

Digital Tools Faculty Expected Students to Use During the COVID-19 Pandemic in 2021: Problems and Solutions for Future Hybrid and Blended Courses

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Abstract

Covid-19 resulted in a pivot to remote teaching and learning in most North American colleges and universities. All of a sudden faculty expected students to use a variety of digital technologies. Here we report on the technologies post-secondary students had to use and on the problems experienced by students with and without disabilities (e.g., mobility and visual impairments, attention deficit hyperactivity disorder, mental health related disabilities). In a sample of 24 post-secondary students, we found a series of problems related to: software and platform issues; connectivity; how professors managed their courses; classmates' computer behaviors; and equipment issues. We also learned about several beneficial practices and ways to avoid problems that can be retained for future hybrid and blended courses. By giving a voice to post-secondary students our research can inform policies and practices to create a more resilient and inclusive society.

Keywords: Covid-19, post-secondary, college, university, students, disabilities, technology, sustainability, inclusive practices, hybrid courses, blended courses

1. Introduction

With the advent of the COVID-19 pandemic, higher education institutions worldwide made an instant pivot, primarily to remote teaching (e.g., Besser, Flett, & Zeigler-Hill, 2020). Although there are numerous papers dealing with the impact of the pandemic on post-secondary students with (Lazar, 2021) and without disabilities (Browning et al., 2021), little is known about which technologies faculty expected students to use and how well these worked. This is important to know because lessons learned during the pandemic can provide the foundation for sustainable inclusive practices. In this study we wanted to know (1) which technologies / apps professors asked students to use during the pandemic and (2) what problems students encountered while using these. Technologies and practices that professors expected students to use that are seen by students as working poorly could be replaced in the future by practices and technologies that worked well.

1.1 All Students Struggled

A recent study showed that, in general, the impact of COVID-19 on students' academic experiences was similar for those with and without disabilities (Fichten et al., in press). The most common problems were related to concentration, motivation, and discipline. However, students also encountered a variety of problems related to the use of their personal technologies. In the present study we were interested in the technologies that professors required their students, both those with and without disabilities, to use to access their courses.

Blurring between adaptive and general use technologies allows students with disabilities (e.g., mobility and sensory impairments, chronic health related disabilities) access to a vast array of mainstream technologies used by students without disabilities (Fichten, et al., 2020). Many such technologies now have built-in accessibility features such as speech-to-text (dictation), magnification, and text-to-speech (narration). This is true of frequently used technologies such as Microsoft 365 (Microsoft, n.d.-a) and Adobe Acrobat (Adobe, n.d.). Both have built in optical character recognition, contrast view and text-to-speech functionality. Among the most commonly used video sharing platforms during the

COVID-19 pandemic (Trusted Tech Team, 2020), both Zoom (Yale University, 2020) and Microsoft Teams (Microsoft, n.d.-b) have live automatic captioning. Therefore, it is hardly surprising that when it comes to the COVID-19 related technologies that professors expected all of their students to use, difficulties experienced by students with and without disabilities are likely to be similar.

There are also numerous technical challenges that affect all students. These include connectivity, power outages, technical support and technical training (Dias et al., 2020; Ro'fah, 2020). During the pandemic, family computers were less likely to be available to post-secondary students due to parents' and siblings' computer needs (Gillis & Krull, 2020). Home based learning can create problems due to noise and distraction (Top Hat, 2020). As well, students can encounter difficulties with Wi-Fi connectivity (Mupenzi et al., 2020). In fact, numerous studies have documented negative outcomes of remote learning for post-secondary students (e.g., Hagedorn et al., 2021).

2. Method

2.1 Participants

Participants were 24 Canadian college and university students (16 females, 7 males, 1 gender queer, 20 with and 4 without disabilities) who were participating in a larger study (Fichten et al., in press). Median age was 22.5 (range 19-48). Participants attended 11 different post-secondary institutions, with 15 students attending a junior/community college and 9 attending a university. Most university students were pursuing a bachelor's degree. Participants were provided with a list of disabilities and asked to indicate as many as applied to them. Four students indicated no disability. The mean number of different disabilities reported by the 20 students with disabilities was 2.60. The most common disabilities were mental health related disorders (reported by 13 participants), attention deficit hyperactivity disorder ($n = 11$), and chronic health problems ($n = 6$). In addition, 5 students reported a learning disability, 5 reported a neurological disorder, 3 reported Autism Spectrum Disorder, and 2 reported: low vision, a hearing impairment, a speech / communication impairment, and limited mobility: use of a cane / crutch / walker.

