

TPACK *Tried and Tested*: Experiences of Post-Secondary Educators during the COVID-19 Pandemic

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This article explores educators' experiences during the rapid shift from face-to-face to emergency virtual remote teaching and learning as a result of the COVID-19 pandemic. One hundred and forty educators from a Canadian province completed a survey with Likert scale and open-ended questions designed to capture their application of technological pedagogical content knowledge (TPACK) during the pandemic. Data was collected during fall of 2020. More than 50% of the study participants reported that the quality of their practice declined as they shifted from face-to-face to remote teaching as a result of the pandemic. Educators' descriptions of their virtual remote experiences were examined using Hutchings' (2000) taxonomy of scholarship and inquiry questions as an analytic lens. The findings suggest that educators who were more comfortable with their TPACK had an easier transition to virtual remote teaching. Institutional support, students' digital literacy/access, and overall wellbeing were also identified as factors that influenced educators' overall experiences.

INTRODUCTION

Having assessed the global health threat caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), on January 30, 2020 the World Health Organization (WHO) declared the initial outbreak a public health emergency of international concern. On March 11, 2020, the WHO declared the coronavirus outbreak a pandemic; the coronavirus outbreak was occurring worldwide. Many Countries went on lockdown to control the spread of the highly infectious virus. These lockdowns also meant that educational institutes had to seek alternative ways of remotely supporting students' learning by utilizing virtual spaces. Most post-secondary institutions in Canada quickly transitioned from in-person instruction to remote virtual learning and teaching in March 2020. As a result, educators, as well as their students, suddenly found themselves in extraordinary circumstances. How did post-secondary educators cope with the sudden transition to emergency remote instruction? What did these educators learn from both the challenges and opportunities that the COVID-19 pandemic presented? Our inquiry sought answers to these questions (and more) by asking post-secondary educators in one Canadian province to share their COVID-19 teaching experiences—through surveys and interviews. This paper reports on survey data that was collected from October to December 2020.

The implementation of remote learning and teaching in the face of the COVID-19 pandemic, presented both challenges and opportunities (Flores & Gago, 2020). As pointed out by Flores and Swennen (2020), teacher education was challenged as it tried to "(re)think ways of (re)educating teachers for scenarios that are unpredictable and unknown but which raise questions related to equity and social justice" (p. 453). This assertion implies that educators had to reeducate themselves on how they could best facilitate learning during the COVID-19 pandemic, revisiting issues related to inclusion, engagement, technology integration, support and assessment. Since not every educational organization had the capacity to transition to remote learning and teaching; issues of social justice, equity, and access to quality education became more pronounced. In organizations that had infrastructure and capacity for alternative remote learning, educators had to reorient themselves quickly to remote teaching to meet the needs of learners

not used to virtual learning spaces. However, it was not as simple as shifting delivery modes and continuing as normal. Educators at all levels of the education system were forced to reconceptualize what a good learning environment would look like in an emergency reality, and consider the kinds of technology that are relevant, user friendly and powerful. Flores and Swennen (2020) highlighted the importance for educators to have a sound online teaching pedagogy for that integrates technology. The circumstances raised an important question: "Did the educators have the relevant and requisite knowledge and skills to successfully integrate technology in their remote teaching practice in ways that would enhance students' learning during the pandemic?" By exploring the self-reported experiences of educators in a Canadian province during the COVID-19 pandemic, we wanted to gain insight on the kinds of knowledge and skills they needed for them to enhance students' learning in virtual spaces.

The Technological Pedagogical Content Knowledge (TPACK) framework (Koehler & Mishra, 2006) was used to examine educators' experiences. The framework builds on Shulman's (1986) concept of Pedagogical Content Knowledge (PCK). TPACK describes three kinds of teacher knowledge important for professional practice and their interplay (see Figure 1). First, there is Content Knowledge (CK) which refers to the subject matter knowledge that the educator should have in order to successfully perform their duties. Consequently, if one is a history teacher, they should be knowledgeable about historical concepts, ideas, gaps, patterns and practices to develop such knowledge (Koehler & Mishra, 2009; Shulman, 1986). Second, there is Pedagogical Knowledge (PK) which refers to the knowledge of teaching and learning strategies. PK relates to knowledge and understanding of learning theories, classroom management, assessment strategies and the implementation of relevant instructional strategies (Koehler & Mishra, 2009; Shulman, 1986). If one is a history teacher, they should be knowledgeable about how learners learn the concepts, skills and attitudes to make them confident and competent history students. Third, there is Technological Knowledge (TK), which refers to knowledge about educational technologies and resources used to enhance student learning. TK is about "being able to recognize when information technology can assist or

impede the achievement of a goal, and being able to continually adapt to changes in information technology” (Koehler & Mishra, 2009, p. 64). Educators with TK are able to identify and use technological tools in ways that promote student engagement and understanding. Figure 1 shows the visual representation of the TPACK framework by Koehler and Mishra, (2009).

