

Uncovering the influence of pre and post class factors on instructor adoption and utilization of classroom technology

Andy Benoit
Lethbridge College

To better understand situational factors that influence the adoption and utilization of a common classroom technology, interactive whiteboards, this research used a mixed-methods approach to investigate the technological and pedagogical tasks instructors complete prior to and following lesson delivery within the context of institutional scheduling. A five-step model was developed that illustrates instructor behaviors with consideration given to the influence of time on instructor decision making. This research cautiously concludes by noting that the transition time between classes may be an influential factor on how instructors utilize technology in their classrooms.

Background/Context

Educational researchers have demonstrated a longstanding interest in the utilization of technology in the classroom (Cuban, 1986; Price, 2013; Bates, 2020). Kent and McNergney (1999), for instance, note that technology advocates “warn of disaster if educators drag their feet on its use” (p. vii) and Aponte (2015) claims that technology affords students opportunities to manage their own learning and enable participatory and practical experiences.

Despite these aims, underutilized technology “plagues” businesses, even though organizations continue to invest in it (Venkatesh, 2000, p. 342). In the context of higher education, Contact North (2018), a distance education and training network for public colleges and universities in Ontario, Canada, notes that institutions are investing “significant funds, time and energy” in technology for learning, often with little sense of whether the investment achieves its intended aim (p. 3), and Selwyn (2014) laments:

...most digital technologies over the past 30 years have been accompanied by promises of widened participation in education, increased motivation and engagement, better levels of ‘attainment’... Indeed, the field of education and technology is beset by exaggerated expectations over the capacity of the latest ‘new’ technology to change education for the better regardless of context or circumstance (p. 7).

Ultimately, technology integration, however defined, is challenging—and successful integration is explained in part by whether the technology is usable and appropriate for a given situation or context. Kortum (2016) notes that

technology with poor usability results in higher error rates, decreased efficiency, and decreased safety and user satisfaction, ultimately remaining unused. From the viewpoint of activity theory, Nardi (1996) emphasizes the interrelationships between context, situation and practice, drawing attention to the broader environment in which a technology is to be utilized.

Towards the end of 2013 at the post-secondary institution where I work, interactive whiteboards (IWBs) could be found in almost all classrooms (see Image 1). A key aim of standardizing access to this technology was to encourage and promote innovate/digital teaching practices and learning experiences—such as having instructors create and students interact with digitized content during lessons. As this technology approached its end of life in 2018, I sought to determine how and to what extent the IWBs had, in fact, been adopted and utilized as envisioned. The main findings from my research (Benoit, 2018) noted that the majority of



Image 1.

Andy Benoit is an online curriculum developer at Saskatchewan Polytechnic.

instructors used IWB software in less than one-quarter of lessons and that students rarely if ever interacted with the IWBs. These findings led me to realize that despite the interactive potential of IWBs, the technology was being underutilized.

Given that the support team had implemented numerous best practices at our institution, such as offering professional development and ensuring access to skilled technical staff—factors considered integral to technology integration—the nature of IWB utilization was somewhat surprising: I had been expecting to see a higher proportion of instructors using the IWBs and the IWB companion software. Recognizing that there might be unaccounted for situational factors influencing instructor use of this classroom technology, I initiated an exploratory research project. Of particular interest to me were the routine tasks that take place in the classroom immediately before and after a lesson, in addition to the ten-minute break instructors have to transition between classes. In total, four questions guided the research:

1. What is an instructor's routine when travelling from their office to the first class of each day?
2. What is an instructor's routine when travelling from one class to another, given the ten-minute break between classes?
3. What routine tasks do instructors complete upon arriving at the classroom in preparation for lesson delivery?
4. What routine tasks do instructors complete in preparation for lesson wrap-up?

The research findings may be of interest to other institutions looking to develop a more complete understanding of the many, sometimes novel, factors that influence technology adoption/utilization decisions in the context of teaching and learning, especially colleges at which instructors teach multiple, potentially back-to-back courses each day and have to travel from one class to another.