2.2 Procedure

All students were participating in a larger investigation where we studied the use of mobile technologies during the COVID-19 pandemic and its impact on Canadian students' academic performance (Fichten et al., in press). For the present investigation, in January 2021, with the approval of the Dawson College Research Ethics Board, we emailed the 205 students with and without disabilities who participated in the larger study and who indicated that we may contact them for future research to ask them two additional questions:

1. What technologies / apps did your professors ask you to use during the pandemic?
2. When you needed to use technologies / apps during the pandemic, what problems did you encounter?

Students' names were entered in a draw for two Android tablets. Twenty-four students (12%) responded to these questions by email. To ascertain how technologically sophisticated students were, we also examined a 10-point self-efficacy scale item from the larger study that asked students how confident they were in using technology that helps with reading and writing.

Because this may be of considerable interest to students with disabilities, we were also curious about which of the technologies reported in response to Question 1 were artificial intelligence (AI) based. Therefore, we conducted a Google search on each named technology to try to ascertain its AI status.

Responses to Question 2 were coded by 3 trained coders in accordance with a coding manual (Wileman, Havel, & Arcuri, 2021) into 7 categories: software / apps / management, platform issues; connection issues; professor's management of course; classmates' computer skills and behaviors; equipment issues; difficulties regarding tests and exams / submitting assignments; other. The coders were trained to a minimum 70% percentage agreement. Spot checks of 110 codes resulted in an average of 87% inter-rater reliability.

3. Results

Given the small number of participants without disabilities and the literature which shows that students with and without disabilities often have similar technology related concerns during the pandemic we combined the results of students with and without disabilities. The mean combined score of participants on a 10-point technology self-efficacy scale was 8.42 ($SD = 1.34$, median = 8.75, range = 6-10). This suggests that students were quite comfortable using technology. Since responses of students with and without disabilities were similar, we combined the two groups.

The mean number of different technologies students were expected to use is 4 (median = 3, range = 1 - 11). Overall, 41 different technologies were mentioned. Results in Table 1 indicate that 13 of these were mentioned by two or more students (e.g., Zoom, Teams). Among the 13, 5 were AI-based.

Table 1. What technologies / apps did your professors ask you to use during the pandemic?

Technology	Number of students who mentioned it	Is it artificial intelligence-based? Probably:
LMS (Moodle, OmnivoX, Canvas, Via, Blackboard)	16	No
Zoom	15	Yes
Teams	6	Yes
Microphone	4	No
Video camera	4	No
Microsoft Office 365	3	Yes
YouTube	3	No
Adobe Connect	2	No
Discord	2	No
Kahoot!	2	No
VMware Horizon	2	Yes
Webex	2	Yes
WebWorks	2	No

This table presents different technologies mentioned by at least 2 participants.

An additional 28 technologies were mentioned by one student. Of these, 8 are AI-based (MATLAB, Netcad, Outlook, Pearson ERPI, Perusall, Slack, Stream, and Turnitin) and 20 are not (Buckets, Cisco Packet Tracer, Cognitis, Concordia OnLine Exams (COLE), Crowdmark, Desmos, draw.io, DrJava, Google Classroom, Google Drive, Loom, MaBiblio, Mastering Engineering, Moodle Quiz, Padlet, Perusall, PowerPoint, Strava, Top Hat, Tracer, Visible Body). Overall, 32% of technologies mentioned by students are AI based.

Table 2 presents the problems that students encountered organized into the seven coded categories in descending order of frequency: software / apps / management, platform issues (54%); connection issues (28%); professor's management of course (25%); classmates' computer skills and behaviors (25%); equipment issues (25%); difficulties regarding tests and exams / submitting assignments (17%); and other (29%), with examples in each category.

Table 2. Coded student concerns

Student concerns	Students reporting this		Sample responses
	n	%	
Software / apps / management, platform issues	13	54%	Software bugs; collaborative Word document within Microsoft Teams would not update properly; Google accounts/drives can be very problematic when trying to upload a large video file; the platform did not tolerate operating systems older than 1-1/2 years
Connection issues	7	29%	Internet crashing; slow network connectivity; poor Wi-Fi signal quality; there were times when course management system was slow or was "down"; MS Office online platform was unreliable
Professor's management of course	6	25%	A better system for time management and posting of class content would be helpful; the overwhelming number of apps, videos, and content; too many technology options; professors don't always notice when there are questions; sometimes the professor would forget to record a session
Classmates' computer skills and behaviors	6	25%	Students constantly typing into chat boxes is distracting; background noise from other students when their mics weren't turned off; Problems with echo; low volume on the other speaker's end
Equipment issues	6	25%	The roof leaked on my laptop; I had to keep my devices plugged in all day, every day due to their constant use; I sometimes had problems with my microphone
Difficulties regarding tests and exams / submitting assignments	4	17%	If the online exam was poorly designed I didn't have time to finish; I would come very close to the submission deadline because of delays in uploading; I did not always know when quizzes were due on the learning management system
Other	7	29%	Accurate live captioning would be useful for synchronous (live) classes; I had to invest in some blue light glasses because I developed awful headaches; a 3-hour course in front of a screen can become demanding

This table presents problems that students encountered when using technologies.