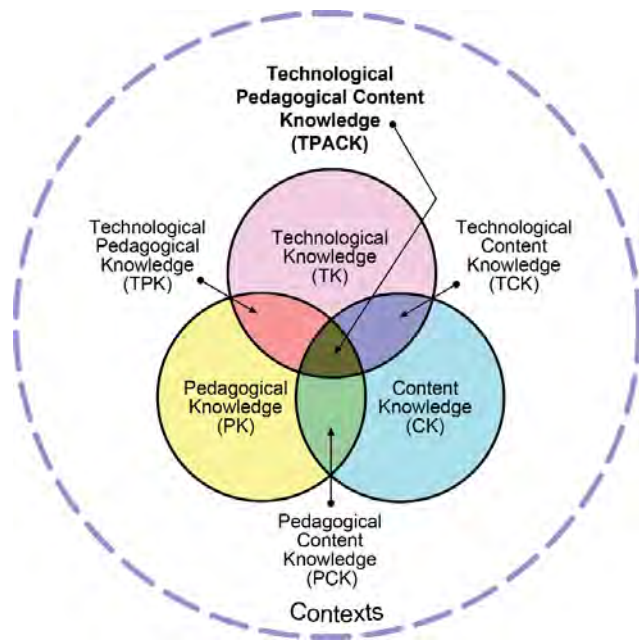


Figure 1. TPACK Framework for Teacher Knowledge
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The TPACK framework suggests that educators should have adequate technological, pedagogical and content knowledge for them to successfully enhance student learning, no matter which environment they are working in. That said, the remote teaching and learning environments hastily fashioned as a result of the pandemic created new realities. How would post-secondary educators draw upon their content, pedagogical and technological expertise to adapt and adjust in their transition to virtual teaching and learning during the COVID-19 pandemic?

AN INQUIRY APPROACH

To examine the knowledge and practices of post-secondary educators during the pandemic, we were guided by Hutchings’ (2000) taxonomy of inquiry questions for the Scholarship of Teaching and Learning (SoTL). SoTL is an inquiry process that focuses on the relationship between teaching and learning in post-secondary (Boyer, 1990). SoTL is about reflection, close examination of professional practice, and sharing of experiences with peers. As pointed out by Hutchings and Shulman (1999), SoTL is not necessarily about excellence in teaching—rather, it involves the systematic investigation of questions in order to gather evidence related to student learning.

Our inquiry questions fall into Hutchings’ (2000) taxonomy of SoTL questions. The four types of questions identified by Hutchings (2000) are:

What is? These types of SoTL inquiry questions seek only to provide descriptions of student learning and student or teacher experiences and they are not necessarily meant to

evaluate effectiveness of an approach. ‘What is’ descriptive questions may include descriptions of pedagogical approaches, students’ prior knowledge or challenges encountered by educators (Hutchings, 2000). In our study, we explored descriptions of challenges, opportunities and surprises educators encountered and how their TPACK influenced their experiences during the pandemic.

What works? These types of SoTL inquiry questions explore the relative effectiveness of teaching practices and pedagogical approaches (Hutchings, 2000). ‘What works’ inquiry questions include exploring whether students learn better when using certain approaches than other approaches (Hutchings, 2000). Effectiveness of teaching is typically measured by looking at students’ mastery of what they are expected to learn and their performance in assessment activities. However, in our study, we focused only on self-reports from educators on what they believe worked (or did not work) during their transition to virtual teaching and learning as a result of the COVID-19 pandemic.

A vision of the possible? According to Hutchings (2000), these types of SoTL inquiry questions focus on what might happen as educators try different strategies to enhance students’ learning. We believe that each time educators try a new pedagogical approach, they should reflect on possible student learning outcomes. In our study, we wanted educators to reflect on their experiences and compare what they envisioned early in the transition to remote teaching and learning and compare that to how it played out.

Formulating new conceptual framework? These types of SoTL questions are designed to generate new models and understandings about teaching and learning. Such questions help to identify emerging themes that may help educators better understand ways to enhance students’ learning. By gathering educators’ experiences and reflections on their practice during the COVID-19 transition, we identified themes that emerged from our analysis. Consequently, our study adds to the scholarly discussion on educators’ TPACK and skills that could enhance remote virtual teaching and learning.

METHODS

Data Collection Tools

To gather information about experiences from educators, we used an online survey. The survey tool included modified items for TPACK from Lin Tsai, Chai et al. (2013) and some open-ended questions. The main focus of the survey was to explore the potential influence of educators’ TPACK on their experiences during the rapid transition to remote teaching and learning, determine where there might be gaps and capture educator experiences during the pandemic. The survey had both Likert scale and open-ended questions. It captured the following information: demographic data, education and professional qualifications, knowledge of online learning and teaching theories, educational technology skills before COVID-19, time taken to transition to online education, types of technologies used for online education, professional development provided, and the affordances and constraints of technology used for online education. The open-ended questions asked educators to share their perceptions about what worked well, what did not, perceived levels of student engagement, the

kinds of support needed, and the technologies they would have liked to see in place.

