Article

University Students' Experiences and Reflections of Technology in Their Transition to Online Learning during the Global Pandemic

Therese Keane [1,*], Tanya Linden [2], Paul Hernandez-Martinez [3] and Andreea Molnar [4]

1   Department of Education; Swinburne University of Technology, Hawthorn, VIC 3122, Australia
2   School of Computing and Information Systems, University of Melbourne, Parkville, VIC 3010, Australia; lindent@unimelb.edu.au
3   Department of Mathematics, School of Science, Swinburne University of Technology, Hawthorn, VIC 3122, Australia; phernandezmartinez@swin.edu.au
4   Department of Computer Science and Software Engineering, School of Software and Electrical Engineering, Swinburne University of Technology, Hawthorn, VIC 3122, Australia; amolnar@swin.edu.au
*   Correspondence: tkeane@swin.edu.au

Abstract: During the COVID-19 pandemic, technology has been used to a lesser or greater extent to facilitate learning and has become an instrumental part of ensuring continuity of education. Students had no choice but to engage in online learning during periods of lockdowns. The quick transition to online learning had the potential to significantly affect the student learning experience and, as a result, their attitudes to studying at university. In this study, we examined self-reported students' attitudes on their transition from face-to-face to online learning. Second-year students from Swinburne University of Technology in Melbourne, Australia, were invited to complete the questionnaire. Students reported a range of attitudes and experiences from very positive and enjoying discovering the new study mode to the very negative where motivation to study was lost and they were considering deferring or quitting their studies. Approximately half of the students discovered the benefits of both online and in-person education and expressed a preference for learning in a blended learning environment. The study results demonstrate the importance of digital technologies that provide flexible and agile educational opportunities with many students being open to new learning experiences despite missing the traditional approaches to education. The results of this study could inform further educational interventions when there is a need to move to online learning with little notice.

Keywords: online learning; digital technology; student experience; pandemic-affected learning

1. Introduction

During the COVID-19 pandemic, technology played a fundamental role in ensuring the continuity of education. The effective use of technologies in teaching could positively impact student learning [1] and the learning experience [2]. However, for the technology to be implemented and adopted successfully, there needs to be an understanding of the barriers that impede students from engaging with it [1] and ensure that they are mitigated.

When technology is successfully introduced in the classroom, it should be based on pedagogical principles [3]. However, the COVID-19 lockdowns forced educators to move fast and did not always leave time to adapt content that was pedagogically effective in face-to-face learning to online mode. Many students and educators had little to no experience with online learning prior to this change [4].

Students had little time to adjust to the new mode of learning, often with changes in the way they learned and changes to assessment happening on the fly. Although there have been many prior studies about the online learning experience [5–7], these have been mostly conducted for students who self-selected to study online.

Melbourne, Australia, where this study took place, has experienced the longest lock-down in the world. In this particular case, for students affected by the pandemic, there were only two choices—adapt and study online or withdraw/defer studies. Past research demonstrated that the learning environment affects students' learning experience as well as outcomes. Understanding student experience across different contexts could help create a deeper understanding of difficulties students encountered and, as a result, be better prepared to mitigate them.

In this study, we aimed to add to the understanding of the new learning circumstances caused by this pandemic by exploring how a sudden move to online learning affected students' experience and their view of studying at university. Specifically, our study addressed the following two research questions:

RQ1. How did students' experience of technology support their fast shift to online learning?

RQ2. How did the shift to online learning alter these students' views on studying at university?

While addressing these questions, we also examined whether demographic parameters had any effect on students' attitudes towards changes caused by the pandemic to the educational environment.

2. Literature Review

During the COVID-19 pandemic, digital technologies were a fundamental and important component of ensuring education. The effective use of digital technologies in teaching and learning has immense impact and enhances the learning experience for students. For technology to be leading edge, the emphasis needs to change from technology-driven to pedagogy-driven use [3]. How digital technologies are used in the classroom is important, and the expectation of use determines whether the technology is being used in innovative ways. Once a barrier for students, wide-ranging access to computers is now considered as an essential tool ensuring that each student has their own machine for learning purposes. Whilst the centrality of digital technologies is indisputable for teaching and learning purposes in higher education, its application has been inconsistent and varies between subjects, the types of delivery, levels of study and amongst different institutions [8]. Undeniably, the role of digital technologies is highly regarded and its importance cemented in a teaching and learning environment; however, its use is not necessarily evenly spread.

