The Impact on Student Performance and Experience of the Move from Face-to-face to Online Delivery in Response to COVID-19: A Case Study in an Irish Higher Education Institute.

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Abstract.

Teaching in higher education institutions (HEIs) in Ireland was suddenly and severely affected by the onset of COVID-19, with Irish HEIs instructed to close from March 13th 2020 and advised to, where possible, teach online. This meant that the last four weeks of a 13 week semester, all associated teaching and assessment had to go online across all Irish HEIs. The research question for this paper is to explore how the sudden move from face-to-face(F2F) to online delivery and assessment affected the achievement of learning outcomes and the student experience in a module International Economic Policy in an Irish Higher Education Institution (HEI). While it draws on comparative contexts such as the impact of other sudden interruptions to the learning environment on student performance and the impact of moving from F2F to online delivery in economics courses in normal circumstances, it argues that there is no real comparable context. The literature on the impact of COVID-19 on student performance and experience is only now emerging. The research strategy is a case study approach to assess if the sudden move from F2F to online delivery and assessment affected the achievement of learning outcomes and the student experience. The research choice is mixed methods. The data collection instruments include exam results and a survey with final year business students. The main findings are that student performance in terms of the achievement of learning outcomes as measured by exam results was only marginally worse in the COVID-19 context. However, students' perceptions of their achievement of learning outcomes were worse in the online environment. In addition, the sudden disruption in the learning environment impacted on the student experience in terms of equality of access and social interaction. The findings suggest that a widespread move to online delivery post pandemic may not be warranted given the findings here and inconclusive findings elsewhere. The study concludes by pointing to some challenges for HEIs in a post COVID-19 context. In particular, it suggests that online delivery must consciously and explicitly use methods to embed social interaction in online learning and that this takes on more importance in a pandemic environment.

Keywords: COVID-19; Economics; Higher Education; Online learning; Pandemic.

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1. Introduction.

Teaching in higher education institutions in Ireland was suddenly and severely affected by the onset of COVID-19 in March 2020. The first case of COVID-19 was observed in Ireland on February 29th. On March 11th, the World Health Organisation formally described COVID-19 as a pandemic (WHO, 2020a). In an effort to slow the spread of the disease, Irish higher education institutions (HEIs) were instructed to close from March 13th and were advised to, where possible, teach online. Galway Mayo Institute of Technology (GMIT), along with all other Irish HEIs, mobilised at breakneck speed to complete the last four weeks of a thirteen-week semester, with all associated teaching and assessment suddenly going online.

While there is some research on the economic impact of (a) pandemics (Gupta et al. 2005 and Keogh-Brown et al. 2010), there is very little research on the academic impact of (a) pandemics on student performance and experience. Van et al. (2009) does consider attitudes and intended behaviour of staff and students towards pandemic H191 in 2009 in a university in Sydney. They noted that students were very willing to continue university schooling via online resources, but they could not consider the impact on student performance or experience of a full closure and move online due to the pandemic.

Given the scant literature on the impact of pandemics on student performance, one could consider other sudden interruptions to the learning environment such as natural disasters. Research on the impact of student performance of natural disasters is mixed. Watson et al. (2011) and Di Pietro (2018) suggest a negative impact while Krane et al (2007) and Kemp et al. (2011) suggest no notable impact on student performance. Wilkinson et al. (2013) suggests that the timing of the natural disaster matters, with a larger negative impact on students the closer to the end of the academic year and examinations.

This pandemic may have negatively impacted on some learners. In particular, some learners were challenged in terms of access to necessary and reliable broadband or suitable devices (QQI, 2020) and inadequate study spaces in the family home compared with their Institute or student accommodation (USI, 2020). Di Pietro (2018) argues that interventions in favour of the affected students in the aftermath of natural catastrophes can mitigate the negative impact on student performance. This could also apply in the case of a pandemic. The principal

interventions in favour of affected students in the COVID-19 environment in GMIT was to move from F2F delivery to online delivery and assessing of students.

Previous research on the impact of face to face (F2F) versus online delivery on student performance in economics modules is inconclusive (Bennet et al., 2019). However, it is worth noting that moving from F2F to online delivery in the COVID-19 environment differs from what might occur under normal circumstances. The COVID-19 pandemic was/is a global health and societal emergency that required unprecedented action by governments, businesses and individuals (WHO, 2020b). The Irish government response to the pandemic escalated from school closures on March 13th to the shutdown of all non-essential workplaces and enforceable rules on physical distancing, hygiene and travel. This period of restriction corresponded to when the students were completing their studies and taking their final examinations. Key differences include the forced and sudden nature of the move from F2F to online delivery and assessment for all students, for all modules and the increase in stress for students due to the pandemic.

This paper is situated in this unique context and there is no real comparable context in the literature: the literature on the impact of COVID-19 is only now emerging. This paper seeks to contribute to this emerging literature by seeking to capture some insights regarding the student performance and student experience in an Irish HEI as a result of the sudden move to teaching and assessing online and considers what these insights mean for the enhancement of online teaching and learning in this evolving environment.

The main research question for this case study is to explore how the sudden move from F2F to online delivery and assessment affected the achievement of learning outcomes and the student experience in a final year module, International Economic Policy, in an Irish HEI.