Institutional Context

Lethbridge College (LC) has approximately 4000 full-time students. It offers more than fifty career-training programs, applied degrees, and apprenticeships in a variety of delivery formats (face-to-face, blended and fully online). As a teaching-focused college, full-time instructors typically instruct four to five courses per term. Instructors are issued laptop computers, which they bring to classrooms for teaching purposes.

Instructors may have one or more courses in a day. These courses may or may not be scheduled back-to-back. As this research project addresses issues of distance and time, a simple map is provided to illustrate the geography of our

campus. With the exception of one building (Instructional Building: 7246 m²) pertinent to this study, all buildings are internally accessible from the main college facility, as shown in Figure 1.

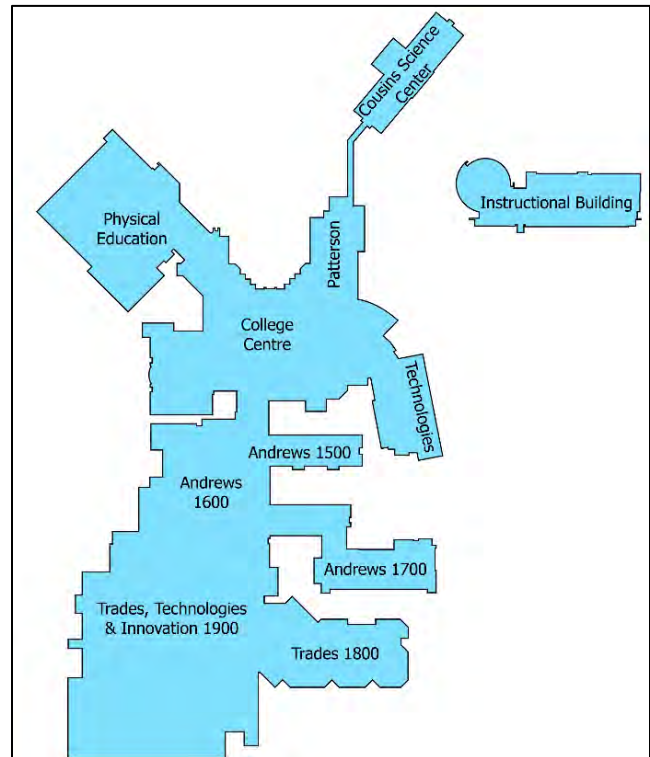


Figure 1. Lethbridge College Building Map

Methodology

Methods/Data Collection

This mixed-methods research project, undertaken to investigate situational factors that might influence instructors' use of classroom technology, received approval from the research ethics board at our institution. Given the institutional schedule, which generally permits a ten-minute transition between classes to allow for travel to and from classes, I collected quantitative data to measure the distance (to the nearest meter using a Rolatope measuring wheel-model # 32-415 M) and time (to the tenth of a second using an iPhone timer) it took instructors to travel from their offices to their classrooms, including back-to-back classes. To standardize measurement, I recorded the distance from each participant's office door to the podium in their classrooms; landings, but not stairs, were included in distance measurements.

On arrival, I completed a semi-structured qualitative interview with each participant to learn more about the

	Office to classroom (meters)	Office to classroom (seconds)	Classroom to classroom (meters)	Classroom to classroom (seconds)
Count	N=7	N=7	N=4	N=4
Mean	140	126	203	193
Sample standard deviation	118	109	135	129
Minimum	44	37	25	24
Maximum	391	361	346	333
Range	347	324	321	309

instructors' routine of travelling to and from classes as well as the tasks instructors typically complete to set up and close-out a classroom lesson. According to Seale (2012), semi-structured interviews "are often used to encourage an interviewee to talk, perhaps at some length about a particular issue or a range of topics" (p. 208). Prior to commencing the interviews, I provided participants with an informed consent sheet to read and sign. In total, I recruited seven instructors from a range of academic centres through an announcement in an all-staff newsletter. The participants represented a range of fields, professions and/or disciplines at our institution, including Nursing, Economics, Biology, Math, Physics, Chemistry and Multimedia. Participant offices were located across the campus, including the Cousins Science Centre, and the Instructional, Patterson, Andrews, and Technologies buildings.