Participant Demographics

An invitation to participate in the study was distributed to members of a provincial faculty association in the fall of 2020. To protect the identities of the participants, the name of the province will be kept confidential. Participants were drawn from 10 post-secondary institutions that are members of the provincial association. A total of 140 educators completed the survey. Of these, 26 % were below 40 years of age, 31% were between 41 and 50 years; 34% between 50 and 60 years and 13.5% were above 60 years. Table 1 shares more information about participant background in educational/pedagogical training.

Qualifications	%
Orientation and Induction training from my institution (e.g. Instructional Skills Workshops)	60.26%
Post Graduate Certificate/Diploma in Education	12.18%
Bachelor's Degree in Education	12.82%
Master's degree in Education	12.82%
Doctoral degree in Education	1.92%
Total	100%

Table 1 shows that majority of the educators in the province who responded to the survey did not have formal training in education other than the initial induction workshops or short courses from their institutions. This is not surprising given that in post-secondary, formal training in education is not a pre-requisite for educators. Rather, their content knowledge and professional experience is of central importance. About 60% of the participants indicated that they completed the teaching orientation provided by their organizations such as Instructional Skills Workshops (ISW). ISWs are four-day intensive workshops offered globally as professional development for educators in higher education. The ISWs are designed to offer educators a quick orientation to teaching in higher education as well as introduce theories of teaching and learning to those without teaching background. ISWs are short in duration (four days) and are focused on lesson planning and delivery; they do not provide a comprehensive overview of teaching pedagogy and practice. And, until recently, ISWs were not tailored for online or remote teaching environments.

More than 80% of the participants had more than 5 years of post-secondary teaching experience and of these, 32.77% had between 11- and 20-years' experience and 17.65% had more than 20 years of experience. Those with less than 5 years of experience were 18.49%. Prior to the pandemic, 94% of our survey participants hosted their classes in-person for face-to-face learning and teaching, 7% had hybrid classes, 2% had all their classes online and 17% had some sections exclusively online and some exclusively in-person for face-to-face.

RESULTS AND DISCUSSION

The findings reported here are based on educator responses to the survey. The survey questions were informed by TPACK domains to help gain insights on what educators experienced as they rapidly transitioned from in-person to remote teaching. We used Hutchings' (2000) taxonomy of inquiry questions to explore the educators' TPACK and the skills they leveraged during the rapid transition to remote learning and teaching as a

result of the COVID-19 pandemic. It is also important to note that the surveys were administered four months after the initial lockdown in response to the Covid-19 pandemic. In these four months educators had an opportunity to learn and develop new skills in facilitating virtual remote teaching. Some had made significant changes in their practice, while others simply tried to "make do" and were anticipating going back to in-person face-to-face teaching when the fall 2020 semester would begin. The responses represent a snapshot in time, and showing an image of educators struggling, coping, embracing, adapting, innovating and even flourishing as they learned to facilitate learning remotely. If the survey had been administered six months later, the picture may have been different. Figure 2 is a summary of the emergent themes.

What was?

When asking "what was?", we are looking at what actually transpired. How well did the educators cope with the shift to virtual remote teaching and what were the implications for student learning? Most educators who responded to the survey indicated that they offered instruction remotely as a result of COVID-19. Educators used video conferencing technology and some had to learn new technology to enhance student engagement and learning. As a result, a certain amount of technological content knowledge and skills were necessary for them to effectively support students learning.

Participants were asked whether the quality of their teaching changed when they rapidly switched to online teaching (see figure 3). About 13% of the participants indicated that they felt like the quality of their teaching practice improved; about 60% said the quality declined and about 28% said the quality remained the same.

The large percentage who self-reported a decrease in the quality of their teaching is a cause of concern, though it is not surprising. In this study, we found that only 40% of participants had formal teaching qualifications; meaning that they might not have had an adequate pedagogical knowledge base as described by Shulman (1986) and Koehler and Mishra (2009) to make rapid and pedagogically sound adaptations in their teaching delivery and support models. In addition, 85% (see table 2) these educators had to use technologies they had never used before and therefore did not have the chance to explore the affordances and challenges caused by using certain technologies. Their assertion of decreased efficacy suggests that the participants might not have had a broad enough technological knowledge base (as described by Koehler & Mishra, 2009) for them to be able to effectively integrate various technological tools into their teaching. As shown in Table 2, a majority of educators were comfortable with their content knowledge but did not have the same level of confidence in their pedagogical and technological knowledge and skills during the rapid transition to remote teaching. Consequently, our findings suggest that limited technological pedagogical knowledge could have been the reason why 60% of the participants felt that their teaching practice declined as a result of the rapid shift to remote teaching due to COVID19 pandemic. Such a decline might have resulted in students having less than optimal learning experiences. At the same time, the decline in teaching practice could also be a result of other factors not necessarily related to teacher knowledge. Engzell, Frey and Verhagen (2021) did a study in the Netherlands and found that some students did not make much progress when they were learning from home and that learning losses were larger in students from low income families and or in