It adds to the literature in two ways. First, most research compares students' overall performance in online economics classes to overall performance in F2F economic classes (Bennet et al, 2019) and does not focus on the student experience. The student experience has become an important strategic priority for many higher education institutions (Sharpe, 2019) and is used in measures of institutional performance assessment in rankings (Mahsood & Richardson, 2016). Indeed, the current GMIT strategic plan (GMIT, 2019) adopts a different approach to previous plans by placing the emphasis predominantly on the student experience.

Second, it considers the impact of the unprecedented HEI response to the COVID-19 pandemic and the sudden move from F2F to online delivery on student performance and experience.

This research is important to help identify the challenges to students resulting from HEIs' response to the pandemic and offer solutions to enhance teaching and learning in the pandemic and post-pandemic environment.

The remainder of this paper is divided into five sections. Section 2 documents the changes to a module (International Economic Policy) delivery in reaction to the COVID-19 pandemic. Section 3 documents the methods used. Section 4 presents a summary of the main findings. Section 5 discusses some of the main findings with reference to the literature anection 6 offers some concluding remarks.

2. Change in Delivery.

Irish HEIs were instructed by the Government to close and to move teaching online, where possible, on March 13th 2020, in response to the COVID-19 pandemic. In the case of the module International Economic Policy, this resulted in the last four weeks of a13- week semester forced from F2F (defined here as lectures and workshops held in a traditional classroom setting) to online (defined here as lectures, workshops and assessment held online).

The move from F2F to online delivery was both immediate and mandatory for the lecturer and students. It happened over a week and involved a very steep learning curve. Therefore, the move did not benefit from the normal approach to teaching which relies on strategies informed by instructional design models.

New online delivery and delivery and assessment methods were adopted. They demanded a significant time investment and included:

- Asynchronous pre-recorded lectures and pre-recorded worked examples to construct knowledge
- Pre-recorded lectures with interactive quizzes to encourage engagement
- Synchronous live workshops and online forums to encourage social interaction
- Online practice quizzes to prepare students for online assessment.

3. Methods.

The approach taken was a mixed methods case study. This section explains the techniques and procedures involved in collecting the data. It is divided into two parts: Part 3.1 describes the site and participants and part 3.2 documents the data collection instruments.

3.1 Site and participants.

The module International Economic Policy in the final award year of a GMIT business degree was chosen as the site for this mixed method case study. The participants include 69.3% of the students (n=61) from the module International Economic Policy (88 students enrolled) in the second semester of the academic year 2019-2020, who volunteered to take part in the study.

The sampling procedure for both quantitative and qualitative data collection was purposeful sampling. It is purposeful in that it selects participants who have had the experience of a sudden change from F2F to online delivery due to the college closure on account of COVID-19. Purposeful sampling is a technique widely used in qualitative research for the identification and selection of information-rich cases for the most effective use of limited resources (Patton, 2002 cited in Palinkas et al. 2015, p. 533). This involves identifying and selecting a sample with knowledge and experience in a phenomenon of interest, in this case, final year business students who experienced a sudden move from F2F to online delivery.

The data was collected on a cross sectional basis over April 2020 and a total of 61 students from one module (69.3%) participated in the study. April 2020 was chosen as students had just experienced three full online teaching weeks t and thus would provide a snapshot of their experience ‘in the moment’. The majority of the participants were aged 19 to 22. The participants’ selection was based on willingness to take part in the study. This implies a downside self-selection bias that results when survey respondents who choose to participate will not represent the entire target population (Sage, 2004). However, ethical concerns regarding voluntary participation superseded this concern over self-selection bias. The study was approved by GMIT’s Research Ethics Committee and all participating students gave informed consent.

3.2 Data collection instruments.

A mixed methods approach was used to evaluate the achievement of learning outcomes and the student experience in the module International Economic Policy. Exam results and a student survey were used to both collect quantitative data and qualitative data.

3.1.1 Quantitative data: Exam results.

The students did two exams, each of which addressed different learning outcomes. The first exam was taken in a supervised setting in the college before COVID-19. The second exam was taken online and was similar to the planned in-class assessment. Each assessment was worth the same amount (15% each) and so it is assumed that students would attach the same importance to both exams.

The online exam used multiple choice randomised questions and calculated questions drawing on randomised numbers to ensure academic integrity. The average results and distribution from each test are presented.

3.1.2 Quantitative and qualitative data: Survey.

A quantitative and qualitative survey was designed based on Cloonan and Hayden (2018), to address the main research question. The survey evaluated how the sudden move from F2F to online delivery and assessment brought about by the COVID-19 induced college closure affected the achievement of learning outcomes and the student experience in a final year module International Economic Policy in an Irish HEI.

The questions used a Likert scale. Participants were asked to agree or disagree with a statement which varied from ‘strongly agree’ to ‘strongly disagree’. They were also asked to rate how helpful particular online resources were on a scale of 1 to 5 (with 5 being ‘extremely helpful to your learning’ and 1 being ‘not at all helpful to your learning’). Participants were also asked to rate how satisfied they were that the remaining learning outcomes were met using online delivery and assessment (with 5 indicating that the learning outcomes were fully met and 1 indicating that the learning outcomes were not at all met). To deepen understanding, the survey also included open questions. For example, students were asked to “*Describe why you were unable to engage with International Economic Policy in an online setting during the college*

shutdown on account of COVID19?" and "*Is there any other comment you would like to make regarding your experience of the sudden move to learning online in the module International Economic Policy?"*. The survey was piloted to test the usefulness of the questions and adapted based on the pilot.