Each interview was recorded and transcribed verbatim. I then invited participants to review their transcripts to check for accuracy and to elaborate on their responses if they had additional insights to share. Three of the seven participants completed this step, suggesting only minor changes.

Data analysis

Using software for qualitative data analysis, I assigned open codes to each interview. Codes were developed for perspectives, ways of thinking, process, activities, actions, events, conditions or constraints, consequences, and strategies/tactics (Liamputtong, 2013). Following this process, similar codes were grouped together across all interviews to generate broader categories in relation to the research questions. Simple descriptive statistics were generated to summarize the quantitative data, encompassing distance travelled and time spent travelling.

Results and Discussion

Quantitative Results and Discussion

Table 1 summarizes the quantitative data for the office-to-classroom and the classroom-to-classroom measurements. Simple descriptive statistics, rounded to the nearest one, are provided for two variables: distance (meters) and time (seconds). While all participants (n=7) participated in the office-to-classroom scenario as each had a first class of the day, only four of the seven participants had a back-to-back class that immediately followed. Analysis of participant feedback reveals that for the first class of the day, the average time required to travel from office to classroom at our institution was about two minutes, though instructors may travel distances that require double or even triple that amount of time. From reviewing the qualitative feedback, I found that the majority of instructors preferred to arrive 10–15 minutes early for their classes, which illustrates the importance the instructors place on preparing the classroom for learners and learning.

Where instructors had back-to-back classes, travel time was about three minutes with similar variability at the upper and lower ends of the range. Subtracting the three-minute average from the ten-minute time allotted to transition between classes leaves a remainder of seven minutes, which is considerably shorter than the amount of time instructors prefer for classroom preparation. The qualitative findings discussed below offer insight into the many and varied tasks instructors need to complete during this window of time and some surprising strategies instructors have developed to ensure they start their classes on time. The results and discussion are presented together and are followed by a brief conclusion.

Qualitative Results and Discussion

Analysis of instructor feedback revealed that **instructors depart their offices early for the first class of the day** to arrive between five to thirty minutes in advance of class start time, with the majority arriving 10 to 15 minutes beforehand. Participants 2, 4, and 5 stated, respectively,: "I tend to like to arrive to class 10 minutes before at the latest"; "Typically, if my classes aren't back to back, I try to be there 15 minutes before"; "If I don't have a back-to-back class, and if I know there isn't another class in there, then I'll give myself 15 minutes before the class starts." The instructors bring a range of resources and equipment with them to class, including a laptop or iPad, whiteboard markers, extra whiteboard brushes, student polling devices (commonly known as "clickers"), instructional materials such as handouts and/or tests/exams, and portable document cameras. Instructors use varied methods to transport technology and class resources including a laptop bag/case (n=5); cart (n=1); teacher tote on wheels (n=1); and a box (n=1).

In terms of the instructor routine when travelling from one class to another, instructors generally indicated that the experience was relatively simple provided that they could effectively transport their equipment/materials and/or were not injured. When there is inclement weather, participants prefer to travel indoors to avoid the cold and potential falls on the ice. One participant indicated this "adds time and length," requiring an even earlier departure from the office. In general, instructors expressed a determination to arrive at class on time: "I don't stop anywhere once I head for class"