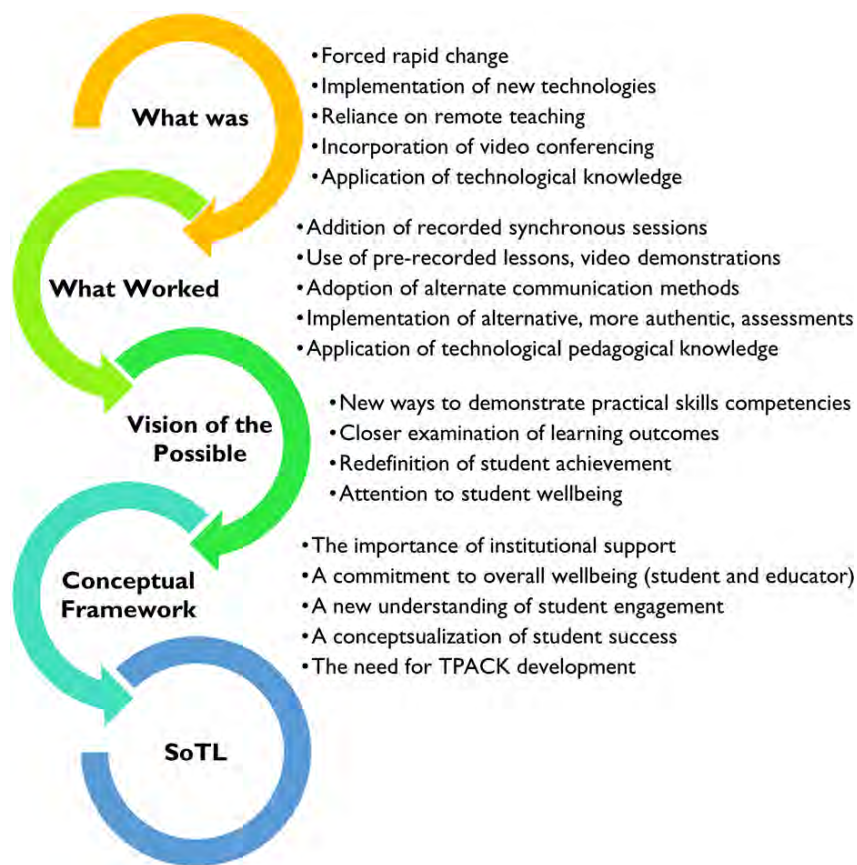


Figure 2. SoTL Inquiry of Educators' Experiences

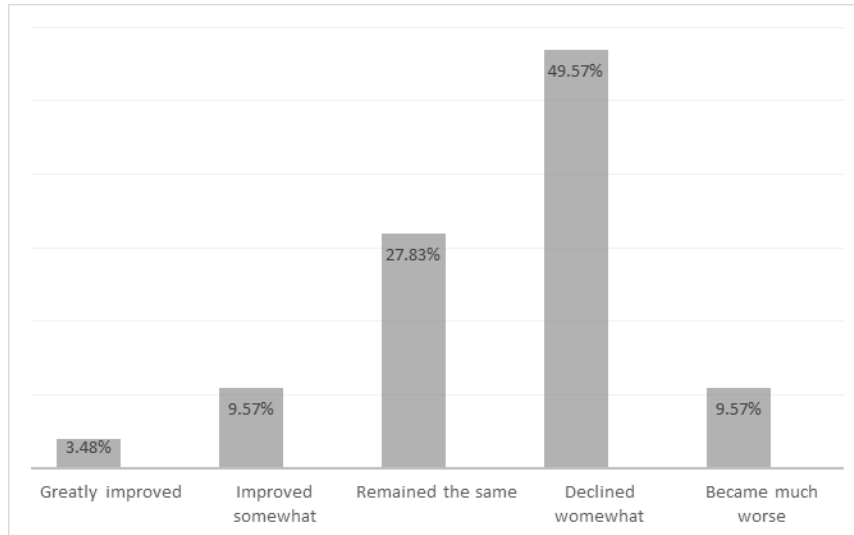


Figure 3. Impact of COVID-19 on Quality of Teaching

countries with weaker infrastructure. The assertion implies that infrastructure and access to technology and supports for staff (and students) could have contributed to a decline in the quality of teaching reported by the educators.