4. Discussion

The list of technologies professors expected students to use was lengthy. Some technologies were used in many courses during the pandemic, such as Zoom and Teams, while others were used less frequently (e.g., Perusall, Top Hat). There were technologies mentioned that are related to specific disciplines (e.g., Netcad, DrJava). Notably, only approximately 1/3 of the technologies mentioned are likely to be artificial intelligence (AI) based. At this point we are not sure whether AI is likely to help or hinder students. We report it here for future research.

As Table 2 shows, it is important that professors teach students how to use all technologies they expect their students to use, even if students are generally proficient in using technologies (Fichten et al., 2018). The comprehensive nature of the technologies reported by the participants suggests that it is unreasonable for students to have to learn to use these by themselves, without any direction from their professors.

4.1 Student Concerns

4.1.1 Problems Related to Software, Apps, Management and Platform Issues

As suggested in the literature (Dias et al., 2020; Ro'fah, 2020), our results also show that students had a variety of concerns related to technologies they had to use during the COVID-19 pandemic. What makes our findings original is that we were looking at technologies that professors were expecting students to use.

Our findings show that slightly over half of the students mentioned problems related to software, apps, management and platform issues. Difficulties included items such as software bugs, problems with uploading, lack of compatibility among technologies, and the need to have the latest versions of software. Such problems are not only frustrating, but they could also interfere with learning. For example, students can lose marks if they have problems uploading assignments and therefore, do not submit their assignments on time. Also, some software platforms do not permit certain types of commonly used files to be uploaded. For example, in one of the post-secondary institutions, the Moodle platform does not allow Pages documents (the main Macintosh word processing software) to be uploaded. Often, students only found out that their video file was too large once their project was completed and the platform rejected it. Students in Zoom breakout rooms can have difficulty getting back to the meeting if they press the wrong key. Additionally, students need to have the latest version of some software. For example, if they do not have the latest version of Zoom, they cannot be put into a breakout room. Such problems can seriously interfere with students' learning and performance.

4.1.2 Connection Issues

A related and frequently mentioned topic involves connection problems such as crashes, slow network connectivity, poor Wi-Fi, and unstable learning management systems. For example, students can miss part of a lecture on Zoom or Teams while it is frozen or if they must reboot their devices. Students can have difficulty with online exams if their connection is slow to update, or if the learning management system is busy and they get booted offline. Also, in some cases the course management system was "down" due to overload, resulting in students missing parts of an exam. In addition, some students use the web-based version of Microsoft 365; it can be very frustrating to have to wait in between entering characters in Microsoft Word because the system is slow.

4.1.3 Professors' Management of the Course

One difficulty students encountered relates to the timing of posting documents. Some students like to prepare for the class and need more than a few hours' notice regarding documents that need to be read before class (Fichten et al., 2019). Another common complaint relates to professors not seeing questions asked by their students in Zoom and Teams chats. By the time the professor notices them, the reason for the question is often times forgotten. Another annoyance for students was that professors would sometimes forget to record and upload lectures to the course management system. This affects students who wish to review course material once their schedule and obligations allow them to do so. In addition, some professors feel that the more technologies they use the more engaging their lecture. However, a conclusion from a study of excellent professors (Fichten et al., 2018) suggests that faculty should use only technologies that they are comfortable using, and that if a technology does not work to simply move on rather than spend time trying to troubleshoot it. Also, the need for students to navigate among a variety of apps, videos and content can be disruptive to learning.

4.1.4 Classmates' Computer Skills and Behavior

Students also noted that their fellow students' behaviors could cause problems. One issue related to echoes, typically caused by students using regular speakers rather than headsets or ear buds. Also, the volume of students' microphones can vary so that some students appear to be yelling while others are almost inaudible. Some students found that constant chat messages appearing during online lectures were distracting. What should I do? Read the chat item or listen to the professor?

4.1.5 Equipment Issues

Students needed to have working headsets and microphones. Some mobile technologies needed to be plugged in to power sources throughout the entire day because they were constantly being used. There were other issues as well, including noise from family members and pets, and as one poor student noted, “The roof leaked on my laptop.”