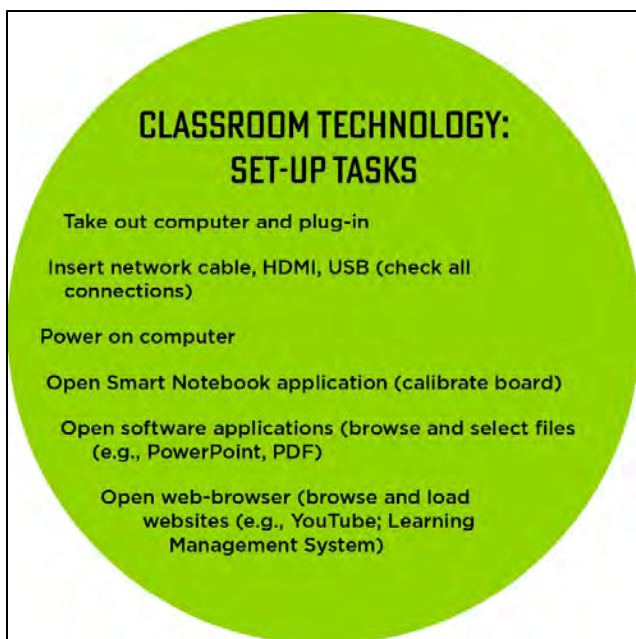


Figure 2.

(Participant 1); "Sometimes I want to get a coffee, but I know how much time I have" (Participant 2); "I don't have time to stop and eat so I take a can of V8 and that's my lunch" (Participant 3).

Upon arriving at the classroom and preparing for lesson delivery, instructors use the remaining time to unpack equipment, to open their laptops and related files, and to complete the connection process between the laptop and interactive whiteboard, including configuring the IWB. A summary of the configuration process is depicted in Figure 2.

An exception to this full set-up routine occurs when instructors opt to not power down their computers prior to transporting them from their offices. On this point, one participant shared the following perspective:

If I waited to get to the classroom to open all my applications, it would add another couple of minutes to the time needed. So, I usually set up all my applications, even have my PowerPoints to the correct slide, and then will put my computer on sleep mode, then take it to the classroom and open it up there. If I have to turn my computer off in my office, and bring it back up, find all of my applications, [add] at least three minutes (Participant 3).

In general, the participants characterized the process of arrival and set up as smooth and simple, indicating that "it will usually go very smoothly" (Participant 8). However, instructors also spoke of the impact of unexpected changes and/or non-functioning equipment, noting "It's really unnerving to come in, and all of sudden none of the equipment is working" (Participant 1). Another described the process as "Sometimes, a little ... crazy cause you have to do it fast, right, and the students are waiting for you. I feel bad if I'm making them wait for me, so ... I think sometimes I'm a little flustered cause you're trying to do it fast. You know it took you a while to get there, so ..." (Participant 7).

Concurrent with the process of technology configuration, instructors are also attending to a variety of pedagogical tasks. For instance, they are writing lesson objectives on the whiteboard, organizing handouts/documents for student pick-up, taking attendance, and addressing student questions in addition to making efforts to create a welcoming learning environment by greeting students. Consider the following interview excerpts:

I walk in, I get out my laptop, hook it all up, get that fired up and starting to turn on, and then usually what I'll do at that point is I go over to the board and on the far right-hand side, I'll put up a schedule for the day, along with usually the next four or five classes and then once I've

written that down, then I'll go to my box and open it up and take out whatever we're needing for that day. Sometimes, I'll write some stuff on the board before we get started, sometimes not. It just depends what we're doing and where we're at (Participant 4).

If students are already here before me and the door is open, I always greet them first. Ask them if they have any immediate questions. If I have more than one student that has questions, I usually answer those first. But if I have one, I ask them, give me 3 minutes to get set up. So, I pull out my laptop. It's always on before I walk in, so I don't have to wait for the bootup or anything. Plug everything in. Orient the SMART Board, get all my books and notes ready to go and then I open my textbooks and then ask the student what their question is (Participant 6).

I like the feeling of everything is all set up and ready to go and I get to take a gander at the crowd and see what they are doing and maybe participate in a discussion, have some light conversation, answer a few questions, whatever it is (Participant 2).

Essentially, then, prior to commencing class, instructors are simultaneously configuring technology and engaging in a variety of pedagogical tasks, as depicted in Figure 3. As noted by Hattie (2012) and Schneider and Preckel (2017), pedagogical tasks such as communicating lesson objectives at the outset of the lesson have been linked to gains in student attainment of course outcomes. In considering the

many tasks instructors are engaging in, encompassing both technology and pedagogy, a more complete picture of the instructors' experience prior to class commencing begins to emerge, which may vary depending on whether the instructor has 15 minutes available to prepare for the first class of the day, as depicted below, or seven minutes for classes that immediately follow.

