STATISTICS STUDENTS' PERSPECTIVES OF FORCED ONLINE LEARNING

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We describe a study that explored perceptions and experiences of statistics students at universities in the United Kingdom who had to adjust to learning online as a result of COVID-19 restrictions. Students from two universities (one research-intensive, the other with a teaching focus), and groups of first- through third-year students from five undergraduate statistics courses were surveyed. The wellbeing of students studying online differed between the two universities, and wellbeing was related to students' experiences of learning remotely, with more negative wellbeing scores associated with worsening online learning experiences. Students did not feel they interacted as well with their peers or lecturers in an online learning environment compared to in-person learning. This study can inform statistics educators how to better support their students' learning.

INTRODUCTION

Studies have been conducted prior to the COVID-19 pandemic focusing on students in higher education who enroll in online courses and their feelings towards online learning. These studies found that students learning in a "virtual environment" were more likely to drop out (Park & Choi, 2009). The reasons for this included not having enough motivation (Artino & McCoach, 2008), feeling lonely and isolated (Paulus & Scherff, 2008), and suffering with technology issues (Hara, 2000). In the 2019–2020 and 2020–2021 academic years, all university students in the United Kingdom (UK) had to adjust to a virtual learning environment because of COVID-19 regulations. The rules meant that all teaching material and interaction with other students and teaching staff, which had formerly been done in-person, had to be done online. Whether they liked it or not, students very suddenly had to adapt to online learning. Consequently, this meant these students were potentially at risk of the same issues, such as lacking motivation and technology issues, as those observed in the studies of voluntary online students. Another potential big effect of the pandemic was an increase in mental health issues with feelings of isolation especially high. This, combined with the fact that interactions had to be done virtually and that in-person socializing was not allowed, is likely to have affected students and their studies.

This paper describes a study to investigate the remote online learning experience of statistics students who in 2020–2021 had to adjust to learning online because of COVID-19 restrictions. The study explored and compared the perceptions and experiences of students learning online, together with their general wellbeing, at the University of Glasgow and Sheffield Hallam University. These universities represent different types of UK universities: the University of Glasgow is part of a group of 24 British research-intensive universities, and Sheffield Hallam University is a teaching focused university.

SURVEY DESIGN

The data were obtained via surveys filled out by students at the two universities at the end of the 2020–2021 academic year. Table 1 displays the sample sizes of students who filled out the surveys at each university.

Table 1. Sample sizes of different cohorts of students

Institution	First Year	Second/Third Year	Total
University of Glasgow	44	22	66
Sheffield Hallam	54	33	87

The survey was comprised of statements about the learning experience of students in a remote learning environment to which each student was asked how much they agreed with the statement from

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1 (strongly disagree) through 4 (neither agree nor disagree) to 7 (strongly agree). The statements used in the survey were primarily from the Motivated Strategies for Learning Questionnaire (Pintrich et al., 1991). Some statements were modified to be specific to learning statistics remotely. The survey statements explored how the students felt about their general online learning experience, their passive and active participation, their ability to ask for help, their motivation, and their general preferences for teaching methods. The statements were grouped into sub-categories, and the values of the response in each subcategory was the average of the student's numerically coded answers to all the statements within the sub-category. The names of the sub-categories, along with a brief description of what they mean, are displayed in Table 2. Every sub-category describes a different aspect of online learning, and a higher response indicates a more positive learning experience.

Table 2. Table of subcategories created from the learning experience survey statements

Sub-category	Description of Subcategory
General Experience	How they have found online learning to be
Passive	Regular attendance when learning remotely
Active Learning	Active engagement when learning remotely
Help-Seeking	Getting help when needed when learning remotely
Own Learning	Ability to learn effectively when learning remotely
Persistence	Perseverance despite difficulty and lack of motivation learning remotely

Second- and third-year students, who had been taught in-person the previous year, were additionally given the same group of statements as those set in the remote learning environment but set in the face-to-face environment they experienced throughout the 2019–2020 academic year. In addition, all students were also asked these four questions about their wellbeing:

1. How often have you felt worn out?
2. How often have you had problems concentrating?
3. How often have you felt sad?
4. How often have you felt tense?