When comparing online classes to a traditional physical classroom environment, online modes of delivery heavily rely on the use of digital technologies and the internet. Without these two aspects, students would struggle to undertake online classes. In fact, there are three options for course delivery in higher education: face-to-face classes, online learning and blended learning. All three delivery methods either use or rely on technology to ensure learning takes place. Traditional face-to-face classes require teachers and students to interact in a physical space, whereas in an online environment, the learner is not in the physical space with the educator and interactions happen in synchronous or asynchronous modes. Blended learning oscillates between a combination of face-to-face and online learning.

Students who specifically choose to undertake classes via online offerings self-select this option because of the number of advantages they perceive such as their preference to work individually [5], simultaneously maintain a full-time job, accessibility and flexibility [6,7] and learning at their own pace [9]. However, taking online classes is not a preference for all students as it requires additional motivation, self-discipline, strong time management skills and a high degree of organization to be successful in an online environment [10]. Some students also argue that online and blended learning is a costly option given they have to supply their own internet access [11], and for those who were unable to do this, they were stressed and "felt the distance" as they were unable to engage in their studies [12]. Some even identified anxiety due to the unpredictability of their lives and the impact on their studies [13]. The ability to study online was a choice prior to the COVID-19 pandemic, and the take-up of online learning was based on several variables such as the age of the student, subject areas and institution [14]. However, during the pan-

demic, where face-to-face classes were immediately ceased, online education was no longer a choice but rather the only option to ensure continuity in education. For some, this was not an easy transition as they encountered several challenges such as distractions from noise, not having an appropriate dedicated space to study and an unconducive environment for effective learning [12].

As we move towards a post-pandemic environment of learning, students' preferences have shifted to blended learning so that they can benefit from the hybrid experience of a face-to-face classroom with the advantages of online learning. Whilst online education has been perceived to not be on equal standing as traditional classrooms, some students have a stronger preference for face-to-face classes even though their online experiences were also positive [15]. As we emerge from the pandemic, blended learning is considered to be effective and an accepted teaching environment that is very popular [16] and even considered as the new normal [17].

One of the most important dimensions of the learning process is student engagement. Astin's [18] seminal work defined this theory of involvement as the "amount of physical and psychological energy that the student devotes to the academic experience". However, there is no one definition that covers all the possible scenarios and environments that student engagement spans across [19]. Some studies have shown that with the rapid transition to online learning during the pandemic, the overall student experience was poorer [17,20]. In a study undertaken by Sim, Sim and Quach [12], it was reported that some students found the transition to online learning during the pandemic to be difficult, as they could not easily adapt to the new environment, identifying inability to meet their peers or their lecturers face-to-face as a significant factor. Students in this study also reported that they were bored with online learning, and this was compared to Morgan's [21] study where students identified that they had trouble concentrating and fell asleep during this mode of delivery. However, the student experience varies depending on the course modality and the demographics of the students, although gender does not factor in this discussion [22]. Gender has no significance in online courses according to [20,23–25], and previous studies found that it was difficult to draw conclusions about gender and student experience in online learning environments.

Whilst online learning has several advantages, students undertaking subjects that rely on having a physical presence on campus such as specialized access to rooms, equipment or the practical hands-on applications found the shift difficult. Working online denies these students that exposure which detracts from the overall student experience [2]. Some universities have implemented workarounds such as using online simulations to teach laboratory classes [26], or, as we move towards a post-pandemic world, virtual laboratories are being developed to complement in-person laboratories [27]. All these initiatives are there to ensure education continues despite the challenges.

This study reports on investigating how students' experience of technology supported their fast shift to online learning and how this shift to online learning affected their view on studying at university.

3. Methodology

In this study, we aimed to understand students' attitudes towards their university studies as affected by the global pandemic, i.e., how the sudden move to online studies affected their views on learning and experiences of their university life.

Due to the need to collect data from multiple participants while expecting a rich nature of the data, it was clear that quantitative or qualitative methods separately would not meet the needs of this study. On the one hand, a survey instrument was needed to collect data from a large number of participants in a short period of time. On the other hand, the data reflecting students' views and experiences needed deeper insights and contextualization; therefore, qualitative questions, such as "Explain your answer" had to be added to the survey after some quantitative questions. Thus, this study employed QUAN + QUAL design [28].

As a quantitative instrument, we developed a questionnaire based on previous studies investigating the use of technology at schools and universities (e.g., [14,29–31]). However, at the time of the questionnaire design and data collection, none of the previous studies examined students' experiences discovering new digital technologies and new uses of known technologies in the context of a pandemic. Also, since previous studies did not survey students' expectations, the researchers needed to add further questions exploring students' satisfaction with technology as well as their views on unexpected change caused by the pandemic.

The online questionnaire had 26 questions used for a wider study, starting with questions about participants' demographics and then exploring their self-reported attitudes and experiences towards technology, such as the technologies used at secondary school, their experience of technology use at the university and their attitudes towards the shift to online learning. It should be noted that psychological aspects such as digital stress were outside the educational scope of this study. This study focused on understanding students' attitudes with respect to online studies in the context of COVID-19, as can be seen in the questionnaire (Table 2).