In preparation for lesson wrap-up, participant feedback illustrated the challenges of wrapping up class and departing on time. Almost all the participants indicated it was common for students to approach them after class to ask questions. Questions typically revolve around seeking additional explanations (e.g., a concept), asking about assignments, and seeking personal advice. One participant summarized students' questions in the following way:

It is a whole range of stuff. I would say most of the questions are specific to that day or that unit ... the material at hand, but some of it does have to do with personal stuff like missing, or they're going to be gone, or you know they were ill, or you know, could they get something for somebody that wasn't there ... that kind of thing (Participant 4).

While instructors want to be available to address student questions, such delays influence the balance of time remaining to prepare their classrooms for their subsequent classes. In this regard, participants stated:

I don't want to rob students from one class of time for another class, so if students still need help...then I will

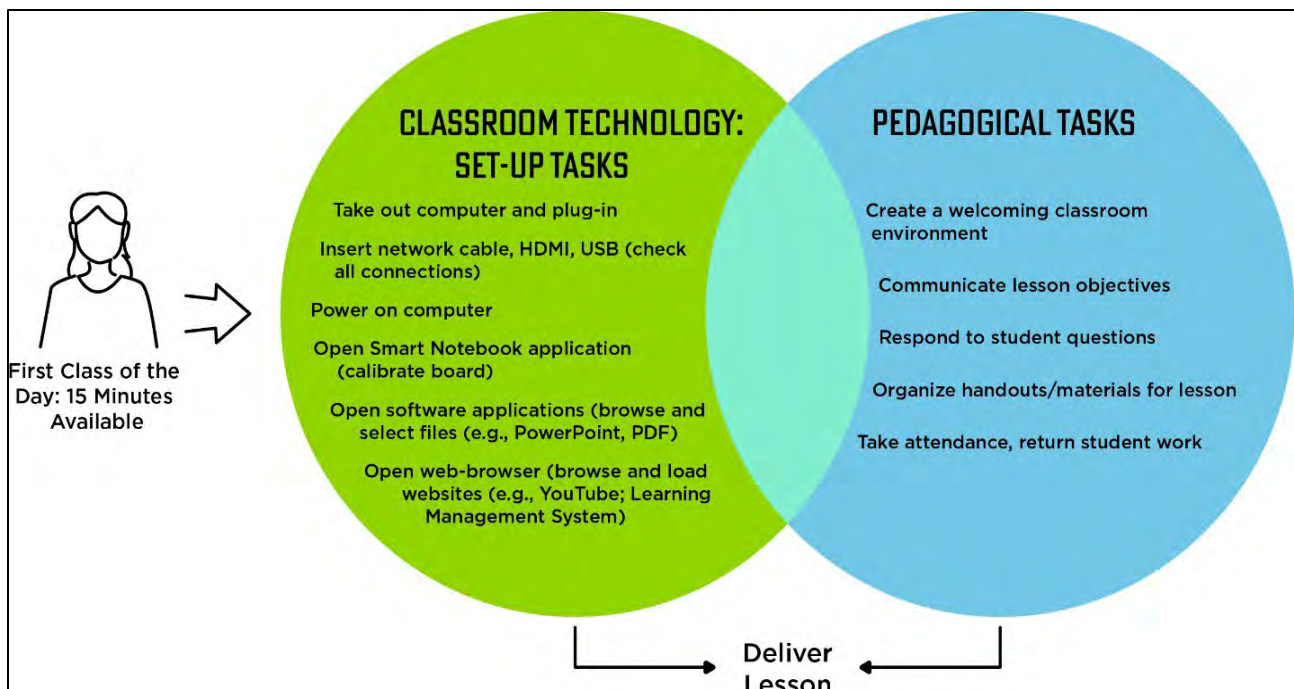


Figure 3.

just schedule time or say come by my office after that class because I can pop back over there easily, again (Participant 8).

