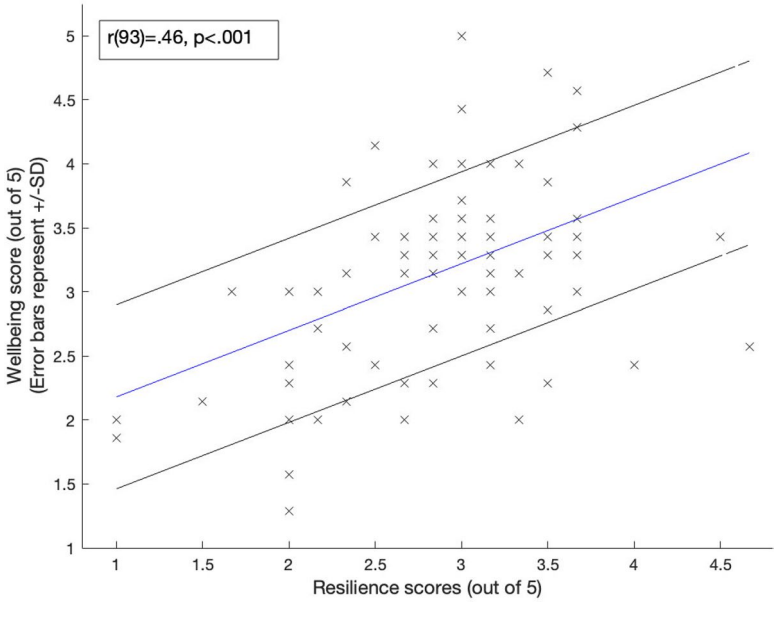

Figure 3. Resilience scores plotted against well-being scores. Note: Error bars represent +/- 1 standard deviation.

The relationship between lifestyle changes and well-being

To investigate the association between these reported lifestyle changes and participants' well-being, Pearson's correlations were performed between well-being scores, and the difference in hours spent engaging in phone screen time, travelling, hobbies, university commitments and the number of alcohol units consumed (see Table 3). A higher difference

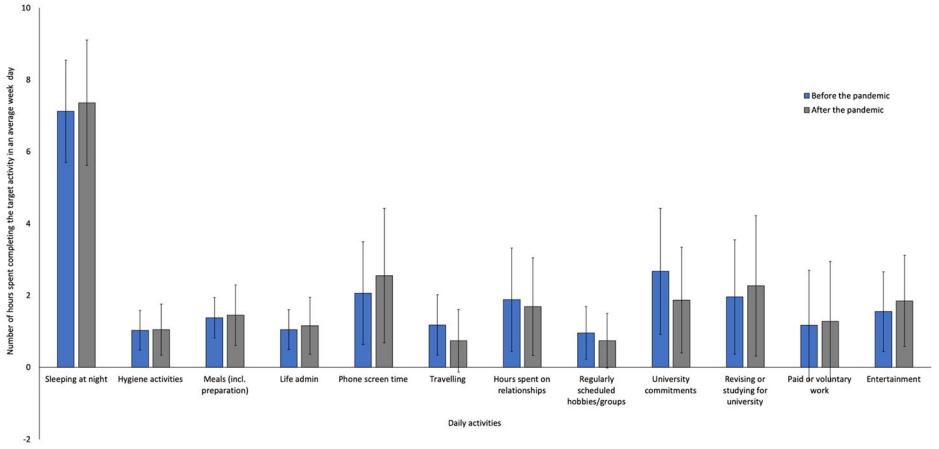

Figure 4. Number of hours spent engaging in 12 daily activities before the Covid-19 pandemic and after the Covid-19 pandemic began. Note: Error bars represent +/- 1 standard deviation.

Table 3. Inter-variable correlations between well-being, effort-reward imbalance and each activity of interest.