Ninety-seven percent of the educators who responded to our survey reported that before the pandemic, they felt confident about their content knowledge and only 13% started questioning the extent of their content knowledge understanding. This shows that the majority of participants had confidence in their content knowledge. The finding was not too surprising given that

in most post-secondary organizations, content knowledge is highly valued and is a prerequisite for hiring. In contrast, teaching qualifications are not seen as a prerequisite for actually teaching in most programs in post-secondary institutions. However, Hoekstra and Newton (2016) pointed out that while post-secondary educators may not have the same preparatory training as K-12 teachers have, most educators continue to learn about pedagogy and develop their professional practice through workshops, mentorship, personal study, collaboration, reflection and other forms of support provided by their institutes. This finding implies

Question	Agree	Neutral	Disagree	Mean	SD	Variance
Before the COVID-19 lockdown I felt confident in the subject matter I teach (Content Knowledge)	97.39%	0.87%	1.74%	1.2	0.62	0.39
The COVID-19 pandemic made me question the extent of my understanding of the subject matter I teach (Content Knowledge)	13.04%	11.30%	75.65%	4.19	1.1	1.22
During COVID-19 pandemic, I could not use most of the materials I used before the pandemic (Technological Content Knowledge)	34.79%	20.00%	45.22%	3.2	1.23	1.52
During COVID-19 pandemic, I was able to stretch my students' thinking by creating challenging tasks for them (Pedagogical Knowledge)	38.27%	28.70%	33.05%	2.94	1.1	1.2
During the COVID-19 pandemic I was able to guide my students to adopt appropriate learning strategies for themselves (Pedagogical Knowledge)	57.39%	20.00%	22.62%	2.63	1.02	1.03
During COVID-19 pandemic, I was able to guide my students to discuss effectively during group work (Pedagogical Knowledge)	43.48%	23.48%	33.04%	2.91	1.18	1.38
I find it easier to address common misconceptions my students have about the taught subject matter in face-to-face environments (Pedagogical Content Knowledge)	77.39%	12.17%	10.44%	1.8	1.11	1.24
I find it easier to help my students to fully understand the content knowledge in face-to-face environments (Pedagogical Content Knowledge)	82.61%	7.83%	9.57%	1.7	1.05	1.1
Before COVID-19, I felt confident in my technical skills to support and engage students in their learning (Technological Knowledge)	90.78%	4.35%	5.22%	1.61	0.83	0.69
The COVID-19 situation challenged me to use technology I have never used before (Technological Knowledge)	85.21%	4.35%	10.44%	1.77	1.05	1.1
I can learn technology easily (Technological Knowledge)	78.26%	13.91%	7.83%	1.89	1	1
I keep up with important new technologies to support student learning (Technological Knowledge)	72.81%	17.54%	9.64%	2.12	0.95	0.9
It was easy for me to transition to online teaching during Covid-19 pandemic (Technological Knowledge)	54.78%	8.70%	36.52%	2.7	1.36	1.84
During COVID-19 pandemic, I was able to effectively use technology to support students learning (Technological Knowledge)	76.52%	11.30%	12.18%	2.18	1	1
During COVID-19 pandemic, I was able to facilitate students to use technology to plan and monitor their own learning (Technical Pedagogical Knowledge)	52.63%	25.44%	21.93%	2.69	1.06	1.13
During COVID-19 pandemic, I was able to facilitate my students to collaborate with each other using technology (Technical Pedagogical Knowledge)	42.61%	26.96%	30.44%	2.86	1.11	1.23
I can teach lessons that appropriately combine knowledge of the subject matter, technologies and teaching approaches (TPACK)	74.78%	16.52%	8.7%	2.17	0.84	0.71

that post-secondary educators could acquire necessary pedagogical knowledge and skills through practice and professional development.

Thirty-five percent of the participants indicated that they could not use the materials they typically used for their in-person classes for remote teaching. Surprisingly, 20% were neutral about whether they could continue to use the same materials. This could be because 92.3% had indicated that they relied heavily on presentation software like PowerPoints during the transition to remote teaching, and they felt that they could continue to use the same materials. 97% reported that they made effective use of video conferencing tools and the LMS during the pandemic. 40.5% used prerecorded video lectures for their classes and the rest rarely prerecorded their lectures. These descriptive statistics indicate that many of the survey participants relied heavily on a "stand and deliver" type of teaching approach (teacher centered), where content is transmitted to students through lectures, prerecorded videos and readings. These educators may not have seen the opportunity to change their approach and simply chose to continue giving these same lectures online, through synchronous video conferencing (through Zoom, Teams, Blackboard Ultra, etc.) and through pre-recorded lectures (uploaded to Moodle, Canvas, D2L or another LMS). This study did not explore the impact of specific teaching strategies on student learning, however, it would be worthwhile to explore whether pre-recorded videos would have the same learning outcome as synchronous in-person teaching and learning given that prerecorded videos lack interactions.

In the open-ended questions of the survey we found that educators often used technology only as a substitute for prior practice and that educators were hesitant or unaware of how

they might augment, modify, or redefine the use of technology using online apps or the interactive elements of the LMS and video conferencing tools. The pressures of the pandemic pushed some educators to simply repackage and not to reconceptualize and redefine how they might use technology to promote engagement, enhance learning and improve achievement. Moreover, these educators often had difficulty in making their pedagogical substitutions, which may reveal inadequate technological pedagogical knowledge. For example, some educators cited overwhelming challenges with how to use breakout rooms effectively, difficulties in monitoring the chat feature, and frustrations in incorporating plug-ins and online apps. Educators indicated that the synchronous virtual environment did not have the same spontaneity, peer-to-peer interaction, or collaborative work; instruction became more transmissive than interactive. In fact, about 48% of educators who responded to the survey indicated that their instructional approaches became more teacher-centered (see table 3).