It's usually considered more important to begin a class on time, so I will usually end class at least five, sometimes 10 minutes early in order to give myself more travel time, which means the earlier class is missing up to 10 minutes of teaching (Participant 3).

I think if I'm right on time, and I know it is OK to be right on time, but then I can't start on time. So, I guess a mild sense of anxiety that I didn't get started on time, and I feel flustered, but I've been teaching long enough, where I can hide that (Participant 6).

Yes, like I said before, sometimes, I actually have to end a class before, a little bit earlier, just so that I know I can make it to the next one and get everything set up. And the other thing is, even ending the class ... if you end the class right at the right time, there is often, same thing,

there is a line-up of students wanting to ask you questions or wanting to tell you something at the end of a class so then you can't get out of the classroom either, so that all influences it (Participant 7).

Within the context of the seven minutes remaining for instructor classroom preparation—once travel time is deducted—feedback revealed that some instructors end their classes early to ensure they can begin their next classes on time. That instructors find the process causes a “mild sense of anxiety” is perhaps not surprising, given that they are responding to student questions as they try to conclude their lessons while at the same time disconnecting and packing up resources to ensure they exit the class on time to make it to their next class.

The complete cycle of setting up for a class, depicted in Figure 4 as a 5-step process, provides a more complete picture of the instructor experience—from arriving at the classroom with seven minutes remaining (Step 1); to completing a variety of technical and pedagogical tasks (Step 2); to delivering the lesson (Step 3); to concluding the lesson, which also entails disconnecting technology, packing up