Participants

As only direct sampling from the university itself can provide insights into students' views, all students in their second year at the main campus of Swinburne University of Technology were invited to take part in the study. Out of 3441 students, a total of 422 students accepted the invitation to take part in this study. However, application of selection criteria significantly decreased the number of eligible participants, resulting in 233 respondents not qualifying and being vetted out by Qualtrics, the online tool used for data collection. The final data pool consisted of 189 students who voluntarily completed the online questionnaire. The following criteria were applied for exclusion:

- Not consenting to the questionnaire (6 respondents did not consent);
- Having undertaken less than six subjects of study physically on campus (36 respondents undertook less than six subjects);
- Graduation from secondary school was outside 2017–2019 period (95 respondents graduated before 2017, 0 respondents graduated in 2019 or later);
- Aged under 18 or over 20 years (1 respondent was under 18 years, and 88 respondents were older than 20 years, 20 of whom also graduated before 2017);
- Not fully completing the questionnaire (27 respondents abandoned the questionnaire closer to the middle of the survey).
- The exclusion criteria were designed to ensure that responding students:
- Had experienced at least a full-time equivalent of a first-year teaching, learning and technology use;
- Had recent secondary school experience (since 2017);
- Had at least one year of study on campus (face-to-face) that they could compare to COVID-19-enforced online environment.

The criteria also ensured that there was not a large gap between school and university to avoid significant technology advancements. Also, this cohort of students had at least one year of on-campus study before COVID-19 enforced a shift online, and therefore it was possible to compare both modes of study. Table 1 summarizes the demographics of participants.

The total number of respondents to the questionnaire (*n* = 189) were from three Faculties—Science, Engineering and Technology (31.75%), Health, Arts and Design (50.79%) and Business and Law (17.46%), which proportionally corresponds to the enrolments in the three Faculties (Table 1). Approximately half of the enrolled students (53.54%) were studying in the Faculty of Health, Arts and Design (FHAD), and this is also reflected by the corresponding number of respondents being from FHAD (50.79%). The enrolments in both the Faculty of Science, Engineering and Technology (FSET) and the Faculty of Business and

Law (FBL) were 27.82% and 19.18%, respectively. The percentage of respondents in FSET was 31.75% and FBL (17.46%). Therefore, the distribution of respondents across the three Faculties is proportionally close to the distribution of enrolments.

Table 1. Demographic profile of participants.

Profile	Category	Number (*n*)	Percentage (%)	University Wide—Second Year Students' Enrolments
Gender	Female	115	60.85%	43.77%
	Male	68	35.97%	55.97%
	Non-binary	3	1.59%	0.26%
	Prefer not to answer	3	1.59%	
Faculty	Faculty of Science, Engineering and Technology (FSET)	60	31.75%	27.28%
	Faculty of Health, Arts and Design (FHAD)	96	50.79%	53.54%
	Faculty of Business and Law (FBL)	33	17.46%	19.18%
Secondary school location	City-based Metropolitan	125	66.49%	
	Regional	49	26.06%	
	Rural	14	7.45%	
Type of secondary school attended	Government	80	42.32%	
	Independent	51	26.98%	
	Catholic	58	30.69%	

4. Data Analysis

The study used a questionnaire instrument to collect both quantitative and qualitative data. The focus was on understanding students' attitudes towards a sudden and fast shift to online studies and in view of these new circumstances beyond everyone's control, which factors could have a determining impact on success in their studies. To understand students' views and experiences, responses to the following three questions were analyzed:

- How easy was it to shift online quickly? (Likert scale with answers ranging from 'very easy' to 'very difficult');
- Which do you prefer for your studies? Please select one (three options—online, on campus, a combination of both);
- Has the shift to online learning altered your view of studying/attending university? (Yes/No answers)

To get a deeper understanding of students' answers to the questions above, students were given an option to provide a free-text answer. The free-text answers were read and coded by researchers. The researchers did not have a pre-defined set of codes; therefore, an open-coding approach was used where codes were developed based on the themes identified in the data [32].

