Attitude of Science Students towards Zoom Online Lectures

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Abstract

Objective: The importance of understanding the effectiveness of online teaching was highlighted by the COVID-19 pandemic, with students more commonly studying remotely, specifically, *via* Zoom. However, attitudes of science students to online lectures are largely unknown; consequently, understanding attitudes will help develop the most effective ways to deliver lectures, taking into consideration student well-being.

The hypotheses were: science students would have a negative perception towards Zoom online lectures; biomedical students would be more negative towards Zoom online lectures than other science students.

Materials and methods: To evaluate perceptions of Zoom online lectures, 20 statements were developed utilising the Thurstone and Chave method 1951. Using these statements, an online questionnaire was made, utilising Google Forms. With ethical approval, the questionnaire was sent out to undergraduate bioscience students *via* university email addresses. Survey responses were collated; based on agreement to the scored statements, mean scores were calculated. The Wilcoxon test was used to identify any significant statistical differences.

Results: The mean score for all science students indicated positive perception, with no significant difference between Biomedical science students and other science degrees, such as between Biomedical science and Biochemistry (p=0.3374 U=3527). Males had a more positive perception than females (p=0.02207 W=13946). Between ages 18-19 years and those aged 20+ there was no significant difference (p=0.1719 W=17586).

Conclusion: Overall, the perception of science students to Zoom online lectures was positive. There were no significant differences between different degrees: Biomedical science students were not more positive. Significant difference between genders was seen, however, age had no impact.

Keywords: Pandemic • Questionnarie • COVID-19 • Universities • Perception

Introduction

The COVID-19 pandemic has spread around the world, beginning in December 2019 and has had devastating impacts on human life both physically and mentally [1].

In the UK, from 2018-19 to April, one month into the United Kingdom lockdown, mental distress levels rose from 18.9% to 27.3% amongst the general public [2]. In China, moderate or severe anxiety associated with the pandemic was 28.8% [3].

The 'Stay Home, Protect the NHS, Save Lives' message was delivered by the UK government on 23rd March 2020 [4]. As a result of quarantining and social distancing measures to prevent transmission of the virus, remote learning was adopted by United Kingdom universities [5]. 1.58 billion Learners worldwide were predicted to have had interruption to their education as a result of the COVID-19 pandemic, indicating the scale of impact [6].

This resulted in lectures being delivered online, utilising platforms such as Zoom, a videoconferencing platform which incorporates features such as online meetings, chat services and screen sharing [7]. This article focusses on Zoom lectures as this is the online platform utlised by Cardiff University.

Consequences of remote learning on student mental health and wellbeing have been suggested. In China, a study indicated that the percentage of college students experiencing anxiety as a result of the COVID-19 outbreak was 24.9%, demonstrating the psychological toll of the pandemic on students [1]. Moreover, in a study amongst United States students, 71% (138 students) of US students demonstrated increased stress and anxiety, with 91% (173 students) indicating they had been negatively impacted by the pandemic [8]. Consequently, understanding the negative factors surrounding remote learning, more specifically lectures *via* Zoom is important. Moreover, the hypothesis was made that science students would have a negative perception towards Zoom online lectures.

Factors influencing the impact of remote study have been identified as the learning environment or living arrangements, technological requirements and relationships between students and lecturers [6]. Such factors impact learning and student wellbeing due to accessibility to the educational materials and societal isolation. This further demonstrates why the hypothesis was made that science students would have a more negative perception towards Zoom online lectures.

The hypothesis was made that those students over 20 years old would have a more negative perception towards Zoom online lectures compared to younger students. This is perhaps due to older students having more experience of 'conventional' face-to-face lectures and laboratory practicals, thereby impacting their view of online lectures.

Science students face a unique challenge in completing their education remotely due to the need for laboratory and practical experience such as dissection in anatomy modules [9]. Delivering these practicals *via* Zoom may alter the attitudes of science students towards Zoom online lectures as a result of the effective or ineffective delivery of these practicals. As a result, different science degree titles may have different perceptions towards Zoom online lectures and it was predicted that biomedical students would have the most negative perception towards Zoom online lectures. At Cardiff University, cadaveric dissection is utilized over two semesters as a method to teach Biomedical students. Thus, in normal circumstances, biomedical students are subject to more face-to-face teaching than other science students and consequently, may have a more negative perception towards Zoom online lectures.

This study is based on the established framework according the Thurstone and Chave method.

Aims

The objectives of this research were

• To analyse the perception of science students towards Zoom online lectures.

• To identify any potential differences between the perceptions of different degree titles

• To assess any other factors which may impact perception of Zoom lectures

Hypotheses:

• Science students have a negative perception towards Zoom online lectures.