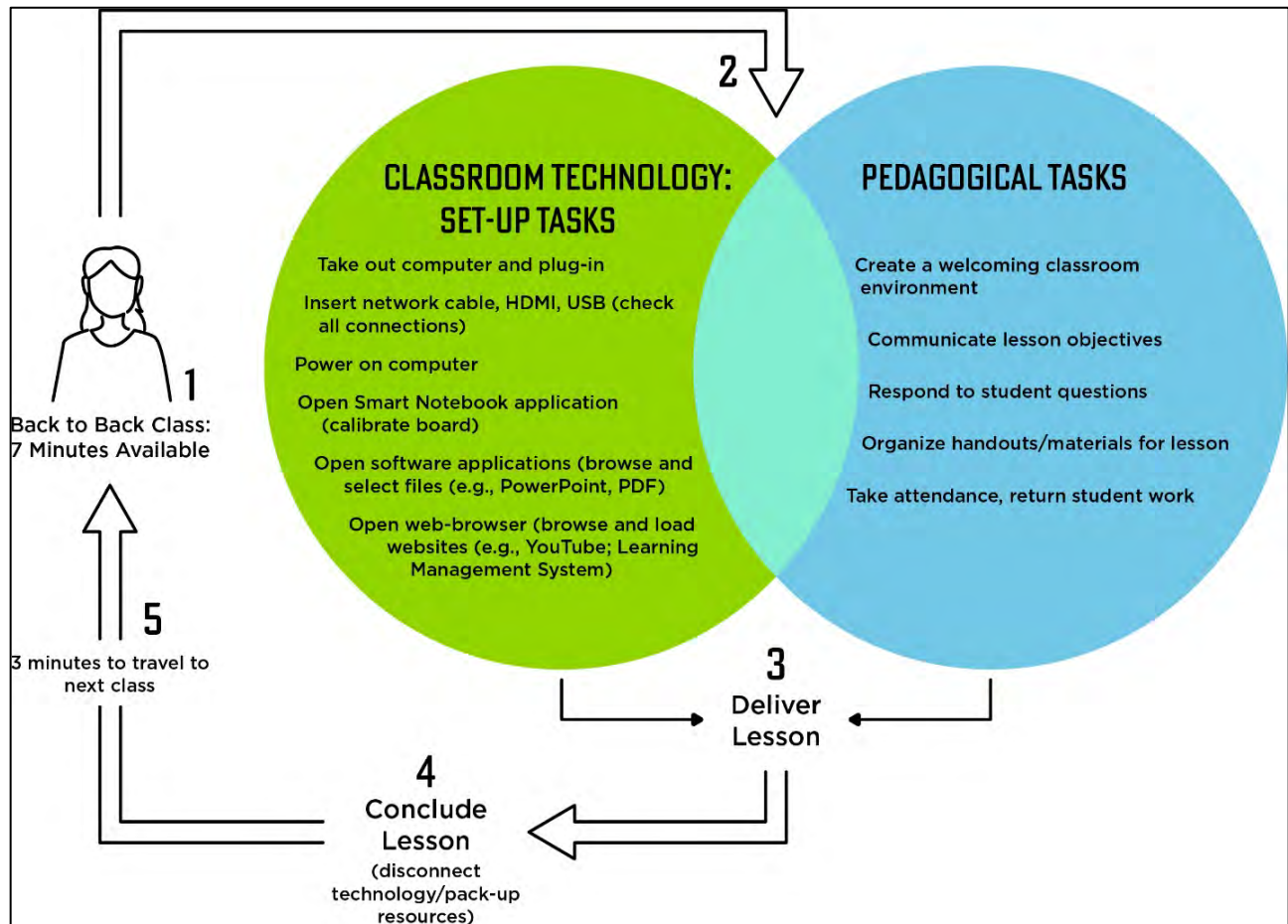


Figure 4.

equipment and materials and responding to last-minute questions from students (Step 4); to travelling to the next class (Step 5).

Conclusion

Classroom technology represents a sizeable investment on the part of institutions and expectations that technology will improve student learning remain optimistic; however, a brief scan of the literature reveals that adoption and utilization issues persist. This research project was undertaken as follow-up to a prior project that found the majority of instructors at a small college used interactive whiteboard (IWB) software in less than one-quarter of lessons and that students rarely if ever interacted with the IWBs in classrooms (Benoit, 2018). The purpose of this project was to explore whether situational factors related to time and distance might be influencing instructor adoption and utilization of interactive whiteboards.

Practically speaking, the findings from this research have brought to light the ideal amount of time some instructors prefer when setting up the classroom for lesson delivery, which is 15 minutes—a substantial difference from the seven-minute average available to instructors that participated in this research. Analysis of participant feedback has also contributed to a more complete picture of the many technological and pedagogical tasks that instructors must complete within the seven-minute window prior to a lesson commencing as they also attend to the varied needs and concerns students bring into the classroom. Finally, the feedback shows that instructors are using a variety of strategies to protect this window of time, including pre-loading applications on their laptops prior to departing their offices and not stopping on the way to their classrooms, in addition to looking for opportunities to gain additional time, which has resulted in some instructors ending their classes early to ensure they can arrive at their next classes with sufficient time remaining.

Mindful of the small scale of this research project, this research cautiously concludes by noting that the transition time between classes may be an influential factor on how instructors utilize technology in their classrooms given the many technological and pedagogical tasks instructors must complete to prepare for lesson delivery. Quite simply, instructors may not have any additional time available to load additional computer applications such as the IWB companion software, to complete additional steps in the IWB configuration process, and/or to prepare the classroom environment such that students could interact with the technology during lessons. This line of thinking may explain, in part, the low adoption rates and under-utilization of interactive whiteboards in our institution. Such findings

may be of broad interest to anyone with a stake in the use of classroom technologies in the post-secondary context.

An additional question this research has raised is whether the findings from this research project are applicable to other types of technology used in classrooms, for instance, laptop carts, audience response software, and perhaps even those technologies that are still emerging such as virtual reality. Future research projects might seek to explore whether instructors are more apt to integrate technology into their teaching practices when they have more time available to transition between their classes. This avenue of inquiry may have a role to play in ensuring that technology is more widely utilized amongst instructors in higher education.

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