To determine significant factors affecting students' views and experiences, the association analysis between demographic variables and students' attitudes towards online learning was conducted. To analyze the association of two categorical variables, the common statistical method used is the Pearson chi-square test of independence. The ANOVA test, whilst well known for comparison of means, could not be used in this study, as it is possible to have two groups of respondents with the same mean but differently polarized distributions. In this research, we needed to compare two categorical variables, and therefore we used the chi-square test (or Fisher–Freeman–Halton exact test where expected

count <5). The chi-square test determines the difference between the value from the collected data and the expected count for the same variable. For cases where an expected count is below 5, the standard practice is to apply the Fisher–Freeman–Halton exact test, which is applicable to data in tabular format with dimensions > 2 × 2 [33]. Our data when presented in tabular format meet these requirements. As in most studies performing these tests, a *p* value below 0.05 was deemed statistically significant [34]. To determine the strength of the relationship between the two variables, Cramer's V test was calculated. The following demographic variables were examined:

- Type of high school (government, independent, Catholic);
- Location of high school (city-based/metropolitan, regional, rural);
- Gender;
- Faculties where students study (the university has three Faculties—Faculty of Business and Law (FBL), Faculty of Science, Engineering and Technology (FSET) and Faculty of Health, Arts and Design (FHAD)).

The questionnaire used for this paper is provided in Table 2.

Table 2. Relevant questions from the questionnaire distributed to second-year university students.

Number	Question	List Response	Respondents	Percentage	Total
1	As a higher education student, have you studied at least 6 of your first-year subjects on campus at Swinburne University?	• Yes • No	189 0	100 0	189
2	In which year did you last attend secondary school (high school)?	• 2019 • 2018 • 2017 • 2016 • 2015 or earlier	0 160 29 0 0	0 84.66 15.34 0 0	189
3	What is your age?	• 17 years or younger • 18 years • 19 years • 20 years • 21 years or older	0 1 65 123 0	0 0.53 34.39 65.08 0	189
4	How do you identify your gender?	• Non-binary • Female • Male • Prefer not to answer • Please specify	3 115 67 3 1	1.59 60.85 35.45 1.59 0.53	189
5	Are you a domestic or international student?	• Domestic • International	189	100	189
6	Which Faculty are you associated with?	• Faculty of Science, Engineering and Technology • Faculty of Health, Arts and Design • Faculty of Business and Law	60 96 33	31.75 50.79 17.46	189
7	What is the name of the Bachelor degree you are studying?	Entries are accepted through free text			

Table 2. *Cont.*

Number	Question	List Response	Respondents	Percentage	Total
8	Where did you last attend secondary school (high school)?	• VIC • ACT • NSW • NT • QLD • SA • TAS • WA • International	184 0 1 0 1 1 0 1 1	97.35 0 0.53 0 0.53 0.53 0 0.53 0.53	189
9	Please select whether your secondary school was:	• City-based/ Metropolitan • Regional • Rural	125 49 14	66.49 26.06 7.45	188
10	What type of secondary school (high school) did you last attend?	• Government • Independent • Catholic • Other (please specify)	80 48 58 0	42.33 26.98 30.69 0	189
11	How easy was it for you to shift to online learning?	• Very easy • Somewhat easy • Neither easy nor difficult • Somewhat difficult • Very difficult	25 71 25 57 11	13.23 37.57 13.23 30.16 5.82	189
12	Why? Please explain your answer selected above	Entries were accepted through free text			
13	Which do you prefer for your studies? (Please select one)	• Online • On campus • A combination of both	12 81 96	6.35 42.86 50.79	189
14	Has the shift to online learning altered your view of studying/attending university?	• Yes • No	113 75	60.11 39.89	188
15	If you answered "yes" above, please describe in what ways.	Entries were accepted through free text			
16	How has the move to online learning altered your technology use?	Entries were accepted through free text			
17	Do you have any other general comments about technology use under COVID conditions?	Entries were accepted through free text			

4.1. Shifting Online

For the first question—'How easy was it to shift online quickly?'—close to 51% of students selected the 'somewhat easy' or 'very easy' option, whereas 36% selected 'somewhat difficult' or 'very difficult'. Only around 13% selected 'neither easy nor difficult'. Testing the relationships between responses to this question and demographic parameters produced the following results. The data showed no significant association between the variable 'self-reported ease of shift to online learning' and type and location of the high school a student attended. To determine the existence of the relationship between 'self-reported ease of shift to online learning' and type of high school attended, a chi-square test was calculated ($\chi 2$ (8, N = 513) = 5.553, p = 0.697). In this case, no relationship was determined since the *p*-value is not below 0.05. For school location, 33.3% of cells had an expected count less than 5; therefore the Fisher–Freeman–Halton exact test was calculated (*FFHET (N = 188) = 2.332, p = 0.979*). Again, the *p*-value is not below 0.05, and therefore there is

no evidence of a relationship between 'self-reported ease of shift to online learning' and attended high school location (Table 3).