Overall, more than a quarter of the participants felt that they were not able to help their students develop relevant skills necessary for their chosen field. This might have been because courses that were initially developed for in-person instruction were now offered remotely without adequate preparations. Or maybe some courses that were practical skills based needed additional innovative ways of teaching.

What worked?

Given the challenges and opportunities presented by the rapid transition from in-person to remote learning and teaching, it is important to ask "What worked?" Such information could provide a starting point for scholarly discussions on how switching to

Table 3. Instructional Approaches

Question	Agree	Neither agree nor disagree	Disagree
The move to online, due to the COVID-19 Pandemic, still allowed me to share and assess the most important content for my courses and program.	72.97%	5.22%	21.74%
The move to online, due to the COVID-19 Pandemic, still allowed me to help my students develop the essential thinking and practical skills necessary for their chosen field of study	64.76%	19.13%	26.09%
The move to online, due to the COVID-19 Pandemic, still allowed me to challenge my students to develop and practice professional judgement	58.18%	17.39%	24.35%
During the COVID-19 pandemic, my classes became more student-centered	23.69%	31.58%	44.74%
During the COVID-19 pandemic, my classes became more teacher-centered	47.82%	30.43%	21.74%

emergency remote online teaching could be managed. Participants were asked to share their successes and challenges through a number of open-ended questions. In reviewing the open-ended responses, we were able to identify how instructors employed sound pedagogy and skillful use of technology to help their students connect with the content, develop skills and explore attitudes related to the course outcomes (TPACK). These teaching practices sought to enhance:

1. Communication with students.
2. Communication between students.
3. Collaborative learning.
4. Scaffolding supports for learning.
5. Assessment practice.
6. Clarity of instruction and illustration.

A complete overview of each of these teaching concerns and the ways educators worked to meet these challenges can be found in Table 4. As shown in Table 4, many educators found opportunities to take advantage of the educational technology affordances that come from a shift to remote learning. However, while participants found a wide variety of ways to enhance learning, there were still many challenges and frustrations that hindered learning. Issues of technological literacy, connectivity, and technical set-up (screens, microphones, cameras, drawing tablets, etc.) presented some challenges for both students and faculty. Survey participants suggested that students from low socio-economic groups were disadvantaged and may have experienced more challenges with access and engagement. This could have been partly because some students did not have personal laptops (some borrowed from their institute) and also had issues related to internet connectivity and bandwidth.

For some educators, the switch to remote emergency virtual teaching was something they simply had to endure. The following quotes are from frustrated educators who responded to our survey. It is important to note that negative experiences could have been a result of lack of preparation for transition, insufficient TPACK or a lack of institutional support.

“Nothing worked well. We are just trying to survive this online stupidity. It doesn’t make any sense to attempt to teach courses with a very practical hands on skill base

without being able to physically interact with the students”. (Survey participant)

“Students are unable to navigate break out rooms so I had to end that. Online teaching flattens learning to the point everyone is sick of it. I ask students, they hate all their online learning. I hate it too. The methods don’t make it better, the technologically cute apps or tricks don’t make it better”. (Survey participant)

In Table 5 we unpack the factors participants listed as having negatively impacted teaching and learning during the rapid transition to remote emergency instruction. What is interesting to note is the relative impact of not having adequate TPACK competence and confidence (unfamiliarity with mode, lack of institutional support, changes in interactivity and increased workload) and the educators’ focus of frustration on factors that were outside of their control (technology issues, competing interests, and stressors).

While most of the participants traced a less than optimal teaching and learning experience to the technological and pedagogical challenges associated with a quick transition to remote virtual teaching, several also pointed to their students, and their lack of motivation, organization, maturity and conscientiousness as a source of frustration:

COVID-19 created many real challenges, but also allowed an easy excuse not studying and putting in the time. Students always had to study to do well in class before the pandemic, and read the material on their own, but with COVID-19, the reason they did not study was always “we didn’t sign up for online learning”. Based on the number of views on my YouTube instruction videos, less than 25% of my students even watched the added learning material. At least half the students who showed up to the online class would bolt whenever we did breakout sessions. (Survey participant)

The wide range of experiences, both positive and negative, left us wondering why some post-secondary educators managed to adapt and even thrive while others struggled. As we reviewed the surveys and the interviews we found that we could identify four different types of educator who participated in this survey:

1. Those already comfortable with technology for virtual remote teaching, either synchronously or asynchronously—an indication of adequate TPACK.
2. Those who were given training and support during the transition. These educators were open to developing their skills, enhancing their TPACK, and making strategic instructional changes in an effort to enhance students’ learning.
3. Those who taught themselves new technologies to support students learning. These educators called on colleagues, did their own research, took risks and tried new ways of teaching. They developed TPACK by being reflective, adaptive and intentional in responding to the COVID-19 teaching reality.
4. Those who continued with more traditional teaching practices, simply moving in-class lectures, activities and assignments into a virtual remote environment. Some of these educators did not receive enough support and were uncertain about where to turn, while others chose to forgo supports offered to them and looked to the end of restrictions as their deliverance.