Students were asked to respond to each wellbeing question using this scale:

1. not at all;
2. a small part of the time;
3. part of the time;
4. a large part of the time; and
5. all the time.

Responses to these four questions were averaged for each student to define a wellbeing score. It should be noted from the definition of the above scale that higher values of the wellbeing score (perhaps counterintuitively) reflect more negative emotions.

RESULTS

Student Wellbeing

Comparisons of the wellbeing scores between the two universities and different year groups using a two-way ANOVA model revealed that there were significant differences in the mean of the students' responses to the wellbeing questions between universities (p-value = 0.001) but not between year groups (p-value = 0.464). Further analysis comparing the distributions of the responses to the four wellbeing questions between the two universities using chi-squared tests of association and adjusting for multiple comparisons revealed that the universities only differed significantly with respect to the fourth wellbeing question "How often have you felt tense?". The relative frequencies showed that Sheffield Hallam students were generally more likely to feel tense than Glasgow students.

Online Versus In-person Learning Experiences

The Wilcoxon signed-rank test was used to test whether there was a statistically significant difference in the second- and third-year students' paired responses to learning experience statements when learning online and in-person. Each university was considered separately, and after adjusting for multiple comparisons, significant differences between online and in-person experiences were found for Sheffield Hallam in two statements:

1. I actively participate in tutorials e.g., complete exercises/tasks, communicating with staff/students about class work.
2. I work regularly with other students to understand class material or complete assessments.

The distributions of these paired differences revealed that students agreed more that they participated in tutorials and worked regularly with other students while studying in-person than remotely. This was in contrast to the other 16 learning experience statements, where no significant differences between online and in-person learning were found, and to Glasgow students, where no significant differences between online and in-person learning were found.

Relationships Between Student Wellbeing and Learning Experiences

Linear models were used to explore relationships between the learning experience subcategories (see Table 2) and the universities and year groups whilst also taking into account students' wellbeing scores. All of the final models with each of the learning experience subcategories as responses (see Table 3) had significant negative linear relationships between the online learning experience subcategories and wellbeing scores. This means that a higher score in wellbeing (representing negative emotions) corresponded to a more negative experience of online learning. In four of the subcategories (general online experience, passive, help seeking, and own learning) the only other significant term was related to the universities, with Glasgow associated with higher online learning experience scores (after accounting for wellbeing) in all subcategories except "help seeking," where it had a significantly lower score compared to Sheffield Hallam, as shown in Figure 1. The only subcategory that had a significant interaction between university and wellbeing score was persistence, which had a negative correlation with wellbeing in both universities, with a steeper slope for Glasgow.

Table 3. Table summarising the coefficients for each linear regression model, with significant coefficients highlighted with an asterisk (*)

Response	Intercept Coefficient	University Coefficient [95% CI]	Wellbeing Coefficient [95% CI]
General online experience	6.714	0.397* [0.049, 0.745]	-0.673* [-0.844, -0.501]
Passive	6.366	0.648* [0.226, 1.070]	-0.594* [-0.802, -0.386]
Active learning	6.110	-0.177 [-0.617, 0.263]	-0.476* [-0.693, -0.259]
Help seeking	6.517	-0.914* [-1.413, -0.414]	-0.560* [-0.812, -0.309]
Own learning	6.526	1.018* [0.608, 1.428]	-0.734* [-0.936, -0.533]

CONCLUSIONS

Previous studies have looked at the experiences of students who have chosen to study online distance learning courses. This study adds to the knowledge of student experiences of online learning in statistics by considering cohorts of students who did not choose online learning but were forced to adopt this mode of learning.

This study found that the wellbeing of students studying online differed between the two universities. It should be noted that Sheffield Hallam students took the survey around the time of assessment, which may have impacted on their self-reported wellbeing scores. Sheffield Hallam students also indicated that they do not feel they interact with their peers or lecturers in an online

learning environment as much as when learning in-person, although in all of the other subcategories and at the other university, no significant differences were found. Sheffield Hallam students were enrolled on compulsory rather than elective courses, which may impact on their approach to learning. Wellbeing, however, was related to the students' experiences learning remotely at both universities, with a higher wellbeing score (indicating negative emotions) associated with poorer online learning experiences.