Table 3. Students' views on shift to online studies based on gender.

| | | | How Easy Was It for You to Shift to Online Learning? | | | | | Total |
			Very Easy	Somewhat Easy	Neither Easy nor Difficult	Somewhat Difficult	Very Difficult	
How do you identify your gender?—Selected Choice	Non-binary	Count	2 a	1 a	0 a	0 a	0 a	3
		Expected Count	0.4	1.1	0.4	0.9	0.2	3.0
	Female	Count	15 a,b	45 a,b	9 b	40 a	6 a,b	115
		Expected Count	15.2	43.2	15.2	34.7	6.7	115.0
	Male	Count	8 a	24 a	14 a	17 a	4 a	67
		Expected Count	8.9	25.2	8.9	20.2	3.9	67.0
	Prefer not to answer	Count	0 a	1 a	2 a	0 a	0 a	3
		Expected Count	0.4	1.1	0.4	0.9	0.2	3.0
	Please specify	Count	0 a	0 a	0 a	0 a	1 a	1
		Expected Count	0.1	0.4	0.1	0.3	0.1	1.0
Total		Count	25	71	25	57	11	189
		Expected Count	25.0	71.0	25.0	57.0	11.0	189.0

Note: Each subscript letter denotes a subset of 'How easy was it for you to shift to online learning?' categories whose column proportions do not differ significantly from each other at the 0.05 level.

Similarly, no significant association was determined between 'self-reported ease of shift to online learning' and the Faculty where students were studying. Due to an expected count below 5, the Fisher–Freeman–Halton exact test was calculated, and it showed no evidence of a relationship between these two variables (*FFHET (N =189) = 9.596, p = 0.282*). When examining the existence of the relationship between the variable 'self-reported ease of shift to online learning' and gender, the Fisher–Freeman–Halton exact test was used for analysis because 64% of cells had the expected count less than 5. The results suggest significant evidence of an association (*FFHET (N = 189) = 24.680, p < 0.05*). To determine the strength of the relationship between the two variables, Cramer's V was calculated, which yielded a value of *V = 0.228*, suggesting that the strength of the association between gender and self-reported ease of shift to online learning is small to medium. A post hoc column proportions test was calculated to determine where the significant associations lie. The data suggested that the proportion of females who indicated that the shift to online learning was 'somewhat difficult' was higher than the proportion of females who indicated that the shift to online learning was 'neither easy nor difficult' (*p < 0.05*). For male students, there was no significant difference in responses on difficulty or ease of moving online. There were also statistically significant differences between the 'non-binary' and 'prefer not to answer' gender groups compared to males and females, but these groups had very low frequencies of respondents (*n = 3* each).

4.2. Study Preference

The next set of responses was for the question 'Which do you prefer for your studies?' with the choice of one out of three options—'On campus', 'Online', 'A combination of both'. Interestingly, less than 50% of respondents selected 'On campus' (42.86%), only 6.35% opted for online studies, and half the students (50.79%) preferred a combination of both. It should be noted that with the emergency transition to online learning, many of the teaching staff

were unprepared and classes were delivered via pre-recorded videos as instructed by the university, as not all students had access to sufficient data or bandwidth. Some university lecturers disregarded the university directives and taught in a synchronous manner using Teams and Zoom as the online technologies of choice. It should be noted that the quality of the course matters, regardless of the modality.

Our qualitative data provide some insights into students' views on why they prefer one mode of study over another. For example:

> Made me even more appreciative of it. I was already making sure I attended every lecture & tutorial because I knew how terrible watching the recordings were, but now I am even more convinced. I do not feel as though I am getting even remotely the same experience or education from online learning, not because of a lack of material but purely because of the format and experience, and I cannot wait to be able to attend classes again.
>
> [Student from FHAD]

A set of tests examined the existence of the relationship between students' preference for the mode of study (online, on-campus, combination of both) and demographic variables. There was no significant evidence of an association between students' preference for the mode of study and gender; this was calculated by employing a Fisher–Freeman–Halton exact test (*FFHET (N = 189) = 8.994, p = 0.333*). Similarly, there was no association determined between students' preference for the mode of study and type of high school attended, as well as location of high school. In both cases, a Fisher–Freeman–Halton exact test was calculated showing no significant evidence of an association (*FFHET* ($N = 189$) = *3.141*, *p = 0.541* for the type of high school attended and students' preference for the mode of study; *FFHET (N = 188) = 2.159, p = 0.703* for school location and students' preference for the mode of study). However, a Fisher–Freeman–Halton exact test determined significant evidence of an association between students' preference for the mode of study and the Faculty where students were studying (*FFHET (N = 189) = 9.971, p < 0.05*). Cramer V was calculated, and it showed a small-to-moderate relationship between the two categorical variables (*V = 0.164*).