	1	2	3	4	5
1. Well-being					
2. Phone screen time	−.14				
3. Travelling	−.07	−.18			
4. Engaging in hobbies	−.02	−.14	.15		
5. University commitments	.24*	−.29*	−.09	.3*	
6. Alcohol units consumed	−.2	−.02	.05	−.04	−.05

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

score indicated a greater magnitude of change in the number of hours spent engaging in an activity. It was found that there was a significant positive correlation between the difference in hours spent attending university commitments and well-being score, $r(93)= .24$, $p= .02$ (see Figure 5). No other variables correlated significantly with well-being (all $p > .05$).

Qualitative results

Thematic analysis extracted two key themes: online learning and online assessment. Online learning encompassed two subthemes: pressure and perceived workload; and inclusivity and accessibility. Online assessment contained three subthemes: uncertainty over expectations; technical and environmental challenges; and confidence and flexibility.

Online learning

Pressure and perceived workload

The majority of participants perceived a-synchronous online learning to increase workload. 'The material online is hours of work before the lecture' and then academic staff upload 'four different recordings for just one topic because they don't want to miss any content, which is quite lengthy for us'. Students described having to spend significantly longer than the allocated lecture time to cognitively process content:

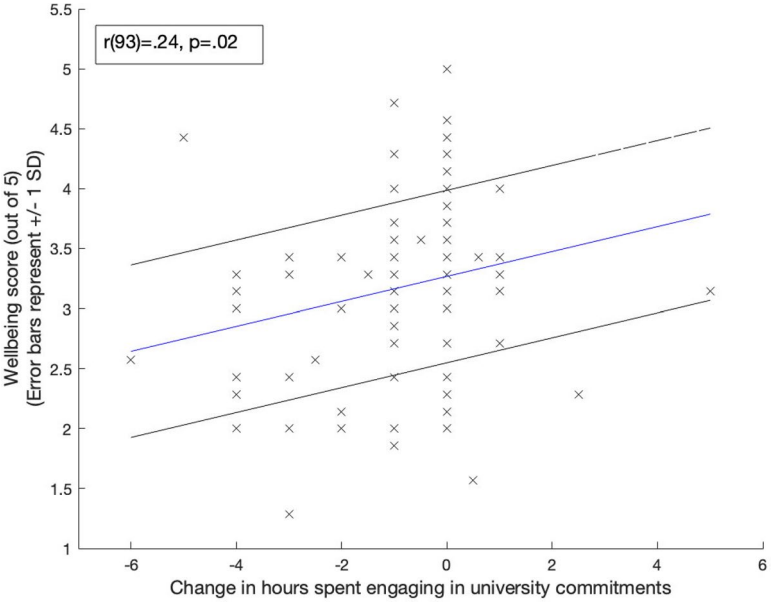

Figure 5. Well-being scores plotted against hours spent engaging in university commitments. Note: Error bars represent +/- 1 standard deviation.

> My lectures are pre-recorded and there is so much content that they give in an hour and a half lecture, so it ends up taking about three hours to do it' which 'puts pressure on generally organising your time and doing the readings on top of that.

Moreover, some students felt their university had not acknowledged the additional emotional labour and cognitive load required to learn online, because 'things that weren't mentally exhausting in person, when they are transitioned to online, I find them so much more difficult'. Students identified additional difficulties to engage and retain motivation with online learning during the pandemic 'with no academic environment – eating, sleeping and working in the same place'. 'Motivation to actually get work done this year has been impossible', because 'it's really difficult to find a schedule at home'; 'work is so unstructured and flexible that it's really hard to push yourself to do it' given that 'it's easier to get distracted when you are learning online'. Participants described how learning online without face-face peer or tutor interaction can reduce academic motivation, engagement and enjoyment because 'you don't really get the connections you would make in a normal learning environment'. For other students, 'the missing part of online is the practical experience', particularly 'in certain more practical degrees like teaching and medicine'. In addition, 'it [online learning] disadvantages some students because of inequality' given that 'not every student is able to access laptops and tablets' and 'not all students have Wifi access'.