• Biomedical science students have the most negative perception towards Zoom online lectures compared to other science degree titles.

• Those aged 20+ years will have a more negative perception towards Zoom online lectures.

Materials and Methods

Design

Initially, twenty randomly arranged statements regarding perception of Zoom online lectures were written including ten positive and ten negative attitudes in Table 1. A panel of 8 individual judges with varying educational backgrounds and ages were selected to judge the positivity or negativity of each statement. These statements were given to the panel that scored each statement according to a set of instructions, detailing the Thurstone and Chave method 1951 Table 1. The Thurstone and Chve method was utilised because it identifies perception/attitude and has been used in previous research regarding scientific education [10]. Accordingly, the statements were rated on a scale 1-11. A rating of 1 means the statement has an extremely favourable attitude towards Zoom online lectures, six means the statement has a moderate attitude towards Zoom online lectures and a rating of 11 means the statement has an extremely unfavourable attitude towards Zoom online lectures. The judges were asked to score the statements objectively on favourability, and without personal opinion. Upon collating the scores, mean averages were calculated determining the level of positivity and negativity of each statement. The judges were excluded from completing the questionnaire.

Questionnaire

The questionnaire was designed on 'Google Forms' for online distribution. On the first page, an information page was provided, detailing the research objectives and confidentiality, email addresses of the research leads were provided in the instance of need for further information. Participants were then asked to complete a consent form to confirm understanding and agreement to take part in the research project. Participants were asked for their age, gender, level of education, science degree title and experience of Zoom online lectures. Finally, participants were asked to indicate which statements they agreed with. Participants were included if they were completing an undergraduate science degree and had completed the consent form.

Ethical approval

Ethical approval was granted *via* the Research Ethics Committee of the Cardiff School of Biosciences and the reference number is 20 12-02.

Distribution

The questionnaire was distributed to Cardiff University undergraduate students completing subjects in the school of Biosciences, such as Biomedical Science, Biochemistry and Neuroscience. Students were sent the questionnaire *via* a link on an email to their Cardiff university email address.

Statistical analyses

All statistical analyses was done using Excel and R studio. Upon gathering the questionnaire responses, an average score was calculated for each participant, according to the panel score of each statement. Scores 1-5 indicated a positive attitude towards Zoom online lectures and 7-11 a more negative attitude. The participants were grouped by science degree, gender and age, the mean average score was then calculated for each group.

Comparisons of scores of participants according to science degree, gender and age were made. The data was not normally distributed subsequently leading to the use of a non-parametric test: Wilcoxon test. An alpha value of $P < 0.05$ demonstrated significance (Table 1).

Participants

393 responses to the questionnaire were collated with students studying biomedical science making up the largest percentage degree title (47.8%). Moreover, the majority of students were female (78.9%). The age range was between 18 and 38, with 73.7% of students aged 20+ years old (Table 2).

Table 1. A table indicating the statements utilised in the questionnaire, with the mean scores taken from the panel of 8 judges.

Number	Statement	Mean
1	Zoom lectures provide a better opportunity for questions to be asked to the lecturer through both the chat function and posing questions out loud.	3
2	A higher number of people can interact in zoom lectures with both the lecturer and their peers.	3
3	Zoom lectures do not cater for those without the required technology and WIFI.	9
4	There is no time or monetary cost associated with transport to zoom lectures.	4
5	Certain content cannot be effectively portrayed *via* Zoom lectures, such as hands on practicals like dissections.	8
6	Zoom lectures can make you feel more isolated.	10
7	Flexibility of timing is increased by utilising zoom lectures.	4
8	Zoom lectures require higher levels of self-motivation and self-discipline	6
9	Zoom lectures can be completed in any global location with WIFI.	2
10	It is more intimidating to ask a question in front of the entire zoom call, in conventional lectures, questions can be directed to one person.	9
11	It is easier for people to become disengaged and distracted in zoom lectures.	9
12	Utilising zoom lectures improves Information Technology skills of students needed in the workplace through the use of different technological platforms.	4
13	Zoom has the breakout room function which facilitates group work during or after zoom lectures.	5
14	Zoom lectures are more accessible to those that are physically or psychologically unable to attend in person lectures.	2
15	Those that live in overcrowded houses would struggle to find a suitable place to do zoom lectures that are quiet and not distracting.	10
16	Zoom lectures are more tiring as they require higher levels of concentration.	8
17	Online resources can be shared efficiently *via* zoom lectures.	4
18	Relationships between students and lecturers are more difficult to build in zoom lectures, without in person contact.	9
19	Learning *via* zoom lectures entails a lot of time spent behind a screen which can lead to physical ailments and health issues.	10
20	Comfort levels can be optimised whilst doing zoom lectures through being at home and tailoring the environment to best suit individual needs.	3

Table 2. A table indicating the number of participants in each degree title.