It is acknowledged that this study has limitations, and the results are not definitive. It is a case study at a point in time, it only considers one module, the sample size is relatively small, students could not be randomly assigned to online versus F2F delivery, no control group was used, and the survey sampling approach suffers from self-selection bias. While this case study approach seeks to address the research question, it is not supposed to be generalisable to the wider student population. It does, however, offer useful insights and understanding and provides analytical rather than statistical generalisation as argued by Cohen et al. (2013).

4. Results.

This section reports the results and is divided into three sections. Section 4.1 documents the achievement of learning outcomes results. Section 4.2 documents the access to module results and Section 4.3 documents the results on social interaction.

4.1 Achievement of learning outcomes.

Figure 1 shows the distribution of results for the quiz following F2F delivery and with the quiz taken in the college with invigilators present and the average mark was 75%. Figure 2 shows the results distribution for the quiz following online delivery with the quiz taken in a remote setting and the average mark was 70%.

Figure 1. Results following F2F delivery

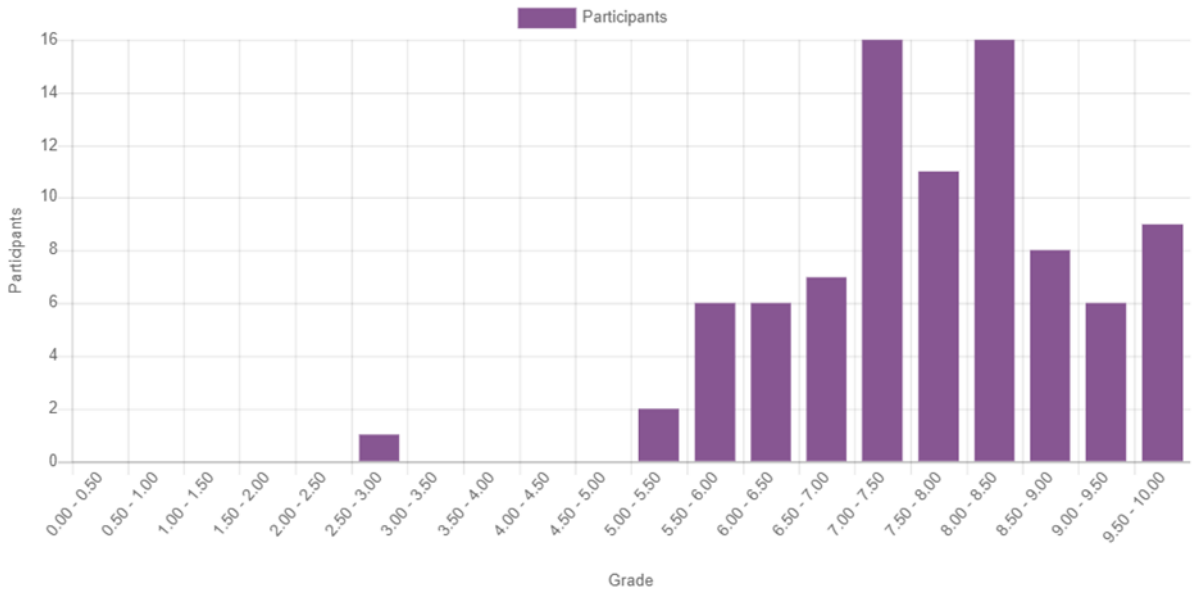
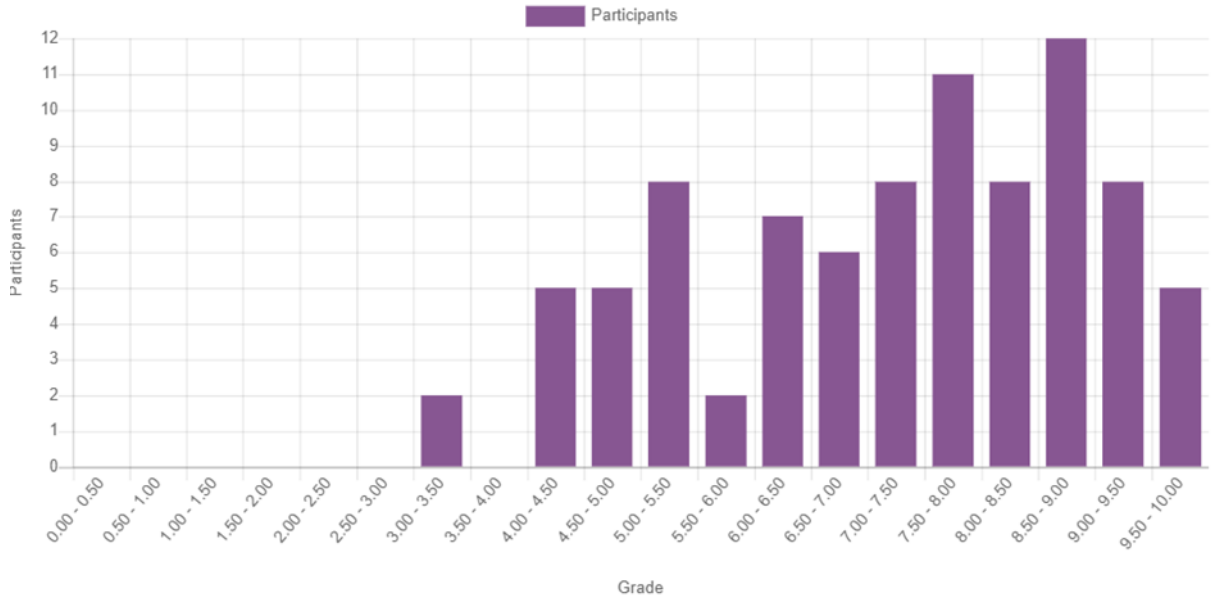