Inclusivity and accessibility

Conversely, other participants felt 'online uni has been a massive benefit' providing greater inclusivity and accessibility, particularly for disabled students. Hence, where other students reported increased workload, these participants appreciated being able to replay recordings and make notes to consolidate their learning. 'In-person lectures, I sometimes find it a bit hard to keep up, so I am a fan of being able to pause and make some notes'. Moreover, online media make it easier to 'ask questions and we don't have to wait a week for our questions to be answered'. Other participants highlighted that 'pre-recorded lectures have facilitated a bit of

flexibility' to individual learning needs and other commitments, 'so you can do it whenever you need to at a time that suits your schedule'.

Online assessment

Uncertainty over expectations

Some participants felt that assessment had 'become more stressful through the introduction of remote, electronic, examinations during the Covid-19 pandemic'. For 'a lot of people in my cohort, the 24-hour exam system is just not working, because it makes the exams so much harder by creating uncertainties and anxieties related to assessment timing, expectations and environment'. Especially 'without the opportunity of having a mock', participants felt that 'the expectations around what the markers want from you in a 24-h exam needs to be made clearer'. Participants described particular uncertainty about expected standards in an extended timeframe. 'It puts all the more pressure on when its open book because then you think they are going to be judging me that I've been looking at my book this entire time and it has to be flawless'.

> if you have 24-hours to write it, maybe the [module] leaders are going to be looking at how long you spent on it and marking it against that - even though I know they say that is not going to happen, I still have that worry about how long other students are spending on it and how long should I spend on it?

In addition, availability of an extended timeframe ostensibly prolonged performance anxieties, with some 'people saying online exams puts too much pressure on them and they want to get rid of it to make it more of a timed thing.

Technical and environmental challenges

Moreover, 'online exams are difficult to do since you are in your own environment in your comfort zone'. Participants described how technical difficulties and 'unfamiliarity with the software and layout of things' could exacerbate examination stress given that 'I don't know if I can do everything I'm expected to do on my computer with technical issues'. Further compounding anxieties about expectational standards, some students felt that 'the integrity of some of these exams is just not very high' given that 'it's becoming easier and easier to plagiarise' and students 'can talk to each other about the exams if it's unmonitored'.

Confidence and flexibility

Other students felt that 'the open book format really helped just with being confident in what you have written' and 'everyone has been really much happier doing the online ones [examinations]'. In particular, 'with the exams being open book, that has definitely made it less stressful by removing the pressure of having to remember things word for word', whilst 'some people really wanted to keep the 24-hour format'. Other students felt 'the 24-hour format allows for a bit more flexibility if you need to leave your exam and come back to it, or for whatever reason you have issues'.

Discussion

This paper has identified the factors impacting on the students' experience of online learning and assessment during the Covid-19 pandemic and the implications for student well-being. The results suggest that, like traditional assessment practices, novel online approaches are not without their own unique challenges. Whilst no direct association was found between online assessment and well-being, echoing the previous findings (Buckley et al. 2021; Tam 2022), the

results of this study indicate that certain students may experience online learning and assessment as more effortful and less rewarding given environmental challenges and uncertainty of expectation. Other students value the increased flexibility and accessibility afforded by online learning and assessment methods. Consistent with effort-reward imbalance theory (Siegrist 1996) and existing evidence (Buckley et al. 2021; Tam 2022), the qualitative findings demonstrate that, for some students, pedagogical unfamiliarity, extended timings of assessments and availability of resources have significantly increased the task demands, whilst unsuitable workspaces and the wider emotional and physical disruption brought by Covid-19 have significantly reduced resources. Prior evidence shows that persistent perceived discrepancy between task demands and personal practical and mental resources can produce excessive academic stress and cognitive overload, with detrimental implications for both student well-being and academic performance in the long term (Williams, Dziurawiec, and Heritage 2018).