Table 4. “What Worked” in Facilitating Learning During Remote Teaching

Concern	Strategies and Tools Suggested in the survey	Educational Purposes	Educator quotes “What worked well was...”
Communication with students	Email, online forums, texting apps, office hours/drop-ins on the learning management system (LMS), one-on-one appointments, as well as regularly scheduled synchronous lessons.	Helped to stay connected with the students so they persevere in their coursework. Gave clarity to students about upcoming challenges and avoiding a flood of emergency/desperation email from learners.	“Scheduling one on one sessions with students allowed for a much better rapport with students going forward.”
Communication between students	Chat functions, online forums on the LMS, open channels (rooms) in the video conferencing tool, written/visual or video introductions in online apps.	Provided ways to help students to participate and share ideas and communicate without speaking. Built a learning community by building connections between students.	“The course chat allows students who are shy to speak in class to share their ideas. They appreciate the option to communicate without speaking.”
Collaborative Learning	Breakout rooms, video conferencing tool, use of shared documents, regular working groups.	Encouraged team learning and the development of soft skills in an online environment.	“...small, student-led group meetings using videoconferencing software worked well.” “For struggling students, I would email pdfs of worksheets so they could print them off and then we would work through them together as I screen shared with pdf editing software.”
Scaffolding and review	Pre-recorded lectures, short videos (often posted on YouTube), recordings of the synchronous lessons, posted resources, use of LMS plug-ins (activities, quizzes, lessons, etc.), links to internet sites.	Provided layers and levels of support in smaller chunks. Allowed students to view materials at their own time and take ownership of their learning. Encouraged rehearsal (formative assessments).	“I love virtual classroom broadcasts; chats; polls”
Assessment	Video submissions, authentic assessments (scenario based), respondus lockdown, assignment drop boxes, & audio/video feedback. <i>(Because of COVID-19 regulations, proctoring in-person exams was prohibited. This restriction raised questions about fairness and academic integrity; it also challenged many educators to design alternative assessments—assessments that could not be “collaboratively written” or researched in real time.)</i>	Allowed students to demonstrate skills Built authentic assessments that encourage application. Leveraged online/virtual technologies to provide choice and “capture” real learning. Encouraged academic integrity.	“Video capture of equipment demonstrations and having the students prepare the instructions for the activity.” “Remote invigilation software for exams, time and training to provide alternate evaluation of learning objectives.”
Synchronous interactivity	Status bar, whiteboard, chat feature, polling, posting, games, and online energizers and icebreakers.	Kept students attentive during synchronous remote lessons. Solicited and captured student response (formative assessment).	“I was able to utilize PowerPoint, screen sharing, breakouts, Kahoots, Menti, and discussions. “I use Zoom, so the breakout rooms are great, as are the polls. Easier all round to work with.” “I loved using ‘poll’ or ‘survey’ tools during live lectures. A great way to get quick feedback and check who’s still engaged...especially when students get ‘shy’ and turn off their video :)” “VoiceThread, Quizlet, Padlet and all the features in Moodle especially chat, discussion forums, etc.”
Clarity of illustration	Digital tablets, recording software, interactive presentation software, high-quality microphones and cameras. (Use of tech tools.) Models, household objects, whiteboards behind the speaker’s chair, student made manakins. (Use of props.)	Provided alternative ways to explain or clarify essential learning outcomes. Allowed some replication for classroom lab situations in an online way.	“As class went along, I talked with our students and let them guide me. They like a combination of class presentation as well as online videos, assessments and quizzes. So, I painted a wall in my office with blackboard paint. Works great by the way! They all seem to really enjoy the “old” classroom feel!” “The Wacom Tablet has been a great tool. Like writing on a smartboard in front of the classroom but in the comfort of my own home.”

It was evident that participants in the fourth group expected interaction patterns during remote learning to be similar to what they had come to expect in an in-person learning environment. However, as these same educators shared, not all students could meet their pre-conceptions and expectations.

It is impossible to gauge the students understanding when you are trying to teach over ZOOM and 2/3 of the class have their cameras off. No one wants to ask questions or respond to the questions that I ask. (Participant quote)

A number of educators indicated that “student engagement” was a concern. Many respondents pointed to: cameras off, little activity on the chat board, hanging silences after asking questions, and quiet breakout rooms as evidence of low student interest and engagement. For these educators, this teaching and learning disconnect raised serious questions related to the way they understood pedagogy and technology integration. Is engagement indicated by the number of clicks on the mouse, or is it more closely related to how students see applications, make cognitive connections and develop professional judgement? More research is needed on engagement concerns raised by the educators. .