Figure 2. Results following online delivery

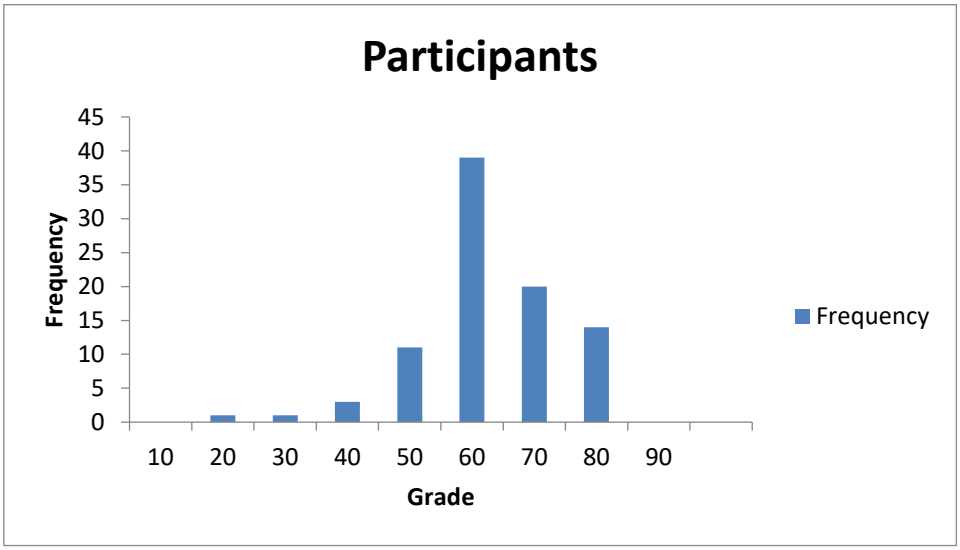


A paired two-tailed T Test was used to determine whether the difference between the means of the two sets of scores were significantly different, using the 5% significance level The mean

grade on the remote setting MCQ was significantly lower than that on the pre-COVID invigilated test result (t(1,86), 2.62, p =.02) .

While one set of scores was higher, both were above 70% and indicated high performance, which suggests that the students were not disadvantaged due to online delivery and assessment due to COVID19. It is worth noting that these relatively high results can be typical of an MCQ exam and in total were worth 30% of the module. The main assignment worth 70% - a country economic report - showed an average of 59% and Figure 3 shows the distribution of results for comparison purposes. This assignment was submitted and assessed when students were off campus. However, the bulk of the work and associated formative assessment took place from January to March 2020 when the students were still on campus.

Figure 3. Distribution of results for economic report.

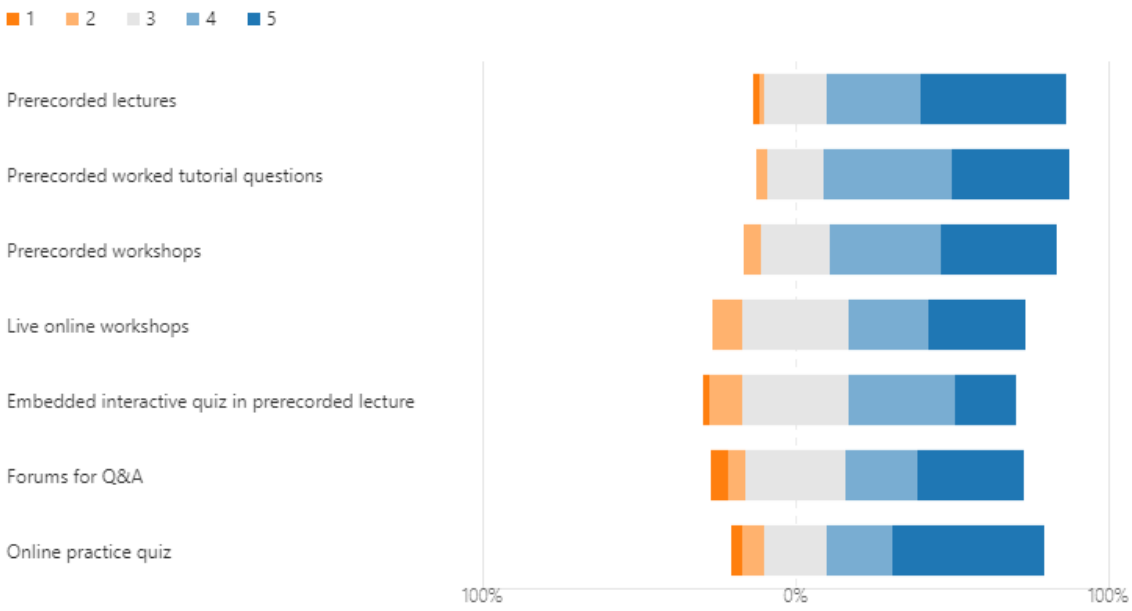


Students were asked to indicate if they felt the remaining learning outcomes for the module were met using online delivery and assessment. 75% of respondents believed that the learning outcome ‘to illustrate comparative advantage among countries’ had been met’. 59% of respondents agreed or strongly agreed the learning outcome ‘to categorise the balance of payments’ had been met.