To determine how a Faculty was associated with the preference of the mode of study, a post hoc column proportion test was performed. The results suggest that these differences lie within the Faculty of Health, Arts and Design (FHAD) and the Faculty of Business and Law (FBL). Within FHAD, the proportion of students who selected 'on-campus' as their study mode preference was higher than the proportion of FHAD students with the preference for online studies. A similar pattern was determined for FBL students, where the proportion of students preferring on-campus studies was also higher than the proportion of FBL students indicating preference for the online mode of study. Note that students at FHAD were significantly more reluctant to do online study than FBL students. For students from the Faculty of Science, Engineering and Technology (FSET), there was no significant preference towards a specific study mode (Table 4).

Although quantitative data do not explain the reasons behind students' choices, their free-text responses provided some interesting insights. We know that the nature of degrees taught at FHAD such as Film and TV, Nursing and Design, require special on-site training or highly specialized equipment that the majority of students do not have access to outside of the university. This is illustrated by this student's comment: "My course is very practical in nature and benefits from the workshops and physical resources of the university" [Student from FHAD]. Some statements referred to very specific technologies required in Film and TV degrees that are fundamental for hands-on experience:

> "A Sound Stage would be very beneficial for the Film course as it would allow for better film productions"
>
> [Student from FHAD]

"HMI lights as they are still used as an industry standard and require different electrical management to regular tungsten . . . "

[Student from FHAD]

Table 4. Students' preferences on the mode of study based on the Faculty.

			Which Do You Prefer for Your Studies? (Please Select One)			Total
			Online	On Campus	A Combination of Both	
Which Faculty are you associated with?	**Faculty of Science, Engineering and Technology**	Count	5 a	23 a	32 a	60
		Expected Count	3.8	25.7	30.5	60.0
	Faculty of Health, Arts and Design	Count	2 a	48 b	46 a,b	96
		Expected Count	6.1	41.1	48.8	96.0
	Faculty of Business and Law	Count	5 a	10 b	18 a,b	33
		Expected Count	2.1	14.1	16.8	33.0
	Total	Count	12	81	96	189
		Expected Count	12.0	81.0	96.0	189.0

Note: Each subscript letter denotes a subset of 'Which do you prefer for your studies? (please select one)' categories whose column proportions do not differ significantly from each other at the 0.05 level.

Students studying in the Science, Engineering and Technology domain are generally more comfortable with various technologies than students in domains related to the Arts, Health and Design which could be a determining factor of successful online studies as evidenced by the comment following:

"That a lot can be done online that is more efficient than doing it on campus".

[Student from FSET]

For many students, the shift to online learning was a completely new experience; therefore, this study wanted to investigate whether the shift to online learning altered participants' view of studying at the university. The majority of students (60.11%) answered 'yes', and the rest (39.89%) responded 'no'. Some students had not experienced online learning before the pandemic and were surprised to discover its positive aspects. The comments show a dramatic change in perceiving online studies as a new viable option:

"I just never realised that online study was such a valid mode of learning. I did tend to think of it as being 'inferior' before this".

[Student from FSET]

"It made me consider studying online full time".

[Student from FSET]

"It has shown me that my course could be done online".

[Student from FHAD]

"It also highlights how a lot of on campus time is unnecessary and can be done from home in a shorter amount of time".

[Student from FHAD]

Others had a negative reaction to the imposed change:

"Online learning has made me want to defer or quit uni altogether as I find it more difficult to relate to the information and understand the topics".

[Student from FHAD]

"Less motivation to continue studying".

[Student from FSET]

"Face to face learning is necessary for me to do my best".

[Student from FHAD]

Uncovering these different views raised the question of whether there is an association between preference for a study mode and the demographics variables. The collected data showed no evidence of association of this variable and the demographics variables. Specifically, to investigate the significance of association between gender and whether the shift to online learning altered participants' views of studying/attending university, a Fisher–Freeman–Halton exact test was calculated, and the results demonstrate no evidence of a relationship (*FFHET (N = 188) = 44.835, p < 0.05*).

4.3. Altered Views on Studying Online

Associations between the variable of 'whether the shift to online learning altered participants' view of studying/attending university' and the type of school as the second variable, as well as the location of school as the second variable, was explored using a chi-square test for each association. In both cases, the results confirm no significant evidence of associations ($\chi2$ *(2, N = 188) = 1.590, p = 0.452* for the type of the school and $\chi2$ *(2, N = 187) = 0.050*, p = 0.975 for school location).

Thematic analysis of students' comments uncovered reasons as to whether students were open to the change in study mode from on-campus to online or a combination of both. One reoccurring theme was travel related. For some students, not having to travel saved them time as well as travel expenses, and they found they were using the time saved to be more productive, as corroborated by the quotes following:

"Less travel time. I can now spend an extra 3 hours everyday working on assignments instead of sitting on the train or in my car. Also don't have to pay for parking and petrol everyday".