Although time spent studying did not change during the pandemic, the qualitative findings demonstrate that participants perceived workload to be greater online due to investment of additional effort, particularly amid challenges concerning motivation, study environment and technology (Buckley et al. 2021). This finding was not echoed in the quantitative results which may be indicative of a disparity in the universities' approaches to online assessment and individual differences in the students' ability to adapt (Tam 2022). Given that previous research has identified a bi-directional relationship between stress and academic performance, the positive association found between resilience and well-being suggests that students with higher resilience are more likely to adapt to unfamiliar task demands online, experiencing moderate situational stress that can enhance cognitive capacities, whilst students with lower resilience experience overwhelming and debilitating stress with lower well-being.

The disruption of Covid-19 restrictions on social relationships and lifestyle, and the detrimental impact on well-being, was not as significant as anticipated - arguably increasing the generalisability of the findings outside the pandemic context. Despite social distancing restrictions and closure of non-essential business, time spent maintaining relationships with family and friends did not change after the start of the pandemic, which may be explained by a significant increase in screen time as students adapted to socialising online. Furthermore, there was no significant difference in participants' self-reported satisfaction with hours spent on daily activities before and after the pandemic started. However, a greater number of hours spent engaging in university commitments, such as lectures and seminars, was found to be associated with greater well-being. Whilst it may be that students with higher well-being were more likely to engage in university commitments, it may equally be the case that greater attendance at university commitments afforded students a method through which to maintain a sense of normality and attachment to their university. Previous research has shown that displacement away from the university campus, as imposed by national restrictions, can result in a loss of identity, sense of purpose and belonging, which in turn can have negative outcomes for the students' well-being (Gopalan, Linden-Carmichael, and Lanza 2022). Conversely, attending university commitments online may have offered a fundamental means to maintain the student's sense of identity and provided a vital sense of normality in a time of heightened uncertainty.

Implications for practice and future research

Corroborating previous evidence (e.g. Jones et al. 2021), the findings demonstrate variable preferences for online and in-person pedagogy and assessment among different students. Whilst some students experienced online learning and assessment as more effortful and less rewarding, others identified beneficial flexibility, inclusivity and accessibility supporting academic self-efficacy and alleviating examination stress. Particularly where traditional pedagogy and/or closed-book and time-restricted examinations in an invigilated environment are reported to negatively impact on student well-being (Durning et al. 2016), online learning and assessment

may offer one strategy to alleviate academic stress for some students as part of a whole university approach. However, the lack of significant correlations between well-being and dissatisfaction with online assessment practices may indicate that online approaches still come with unique challenges that need to be overcome.

There are three recommendations for improving online learning and assessment practices from this study. First, given that online study is associated with greater cognitive effort and lower reward for some students, university staff must ensure that the expectations and criteria for online study and assessment types are clearly communicated to students, particularly in relation to timing. In doing so, staff should ensure online learning and assessments are appropriately scaffolded and integrated into the curriculum, with suitable resources and environment available to every student. Second, given that greater time spent engaging in university commitments was associated with higher well-being, universities should ensure that the barriers to online attendance, such as technical difficulties and decreased motivation, are minimised. Third, given that the lack of any significant association between well-being and the online assessment measures may be attributable to different practices at different universities, it is recommended that the Higher Educational Quality Assurance Agency ensure that a standardised, evidence-based practice is in place across the university sector. Future research should continue to examine the implications of online learning and assessment on student well-being outside of the Covid-19 pandemic context, and the relationship with academic performance.

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Data availability statement

Repository: Online learning and assessment during the Covid-19 pandemic: Exploring the impact on undergraduate student well-being. https://osf.io/sjc3v/?view_only=ffe89ad85f2e4ee49e51140bdffaf4a7

This project contains the following data:

- OnlineAssessment_RawData.csv. (Contains the raw quantitative data).
- OnlineAssessment_ProcessedData.csv. (Contains the processed quantitative data on which all statistical tests were performed).
- Focus Group Data File.pdf (Contains the full qualitative data collected via the focus groups).

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