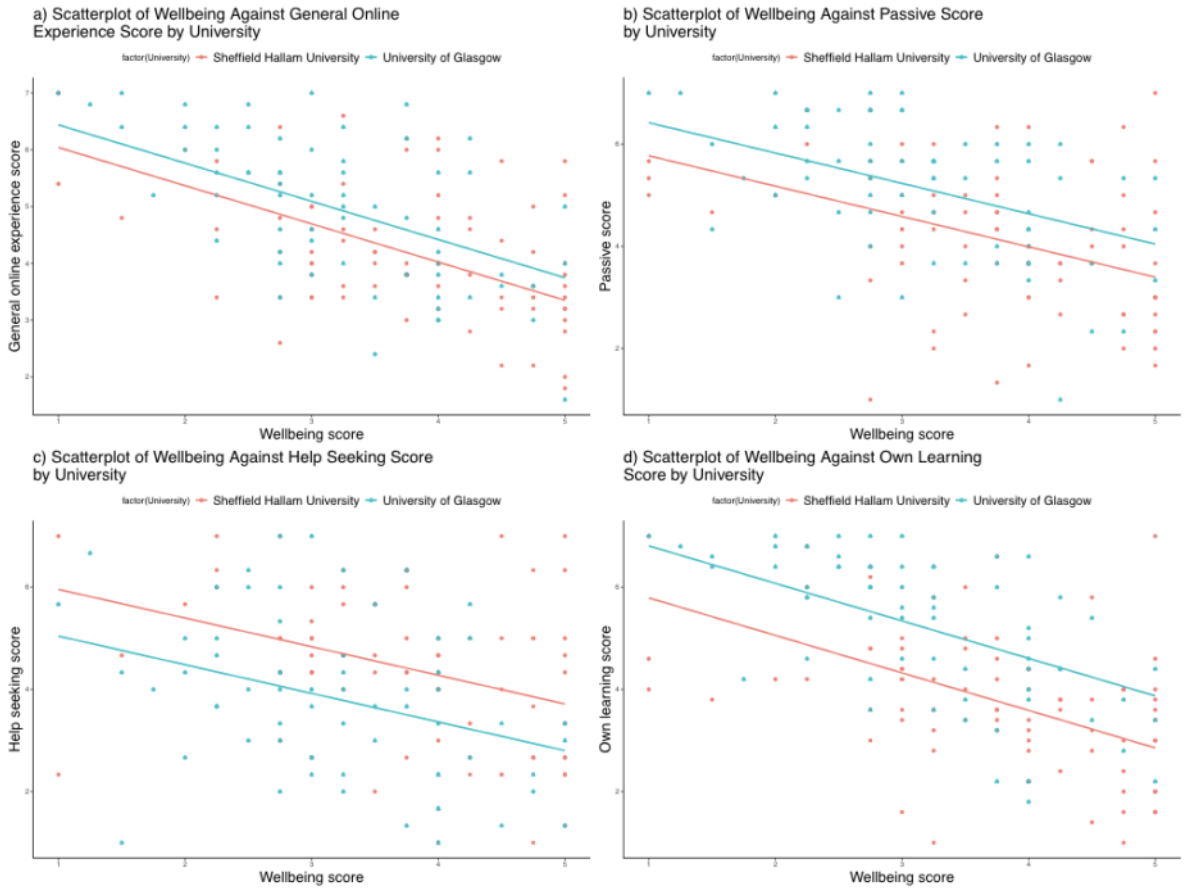

Figure 1. Scatterplots with different fitted models for each university superimposed

Although it is hoped learning and teaching will continue to return to more in-person modes of delivery, the technological advances in online learning continue and will facilitate ongoing online delivery. This study adds to the body of knowledge of the student experience of online learning that can inform statistics educators how to better support their students' learning

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