Science degree title	Number of participants
Biomedical science	188
Biochemistry	34
Biological sciences	82
Medical pharmacology	5
Medicine intercalation	4
Neuroscience	67
Bioscience	13

Results

Overall, the perception of science students was more favourable towards Zoom online lectures with an average score of 4.48. The range was between 1.10 and 5.95 demonstrating that each of the participants held a more positive perception of Zoom online lectures.

No significant difference between the average scores of differing degree titles

When comparing the perceptions of Zoom online lectures of the different science degree titles, each degree scheme indicated a positive perception. Biochemistry (n=34) had the most favourable attitude towards Zoom online lectures (4.28) with those completing Medicine intercalation (n=4) holding the least favourable attitude (4.93).

There was no statistical significance surrounding the differences between the different degree schemes as calculated by the Wilcoxon test (Figure 1). Moreover, the difference between Biomedical science (4.46) and Biochemistry (4.28) was not significant (W=3527, p=0.337). In addition, the prediction that Biomedical students would hold the most unfavourable perception was disproved due to the lack of difference between degree titles. This may be due to the different science degrees having similar experiences of Zoom online lectures, and therefore perception is similar. Additionally, due to low levels of participants with the degree title: medicine intercalation (n=4) and medical pharmacology (n=5) the average scores of said degree titles may not be accurate.

Overall, science students had a favourable attitude towards Zoom online lectures and there was no significant difference between degree titles as indicated by the p values (Table 3) (Figure 1).

Significant difference between female and male scores

Males (n=77) had a more positive perception of Zoom online lectures compared to females (n=310): 4.29 compared to 4.54 (Figure 2). The majority of students in each of the degree titles were female (Table 4).

The Wilcoxon test was utilised to compare this difference between males and females and the p value was less than 0.05 demonstrating a significant difference (W=13946, p=0.0221). Although, even with this difference, both males and females still held an attitude that was more favourable towards Zoom online lectures (Figure 2) (Tables 4 and 5).

No significant difference between individuals of different ages

The participants aged 20+ years old (n=216) had a more favourable attitude towards Zoom online lectures (4.44) compared to those aged 18-19 years old (n=177) (4.54).

When considering whether the difference between said age groups was significant, the Wilcoxon test was used and a lack of significance was identified (W=17586, p=0.172).

In conclusion, even though both age groups held positive attitudes towards Zoom online lectures, age did not significantly alter attitudes of science students towards Zoom online lectures (Figure 3).

Majority of participants agree with strongly unfavorable statements about Zoom online lectures

Aside from the overall perception of Zoom online lectures being favourable, the highest percentage of agreement (n=371, 94.4%) with a statement was with statement 11 "It is easier for people to become disengaged and distracted in zoom lectures" and this had a panel score of 9 indicating a negative attitude towards Zoom online lectures.

Furthermore, the next statement with the next highest agreement (n=352, 90.0%) was statement 5: "Certain content cannot be effectively portrayed *via* zoom lectures, such as hands on practical's like dissections" which had a panel score of 8.

The statement with the lowest level of agreement was statement 12 "Utilizing zoom lectures improve Information Technology skills of students needed in the workplace through the use of different technological platforms." (n=103, 26.2%). This statement had a score of 4 indicating that the statement held a more positive attitude towards Zoom online lectures.

Subsequently, although overall, science students held a more favourable attitude towards Zoom online lectures, there were high levels of agreement with strongly negative statements indicating problems with Zoom online lectures. Unfavorable statements indicated by a score between 7 and 11 had a percentage agreement of 82.16% amongst science students (Figure 4).

Table 3. A table containing p values, calculated *via* the Wilcoxon test of the comparisons made between the average scores of different degree titles.