4.1.6 Difficulties Regarding Tests and Exams / Submitting Assignments

Online exams and quizzes were also problematic. Some exams had severe time restrictions so that students who were not provided with practice tests did not have a chance to complete them. In addition, there were issues related to the availability of information about deadlines. Some assignments took a long time to upload.

4.1.7 Other

Of course, there were many other problems. Captioning, along with transcripts, would have been helpful. Sitting in front of a computer all day could cause headaches and backaches and could result in distraction and boredom.

As can be seen, most concerns of students with disabilities appear to be unrelated to their impairment and, instead, appear to be related to simply being a student. This is consistent with recent changes in commonly used technologies in post-secondary education, such that students with disabilities can and do use mainstream technologies.

5. Limitations

We need to note that the return rate was only 12%. But perhaps the most important limitation is that the results were open-ended, making aspects of coding difficult (e.g., “Moodle crashed because the system could not support the increased simultaneous use.”) The applied rule was that difficulties resulting from the software being used were unrelated to connection issues (speed, lag, quality, reliability, etc.) should be coded as software / apps / management platform issues. Thus, the example above was coded a connection issue.

6. Implications

Our goal was to ascertain which COVID-19 pandemic related technologies and practices by faculty are likely to be useful in the future. By giving a voice to post-secondary students our research can inform policies and practices to create a more resilient and inclusive society.

College and university professors (Lombardi, 2021) and students (Top Hat, 2021) are keen to retain aspects of remote teaching after the pandemic ends. Zoom, the most popular videoconferencing technology (Aratani, 2020), is available on all platforms. Free versions can be downloaded without a university license. Students have learned to use Zoom to network with their peers and families. Thus, Zoom is here to stay. The same is true of Microsoft 365 (Microsoft, n.d.-c) since many colleges and universities provided free licenses for their students and faculty. As collaboration features and speech-to-text (i.e., dictation) are available for Microsoft 365 and because Zoom provides automatic live captions, we expect that these two prominent technology features of the COVID-19 pandemic will be maintained in the future. In addition, access to asynchronous lectures can help all students, including those whose work schedules do not permit attending the live lecture and those who simply missed a class or wish to review the content. Video captioning can also help all students especially those who first language is not the language of interaction. For faculty, there are numerous guides on what professors can do to ensure that their online courses are accessible (Oranburg, 2020).

6.1 Impact of the COVID-19 Pandemic on Professors' Expectations of Students' Technology Use

Consistent with the views of others (e.g., Gillis & Krull, 2020), our findings indicate that students had a difficult time with learning and studying during the COVID-19 pandemic. In particular, students experienced problems related to software, connection, professors' management of course, classmates' online behaviors, equipment, and difficulties regarding tests and exams.

Our results suggest that professors need to instruct their students on how to use the technologies they plan to incorporate into their teaching (see Dias, et al., 2020). Students need to know how to enter, leave and re-enter breakout rooms, and how to upload assignments. Students need to have information about the types and sizes of assignments and video files accepted by their course management system. Professors also need to clearly specify deadlines concerning when the course management system accepts uploads and show students how to download the latest version of the required software.

Professors need to post documents well before these are needed for the course. It is important they take time to check the Zoom or Teams chat during class to look for questions or comments, and they need to remember to record their lectures. If faculty have difficulty doing so, they could ask a student to remind them. Also, professors are advised to use relatively few technologies and ensure that they are comfortable using the technologies they choose to incorporate in their courses.

Faculty need to remind students to mute themselves when they are not speaking in order to minimize distractions. They should also recommend to students that they use a headset or ear buds to avoid echoes; suggestions about high quality but

inexpensive items can be useful. Faculty could designate a student to monitor the chat for questions if they find that they are not checking sufficiently often.

It is important that professors provide practice quizzes before important exams to allow students to learn how to use the interface and how to time themselves. When it comes to uploading assignments using a course management interface professors need to provide a list of file types (e.g., PDF, JPG, Docx) that students can upload.

As for other types of useful activities, professors could consider using live captions during synchronous lectures and providing captioned and transcribed versions of Zoom and Teams lectures. This might assist not only students with disabilities, but also second language learners. Professors could easily do this by uploading the videos of the lecture to Microsoft Stream (Queens University Information Technology Services, 2021) and then using the Stream hyperlink on the course management system to inform their students about the availability of the asynchronous lecture.

Overall, effective teaching techniques learned during the COVID-19 pandemic can easily be integrated into hybrid courses once the pandemic ends.

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