[Student from FBL]

"It has made some aspects more convenient, for example traveling to and from uni took a lot of time that I can now use productively instead".

[Student from FHAD]

" ... Although, studying from home and cutting down on unnecessary travel time has helped significantly".

[Student from FHAD]

Another reoccurring theme was the difficulty to achieve the same level of interaction online with their teachers and students. Quite a few students pointed out issues they experienced:

"Doing Accounting subjects, it is important to have a teacher in front of you doing questions and explaining it. Doing it online nowhere near matches this and makes it more difficult to ask questions and to get the relationship and interaction you desire when attending uni".

[Student from FBL]

"Most of my classes benefit from bouncing ideas off other students in my class. That's hardly facilitated online".

[Student from FHAD]

"So hard to communicate with lectures and tutors. Especially in a hands-on degree, the email chains for possibly a 5-min conversation are annoying".

[Student from FSET]

However, there were students who expressed the opposite view, finding it easier to connect with other students or tutors:

"Everything is all in one place and easily accessible. Tutors are more available for consultation as well".

[Student from FSET]

"It is easy to connect to teachers and students and I feel more motivated to do work at home, in my own time".

[Student from FHAD]

The above difference in attitudes could be coming from students' learning habits and studying styles. Although past research suggested different models of learning styles to support teaching approaches [35], the learning process is more successful when teaching meets students' expectations and preferences. For some students, the online environment meant feeling alone and missing the classroom atmosphere:

"I don't work well alone or online, it's hard to stay motivated and establish a routine".

[Student from FHAD]

"My learning style is more adapted to face-to-face learning, especially asking questions and seeing non-verbal cues".

[Student from FHAD]

"I do a lot more work when I have face to face communication".

[Student from FSET]

Others lacked self-discipline and time management skills since lectures were replaced with recordings and expectations that students will watch the recordings in their own time:

"Lots of distractions at home and not possible to get rid of them, poor internet, disruption caused a huge toll on my mental health which made it really hard also".

[Student from FSET]

"I have never been proficient in using the computer and it was difficult finding the motivation to do the work now that I can do it whenever".

[Student from FHAD]

However, there were students who figured out how to adapt themselves to the new environment and took advantage of flexibility brought on by going online:

"I have discipline, so I created my own schedule and stuck to it".

[Student from FSET]

"Classes are more flexible with everything being pre-recorded".

[Student from FSET]

"Learning from home allows me to manage my time far more efficiently by choosing which lectures and tutorials I need to attend and which I don't, therefore I get higher grades, spend less time in class, and have more free time".

[Student from FSET]

"Units got cut down to half as some got pushed back to summer semester, so I wasn't overloaded with as much work and it allowed me to get used to motivating myself and sticking to my own study schedules".

[Student from FHAD]

Moving online changed students' patterns in using technology. Studying remotely introduced them to new tools, such as cloud-based tools to have access to university-licensed software, and made them aware of the importance of backing up their work, as well as the range of collaboration tools. Many students commented on the increase in using communication tools:

"I never used Zoom before this shift".

[Student from FBL]

"I use Collaborate Ultra and Zoom more".

[Student from FSET]

"Using specific software like Zoom, etc, more than ever before".

[Student from FHAD]

"It has increased the use of online discussion forums . . . "

[Student from FHAD]

"I have become more proficient in using Cloud systems to back up my work".

[Student from FSET]

5. Discussion

The COVID-19 pandemic posed unprecedented challenges to education around the world. Undeniably, technology played a crucial role in ensuring the continuation of educational programs at all levels [36]. Students (and educators) had to quickly adapt to the new circumstances. But exactly who was more affected and how by these new conditions is something that we are only just beginning to understand. In this paper, we looked at university students that had one year's experience of pre-pandemic, face-to-face education. We were interested to know:

RQ1. How did students' experience of technology support their fast shift to online learning?

RQ2. How did the shift to online learning alter these students' views on studying at university?

Our results show that half of the students (51%) thought the experience of shifting to online learning was 'very easy' or 'somewhat easy', which added to those who thought the shift was 'neither difficult nor easy' (13%) points to a smooth transition for the majority of students in this cohort. For some of these students, online study came as a positive surprise; some even considered studying fully online. While the literature has reported positive experiences of online learning, it also reported that despite these positive perceptions students still have a stronger preference for face-to-face classes, e.g., [15]. The fact that some of the students considered going fully online with their education is somewhat unexpected. However, for the other 36% that reported a more troubled transition to online learning, the experience made some of them consider deferring or quitting their studies as they realized how important face-to-face instruction was for them.