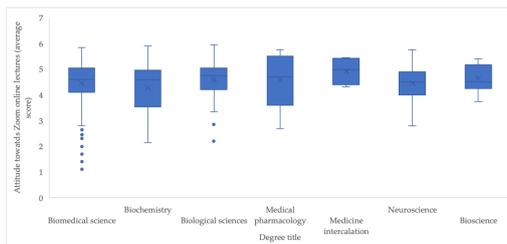|	Biomedical science	Biochemistry	Biological sciences	Medical pharmacology	Medicine intercalation	Neuroscience	Bioscience
Science degree							
Biomedical science	-	0.337	0.502	0.57	0.315	0.375	0.767
Biochemistry	-	-	0.156	0.599	0.216	0.645	0.329
Biological sciences	-	-	-	0.736	0.32	0.122	0.867
Medical pharmacology	-	-	-	-	0.905	0.478	0.622
Medicine intercalation	-	-	-	-	-	0.203	0.308
Neuroscience	-	-	-	-	-	-	0.341
Bioscience	-	-	-	-	-	-	-

Figure 1. Perception of Zoom online lectures of individuals with different degree titles. Note: A series of boxplots depicting the average scores of different degree titles (Biomedical science, Biochemistry, Biological sciences, Medical pharmacology, Medicine intercalation, Neuroscience and Bioscience) towards Zoom online lectures. x= mean. The length of the box is the interquartile range from the 25th to the 75th percentile. Black lines inside the box indicate the median values.
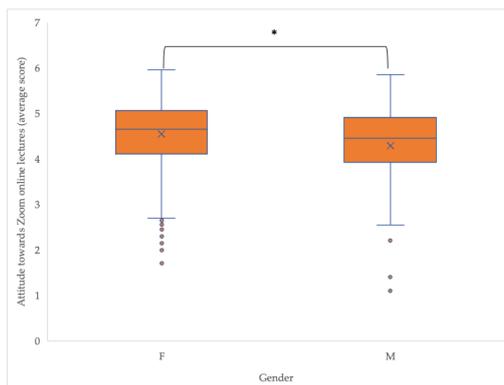

Figure 2. Perception of Zoom online lectures of females and males. Note: Boxplots depicting the average scores of males and females towards Zoom online lectures. x= mean. The length of the box is the interquartile range from the 25th to the 75th percentile. Black lines inside the box indicate the median values. * = P<0.05 (significant result).

Table 4. A table indicating the number of female and male participants in each degree title.

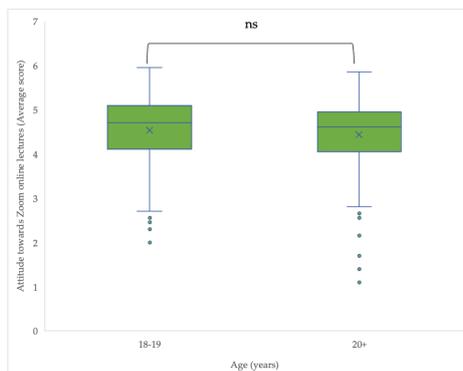| Degree title	Number of female participants	Number of male participants
Biomedical science	148	35
Biochemistry	18	15
Biological sciences	66	16
Medical pharmacology	4	1
Medicine intercalation	3	1
Neuroscience	62	5
Bioscience	9	4

Figure 3. Perception of Zoom online lectures of different aged participants. Note: Boxplots depicting the average scores of participants aged 18-19 years and participants aged 20+ years towards Zoom online lectures. x= mean. The length of the box is the interquartile range from the 25th to the 75th percentile. Black lines inside the box indicate the median values. ns = P<0.05 (no significance).
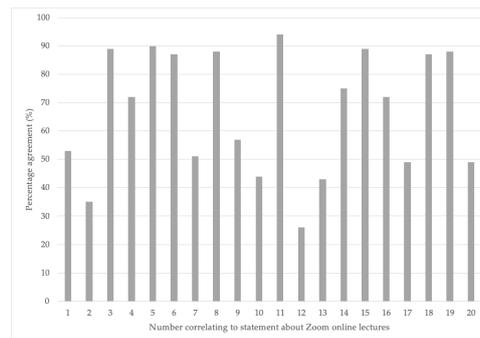
Figure 4. A bar graph indicating the percentage agreement of the twenty statements in the questionnaire. n=393.

Discussion

The results indicate an overall positive perception of science students towards Zoom online lectures with an average score of 4.48 according to the Thurstone and Chave scale 1951. Moreover, the range of scores (1.10 to 5.95) indicates that each of the science students that took part in the survey held a positive attitude towards Zoom online lectures. This may, therefore, indicate that Zoom online lectures should be incorporated into future education post the COVID-19 pandemic. Moreover, in a study performed during the COVID-19 pandemic amongst Indian university students; when asked 56.5% of participants indicated having confidence using E-learning platforms, thus showing the majority of students could use E-learning platforms effectively and thereby positive perception is implied [11].