Figure 4 shows ratings that students assigned to various online tools to support their learning.

with 5 being extremely helpful to their leaning. Pre-recorded lectures, pre-recorded worked tutorial solutions, pre-recorded workshops and practice quizzes were considered to be the most helpful. This was followed by live online workshops, embedded questions in pre-recorded lectures and forums for questions and answers. However, 52% of respondents disagreed or strongly disagreed that they learned more in the online recorded lectures than if the lecture was delivered face-to-face.

Figure 4. Online resources ranked in terms of being helpful to learning (higher scores indicate more positive responses).

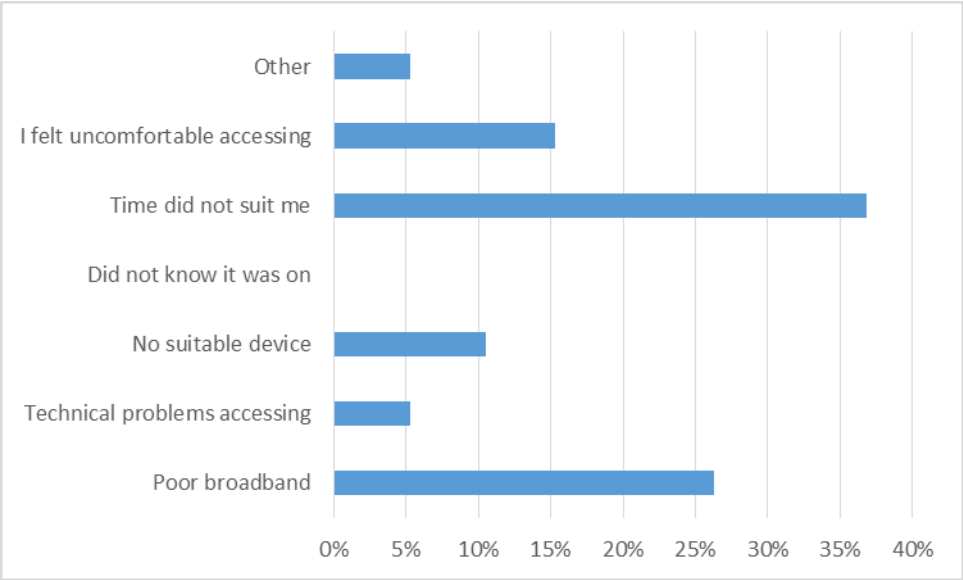


4.2 Student experience – Access.

8% of respondents reported they could not continue with their learning for this module. Reasons cited were increased work commitments, no access to a laptop, poor interconnectivity, increased caring responsibilities and stress due to the pandemic. 45% of respondents said that poor broadband and interconnectivity was a problem for them accessing live online workshops.

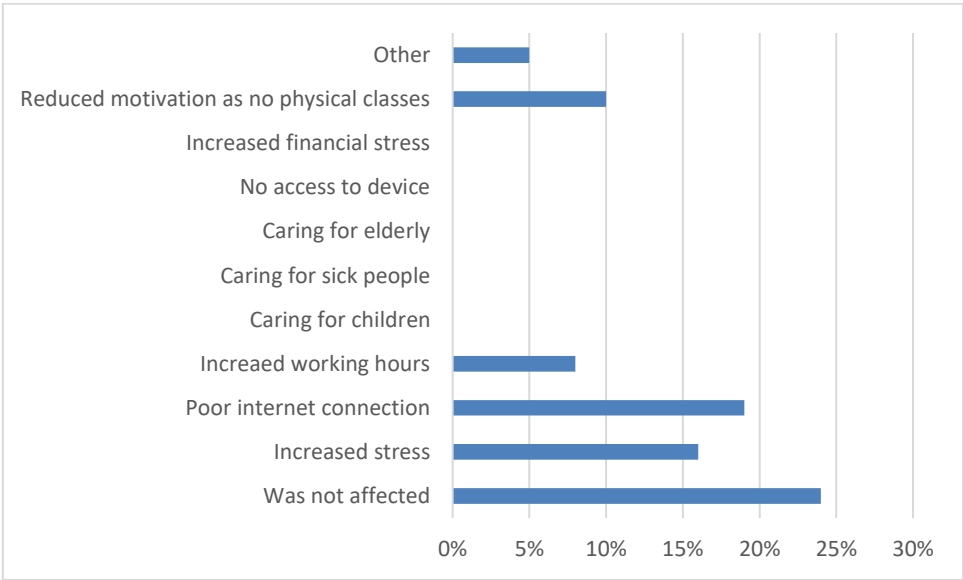
44% of respondents indicated that they did not access the live online workshops and Figure 5 identifies some of the reasons for not attending. However, 95% of these did access the recorded live online workshop at a later time.

Figure 5. Reasons cited for not accessing live online workshops.



33% of respondents disagreed or strongly disagreed that online learning improved their opportunity to access and use the class content. Figure 6 shows some reasons why student engagement with online learning for the module was affected. Respondents cited, among other things, increased stress (16%), poor internet connection (19%) and lack of motivation due to no F2F classes (27%) affecting their engagement with the module.

Figure 6. Responses to "My engagement with online learning for this module was affected by."



In addition, there were a number of responses to open ended questions regarding access and these can be seen in Table 2.

Table 2: Student comments (verbatim) on issues regarding access to module.