An interesting result from the study was the finding of a statistically significant association between gender and how students perceived the shift. It was discovered that more female students thought the shift was 'somewhat difficult' than those who thought it was 'neither difficult nor easy', while data from male students did not show any statistical difference. Studies before the pandemic seem to show no statistical difference between males and females in self-regulated variables and motivational beliefs within online learning environments [20,24,37]. Hence, explanations as to why more females perceived the shift to online learning as more difficult might be similar to those that have been reported for women and caregivers in academia, which point to personal challenges

brought by the pandemic in balancing home responsibilities with their academic work [38]. Indeed, the quote from one of the female students in this study pointed to the lack of a sustainable working environment at home. Some of these issues directly or indirectly relate to technology, as seen in the quotes of some of the students that commented having issues with poor internet connection or not being proficient with computers.

It was also found that half the students (50.79%) prefer a combination of face-to-face and online learning. Perhaps this is a case of wanting to have the best of both worlds, having had this unique opportunity to experience both during their studies. The fact that students could see advantages and disadvantages of online learning was evident in our data. Some students realized that they did not need to spend time travelling to campus and that many learning activities could be done more efficiently from their homes. Other students thought they needed social interaction with their educators and peers and that their style of learning was better suited to face-to-face instruction. Some of them thought that on-campus learning was conducive for establishing a routine and staying motivated, while others felt online classes were more flexible and allowed them to manage their time more efficiently. This wish from students for a combination of delivery modes is in line with worldwide trends towards the adoption of blended learning approaches [16], where technologies will be part and parcel of educational programs in the 'new normal' [17].

However, educators should be cautious on how to implement these changes. Innovations that might work in one field of study might not work so well in another, showing that this is a complex problem that requires further research. If innovations are to be successful, they need to be pedagogy driven rather than only technology driven [3]. Our data indicated that more students from the Faculties of Health, Arts and Design and Business and Law preferred on-campus learning rather than online learning. These students seemed to suggest that the practical nature of their degrees makes online learning not fit for purpose, particularly when physical resources such as sound recording rooms, workshops or special lighting are required. At the same time, there seem to be more technological innovations geared towards scientific disciplines, with the creation of virtual laboratories to complement in-person ones [27]. Irrespective of the degree they were studying, the majority of students (60.11%) felt they had altered their views about university study due to the shift to online learning. For some, it was a positive experience, while for others, it reinforced their belief that physical interaction was important in their learning. For a few students, the experience brought up opportunities to learn new technologies, such as online communication software, discussion forums or cloud systems.

In summary, our results show that the sudden shift to online learning caused by the global pandemic forced many of the students to reflect on their university education and on the advantages and disadvantages that different pedagogies have. Technology is at the center of these reflections, whether students think that online teaching is not suited to the type of degree they are studying, or not having the necessary digital skills poses a challenge that adds to the need to balance home responsibilities, or that learning new technologies presents an opportunity to develop new skills. In many of these cases, technology ensures the continuation of students' education, albeit for some this is not ideal. For others, technology is not enough to change their minds about deferring or quitting education, and this is something that institutions need to address.

6. Conclusions

The COVID-19 pandemic and resulting lockdowns have forced the move to online teaching and learning to ensure learning continuity. The rapid move online has strongly affected students' learning experience. In this study, we investigated how students experienced the transition online, and how this shift affected their view of studying at university. Most of the students reported not having difficulties transitioning online (74%); however, for others, the transition was challenging to the extent that some of them considered quitting or deferring studies. From the qualitative data, this sentiment was expressed mostly among the students who relied on specialist equipment that could not be available

outside the campus and also students who lacked self-discipline, time management skills and control of motivation when studying alone. After being exposed to this experience, almost half of the students reported strong preference in a combination of online and face-to-face learning—with some students discovering and appreciating advantages such as flexibility offered by online learning. Most of the students (~60%) feel that this experience has changed their view of university. These results also provide some insights into the difficulties students encountered and which factors need to be considered in cases of a rapid shift to online learning.

Since this study was conducted within one university, the findings are limited to this context. The students in this city experienced one of the longest lockdowns in the world. This would inevitably have influenced their experience. Additionally, each Faculty in the university implemented their own strategies to move online. Usage of different technologies and strategies in the transition online could have also affected student experience. Further studies are needed to determine how students experienced the shift to online learning in different university contexts around the world. Our results add to the growing literature on the transition to online learning during the pandemic and the role of technology in ensuring the continuation of learning. These findings point to the fact that universities will need to be careful in selecting and developing appropriate technologies for different areas of education while at the same time considering the variety of learners and their study preferences. A more flexible and considered approach to technology in education is needed to ensure a good-quality education.

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