However, these results are contrary to prior research performed in 2014 amongst Australian undergraduate students, where there was significantly more undergraduate students who would prefer to engage in face-to-face activities (n=47) compared to online learning (n=20) (p<0.001) [12]. Moreover, an Indonesian study was performed in 2021 looking at face-to-face learning *vs*. blended learning and online learning: the vast majority of students indicated that they would prefer face-to-face learning (95%) as opposed to online learning (5%) [13]. Additionally, students preferred face-to-face learning over blended learning, however the percentage difference was less (75% versus 25%) suggesting that a blended approach of face-to-face and online learning could be adopted [13]. These studies indicate an alternative negative perception of students towards online lectures both prior and during the COVID-19 pandemic. However, there is potential in a blended approach to education.

There was no significant difference between different science degree titles indicated by the p values, and this may be because of students in the differing science degree titles having received a similar experience of Zoom online lectures. Moreover, given the lack of research into this area, it is difficult to ascertain whether degree title impacts perception of Zoom online lectures.

Interestingly, there was a significant difference between female (n=310) and male (n=77) scores where males had a more positive perception towards Zoom online lectures scoring 4.29 compared to 4.54. This difference in perception has been supported within satisfaction with e-learning, with males having higher levels of satisfaction compared to females, because of differing learning styles [14,15]. However, others have suggested gender does not play a role in perception of E-learning [15]. As a result, it is still unclear the role gender plays in perception towards online learning and more specifically zoom online lectures.

Surprisingly, there was no significant difference between those aged 18-19 years versus those aged 20+ years. Seemingly, age has no effect on perception of online lectures. This lack of significant difference was also identified in a study looking at adult students and online education, where there was no correlation between age of student and confidence level when utilising technology [16].

Amongst all the degree titles, statement 11 "It is easier for people to become disengaged and distracted in zoom lectures" had the highest percentage agreement with the average being 94%. This was supported by a comment a student made in the feedback section: "It is so hard to stay motivated and concentrate while lectures are on zoom".

Hypotheses, proven or disproven?

The initial hypothesis was that science students have a negative perception towards Zoom online lectures. This was disproved as the overall average score of science students was 4.48 which is positive on the Thurstone and Chave scale.

The second hypothesis was that biomedical science students have the most negative perception towards Zoom online lectures compared to other science degree titles. This hypothesis was also disproved, given that there was no significant difference between any of the science degrees. Furthermore, even without the significant difference, Biochemistry had the most favourable score (4.28) compared to Biomedical science (4.46) thereby disproving the initial hypothesis.

Finally, the third prediction was that those aged 20+ years will have a more negative perception towards Zoom online lectures. Given that the results showed no statistical significance, this hypothesis was disproven. There was no difference in the perception aged 20+ years and those aged 18-19 years.

Conclusion

Science students held an overall positive perception towards Zoom online lectures. There was no significant difference between difference science degree titles with each degree title holding a positive score. Males had a more positive perception towards Zoom online lectures compared to females and the difference was statistically significant. There was no significant difference in the perceptions towards Zoom online lectures in those aged 20+ years compared to those aged 18-19 years.

Despite the overall positive perception, the statement that had the highest level of agreement had a negative score. This suggests that there are elements of Zoom online lectures that need to be considered and altered if they are to be integrated into education in the future.

Limitations

A limitation of this study was that there were no statements with an average score of an 11 or a 1 and as a consequence the scores of the participants would be limited. Consequently, the average scores of the participants would be limited to a smaller range and could thereby alter the true attitudes of the students towards Zoom online lectures. In addition, due to the scores being scored prior to being presented to the students, the average panel scores do not necessarily represent the participants' views

and subsequently may have altered the average scores generated and therefore the perception identified.

Another limitation with this study is the newness of Zoom online lectures as a result of the pandemic and therefore the lack of resources to compare the findings of this study to. Consequently, it is difficult to identify where the results of this study stand in the overall picture of Zoom online lectures.

Participants in this study were students solely from Cardiff University, and as a consequence the attitudes derived are based on Zoom online lectures from one institution. The Zoom online lectures from said university may not represent Zoom online lectures overall.

The large majority of students who undertook this study were female (80%) so it is difficult to ascertain the true relationship between gender and perception of Zoom online lectures.

Lastly, due to a lack of samples in certain degree titles: Bioscience, Medical pharmacology and Medicine intercalation, the statistical analysis containing scores from these degree titles was potentially compromised. Therefore, in future analysis, larger sample sizes would be needed to identify the perceptions of students undertaking those degree titles.

Author Contributions

Both authors contributed equally to this paper. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical restrictions.

Acknowledgments

N/A

Institutional Review Board Statement

Ethical approval was granted *via* the Research Ethics Committee of the School of Biosciences and the reference number is 20 12-02.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest

The authors declare no conflict of interest.

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