1. No access to laptop and lack of connection.
2. Working full-time limited my opportunity to attend actual lectures.
3. My problem is wifi, it is very unpredictable I think because I live in a wooded area, it has stopped me accessing lectures online
4. Difficult to follow everything online. Because of the lack of knowledge on how to use the proposed programs. I was not able to follow all the lectures because there is no notification via email or application to inform me about adding new materials. FEELING LOST
5. It is making the best out of a bad situation but for me personally it is almost impossible for me to learn and complete work in this environment
6. I'm now working 3 days a week and if I leave it's voluntary leave during this pandemic and I would lose my job as I would have to be replaced, finding a new job after this entire pandemic will also be tough due to the economy being affected by all of this.
7. I have no wifi and so I am relying on data which is not reliable. It might crash in the middle of downloading something and there's problems streaming videos.

4.3 Student experience - Social interaction.

Figure 7 shows responses to feelings of social isolation. 56% of respondents agreed or strongly agreed that they felt socially isolated when accessing the lectures online compared to face-to-face lectures. 70% of respondents agreed or strongly agreed that they preferred participation in face-to-face discussions rather than online forums.

In addition, there were a number of responses to open ended questions regarding social interaction. Table 3 details some comments provided by students regarding social interaction.

Figure 7. Responses to 'I felt socially isolated when accessing lectures online compared to face-to-face lectures'.

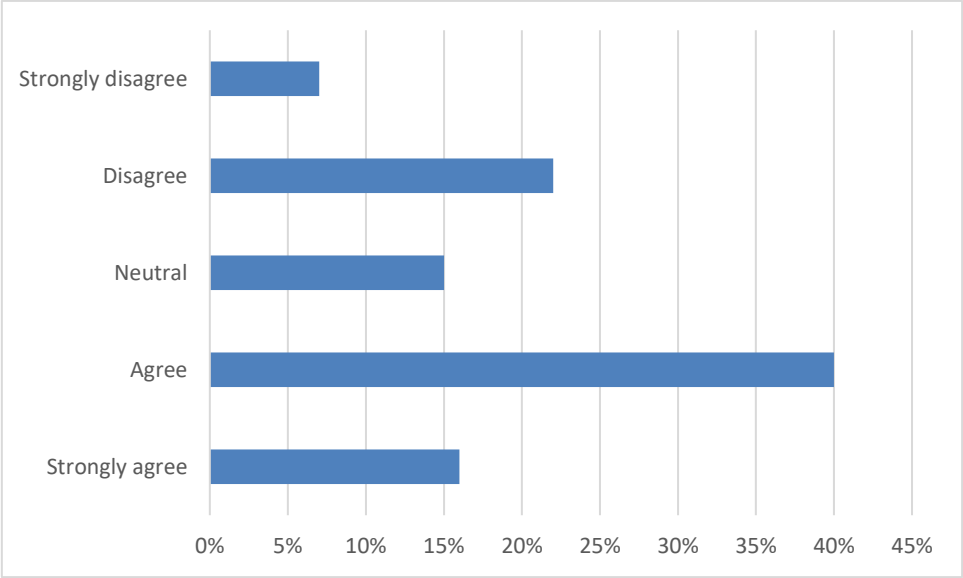


Table 3: Student comments (verbatim) on issues regarding social interaction.

1. I concentrate better in face to face. Being able to talk to lecturer in class makes it easier.
2. I have more motivation to get work done when there is physical classes to go to. I also find that I take in information better when I have heard it in a physical class
3. Microsoft Teams is the best alternative to face-to-face in my opinion. Still I would much rather face-to-face communication.
4. Online is fine in the short-term but would not replace physical lectures.
5. The stress is really affecting me personally and it's putting me on route to a depressing state of mind, especially with the lack of physical communication and lockdown measures.

4.3 Student experience - Social interaction in the online live workshop setting.

66% of respondents attended the live online workshop. The results are mixed on the level of social interaction. Figure 8 shows that 49% of respondents disagreed or strongly disagreed that

they were engaged in the online workshop as much as they would be in the face-to-face classroom.

Figure 8. Responses to 'I was engaged in the online workshop as much as I would be in the face-to-face classroom.

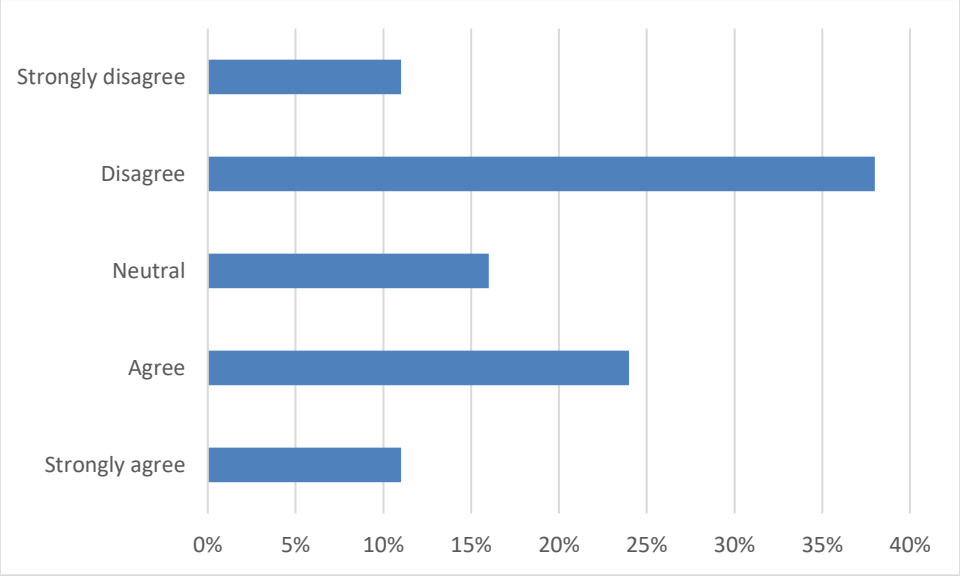
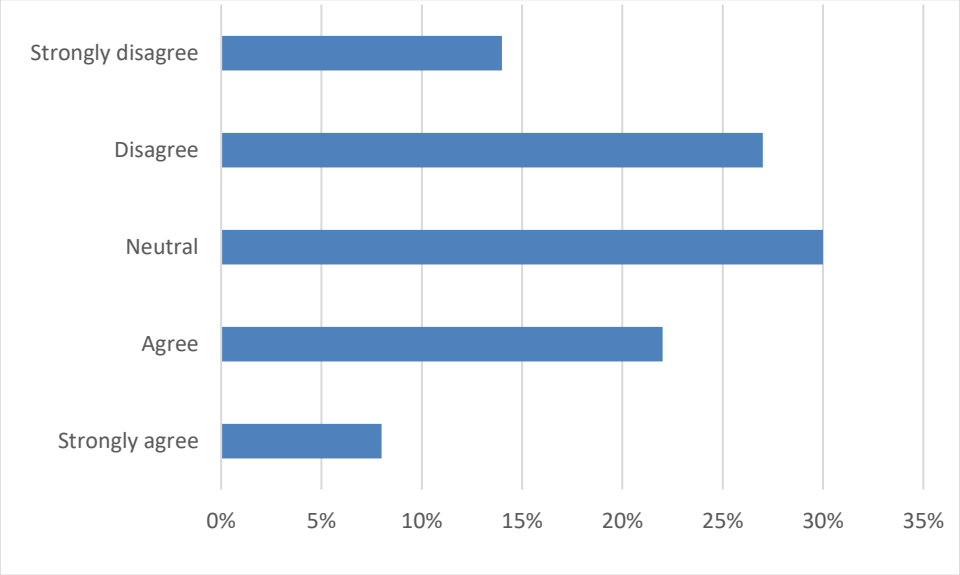


Figure 9 shows that 41% of respondents disagreed or strongly disagreed that they were more likely to ask a question/contribute to the live online workshop than they would be in a face-to face-class.

Only 67% of respondents agreed or strongly agreed that they could easily communicate with the lecturer during the live online workshop and just 66% of respondents agreed or strongly agreed that it was easy to use the conversations window in Microsoft Teams to communicate. However, 84% of respondents agreed or strongly agreed that the lecturer encouraged student contributions via the conversations window during the live online workshop.

Figure 9.Responses to "I was more likely to ask a question/contribute in the live online workshop than I would be in a face to face class.



5. Discussion.

This section situates the findings in the literature and is divided into three sections. Section 5.1 discusses student performance considering the achievement of learning outcomes. Section 5.2 discusses access to module and Section 5.3 considers social interaction in online learning.

5.1 Student performance: Achievement of learning outcomes.

The findings suggest that the achievement of learning outcomes as demonstrated by student performance in multiple choice exams in F2F versus online delivery was only slightly different. Students scored marginally higher on average in examinations following F2F lectures (75%) compared to examinations following online delivery (70%). Even though the difference between the averages is statistically significant, the averages were both over 70%. This suggests that students were not significantly disadvantaged by online delivery and assessment. It is worth noting that this these high averages can be typical of MCQ exams and they were together worth 30% of the module mark. The other assessment –a country economic report worth 70%- showed an average mark of 59%.

Previous research on the impact of F2F versus online on student performance in economics modules is mixed and inconclusive (Bennett, 2019). In line with these results, Shoemaker and Navarro (2000) and Dendir (2016) found evidence that online can be as effective as F2F classroom delivery in a graduate-level MBA introductory course in macroeconomics and a principles of microeconomics course respectively. Figlio, Rush, and Yin (2013) found that the overall effect of live instruction (average score 79.94%) relative to internet delivery (average score 78.502%) is very modest and positive (though not statistically different from zero). However, Alpert et al. (2016) using a randomized study design and considering principles of microeconomics module provides evidence which indicates that learning outcomes were reduced for students in a purely online section relative to those in the F2F format. In addition, Figlio, Rush and Yin (2013) and Bennett et al. (2019, 0.10) suggest that test scores for low ability students were higher in F2F lectures relative to online lectures.

Although the achievement of learning outcomes as demonstrated by exam results show no notable difference, the findings suggest that the student perception on the achievement of learning outcomes varied between online and F2F delivery. 75% of respondents believed that the learning outcome to illustrate comparative advantage among countries was met choosing a 4 or 5 ranking with 5 indicating that the learning outcome was fully met. 59% of respondents believed the learning outcome to categorise the balance of payments was met using a ranking of 4 or 5. In addition, 52% of respondents disagreed or strongly disagreed that they learned more in online lectures than if the lecture was delivered F2F.

This worsened perception regarding the achievement of learning outcomes has implications for how students perceive the integrity of their awards. Awards made in the year of COVID-19 may not be seen as of equal value to those of earlier years and those following them. This could also impact on employers' perceptions regarding the quality of degrees awarded in 2020. This is an area for future research.

Given the findings here and inconclusive findings elsewhere on the impact of F2F versus online delivery on actual and perceived student performance, a widespread move to online delivery prompted by its seismic adoption during the pandemic may not be warranted. Therefore, a blended approach which harnesses the online delivery expertise garnered during the COVID-

19 pandemic may be more appropriate. Indeed, Joyce et al. (2015), Alpert et al. (2016) and Mondal and Culp (2017) all show that there were no significant differences for the average final exam score in blended and F2F delivery of a principles of microeconomics class.

5.2 Student experience: Access.

The findings suggest that the COVID-19 pandemic has created inequality of access. 8% of respondents reported they could not continue with their learning for this module. Reasons cited were increased work commitments, no access to a laptop, poor interconnectivity, increased caring responsibilities and stress due to the pandemic. Forty-four percent of respondents indicated that they did not access the live online workshops citing, among other things, unsuitable times (the workshop times were as per the traditional timetable – which may suggest that students had taken up work or caring commitments which made the times no longer suitable), poor broadband and feeling uncomfortable in an online setting. Forty-five percent of respondents said that poor broadband and interconnectivity was a problem for them accessing live online workshops. Thirty-three percent of respondents disagreed or strongly disagreed that online learning improved their opportunity to access and use the class content.

Inequality of access is a challenge for all HEIs. Indeed, the pandemic has exacerbated a digital divide that was already in place in Ireland prior to COVID-19. Some learners were disadvantaged due to lack of access to devices and poor broadband connectivity. The Irish Government and HEIs have worked to address some of these access issues and this work needs to be enhanced by the enactment of the National Broadband Plan.

5.3 Student experience: Social interaction.

The literature suggests that social interaction is important for learning (Dewey, 1938) and meaningful learning often occurs when individuals are engaged in social activities such as interaction and collaboration (Vygotsky, 1978). Social presence can be defined as the establishment of a supportive learning community, providing a venue for communication within a trusted environment where learners can express individual identities and establish social relationships (Garrison, Anderson, & Archer, 2000). Social interaction online takes on even more

weight in this pandemic with social isolation being experienced by students having to take online programmes rather than coming to campus (Adnan & Anwar. 2020; Elmer et al., 2020; Marelli et al. 2021).

The low level of social interaction reported here - despite the use of live workshops and forums - suggests that social interaction needs to be explicitly and consciously worked into online teaching and assessment. This is echoed in the literature. Hernández-Sellés et al. (2019) suggests that online social interaction does not happen spontaneously and that when social interaction is taken for granted, it is most likely that groups socialise at a very low level, leading to individual feelings of isolation, little social presence and therefore to poor cognitive presence. In addition, creating conscious opportunities for social interaction online takes on more importance in the context of this pandemic.

Many lecturers embraced online delivery for the first time in order to continue the delivery and assessment of modules online in response to the COVID-19 pandemic. However, they did this at breakneck speed, and it is likely in the rush that there was sub optimal design for online delivery and assessment. It is important that we learn from what has just passed and embed solutions to the challenges identified in our evolving teaching and learning online environments.

6. Conclusion.

The higher education sector in Ireland and worldwide has undergone unprecedented changes, moving from F2F to online delivery and assessment overnight in response to COVID-19. In the longer term, the COVID-19 pandemic will leave HEIs with many challenges. It is important to consider what some of those challenges will be and how research can contribute to solutions. This paper seeks to contribute to that process by exploring how the sudden move from F2F to online delivery and assessment brought about by the COVID-19 induced college closure affected the achievement of learning outcomes and the student experience in a final year module International Economic Policy in an Irish HEI.

This study used a case study research strategy, which explored student performance and experience using a mixed methods approach. The data collection instruments included exam results and a student survey. The main findings are that student performance in terms of the

achievement of learning outcomes as measured by exam results was only marginally worse in the COVID-19 context. However, students' perceptions of the achievement of learning outcomes and the disruptions in the learning environment have impacted on the student experience and can be seen in terms of equality of access and low social interaction in online learning.

It is acknowledged that this study has limitations, and the results are not definitive. Nonetheless, it does offer some useful insights into and understanding of student performance and student experience in the move to online from F2F delivery in response to COVID-19. Such insights point to some future challenges for HEIs.

First, as lecturers become more familiar with the technology for online delivery, it is likely that there will be extensive adoption of online learning across HEIs as the pandemic subsides. It is important that this does not happen without understanding the impact that this will have on the student experience and on performance. Given the findings here, the widespread substitution of online delivery for F2F delivery in the aftermath of COVID-19 may not be justified. A blended approach which harnesses the online delivery expertise garnered during the COVID19 pandemic may be more appropriate.

Second, if lecturers do embrace online delivery following their sudden immersion in its delivery and assessment, it is important that they explicitly create space for social interaction in online learning. Future research work could identify, develop, measure and evaluate possible learning activities that explicitly embed the social presence into teaching and assessment online. This includes identifying teaching and assessment techniques for establishing an online social presence (Anderson et al, 2001) such as online lecturer-student interaction, student interaction in work groups, inter-group emotional support and online collaborative support tools and evaluating their impact on social interaction. In addition, lecturers need to be trained in explicitly facilitating and measuring social interaction in their modules. Such social interaction takes on more importance in the context of a pandemic when students are forced online to continue with their studies. On a final note, this pandemic may well prove to be a positive catalyst to enhance teaching and learning in the post digital age.

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