Table 5 . Factors that Negatively Impacted Teaching and Learning			
Factor	Specifics from Survey	Impact on Instruction	Instructor quotes - "Learning was challenged by..."
Technology Issues	Lack of technology, poor technological literacy, weak internet connectivity, constantly changing systems or apps.	Participants voiced frustration in dealing with signal drop-out and having to learn new platforms for video conferencing. Students had a wide range of technology (some were working primarily on their phones) and Wi-Fi. These challenges interfered with the flow and focus of synchronous lessons and lectures.	"Some students did not have tech. devices and/or unreliable internet access." "... many of our students are very low technologically, so they struggle just to be able to manage that aspect of school, let alone the actual course material." "Students struggled with internet access, computer access, and navigating technology." "Getting students up to speed on the new technology. We threw three programs at them and it took several weeks for our students all set-up. 18-22-year-olds are tech-comfortable, not tech-savvy."
Competing interests	Family commitments, roommates, children, parents, pets, job commitments, employment uncertainty.	Participants cited these competing interests as having an effect on attendance, interaction, and assignment completion.	"Learners at home with their children and having to homeschool their children along with keeping up with course work." "It was disruptive, but what was even more disruptive was to wait in suspense and see if you will be laid-off next." "A portion of students are not well prepared to lead themselves in their learning when face-to-face, and the online environment makes it even more stressful for these kinds of students (organizing time, communication, requesting help, study skills...)"
Stressors	COVID-19 anxiety, loneliness and depression, distance and time zones, homelessness, domestic abuse, poverty.	Participants suggested that it was hard to focus on instructional outcomes when they knew that students were struggling with separation, poor finances, and uncertainty about their resident status. This was especially the case for educators working with language training programs and those with a significant cohort of international students. Participants also shared the fact that their own personal and professional circumstances affected how they taught.	"Many learners were just too anxious to concentrate on their course work." "International students in many different time zones. This impacts the class time, but more importantly it is a challenge for the students to manage group project work. Employers in our industry are adamant that working in groups is one of the most important skills we can foster in our students, so it has a high priority."
Unfamiliarity with the mode	Conflicting expectations, inexperience with LMS and video conferencing features.	For many of the participants in this survey, this was their first experience in facilitating online or remote instruction. Some shared that they felt that the facilitation mistakes they made early on impacted student engagement and retention.	"It takes approximately 4 times as long to do anything online. Some students don't have cameras (or mics) so basically you are staring at a black box. Not conducive to good facilitation."
Institutional support	Resources, training videos, technology workshops, learning communities, adequate planning time, funding for tech and resources, individual coaching and mentorship from faculty support.	While some participants indicated that they were given adequate training and support by IT and faculty development, other educators felt that they were not provided with sufficient lead time and support to make the transition. In one institution, Ed Tech staff were laid off as a cost-saving measure and in another, the institution chose to move to another LMS platform shortly after the initial lockdown.	"I wish there had been some direction from leadership around a default conferencing platform. Instructors were using Zoom, Teams, and Blackboard. I'm comfortable using all of the above, but wasn't crazy about using my personal accounts. I could foresee the frustration of students having to learn different platforms so I wanted to conform to what other instructors were using, but that's not possible when everyone's doing something different;" "F2F training sessions were scheduled during a time that I was symptomatic and required to isolate. I asked to attend remotely, but was never invited. Afterwards I was told that the facilitator was overwhelmed with F2F attendees and therefore didn't get around to setting up the electronic meeting." "ZERO, ZIP, NOTHING. They directed me to general videos about the software we were using including lots of features that were not available. No equipment support either." "None. Some bogus teaching assists for online learning that was a garbage collection of existing websites. We were mandated to go through this."
Interactivity	Cameras/microphones on, use of chat and whiteboard, student participation in breakout groups, and responses to teacher questions.	Participants felt that students were not really "attending". There was not enough interactivity to replace the multisensory feedback (body language, gestures, eye contact, nods, and questions) these educators were used to.	"Student engagement and community building. My F2F classrooms were typically buzzing and I am now experiencing radio silence. When we transitioned to online this spring we were able to maintain much of our classroom culture. Now that we have a mix of students—students that don't know me or each other—the dynamics are very different. Those students that worked with me before have bonded with each other and more inclined to participate in discussions, etc." "I miss not being able to "see" the light bulb come on the student's faces, or to see their confusion"
Increased Workload	Planning, pre-recording, communicating with students, designing and marking more open-ended assignments and exams.	The switch to online teaching and learning caused participants to rethink and redesign how their courses were organized and paced and how the learners would be assessed and provided with feedback. Some educators acknowledged being overwhelmed and felt that students were being short-changed in their education.	"Responding to student e-mails as they were upset and were sending on average 10 e-mails per day asking about the course, was this going to affect graduation, couldn't submit assignments on time because they were asked to leave residence with one day notice." "The extraordinary amount of time policing the discussion groups to keep the threads on topic and in the right mode of thinking (philosophically rather than factually)." "Adapting to online hand ins, quizzes, tests, and assignments."

What is possible?

Unlike natural disasters that destroy infrastructure, the COVID-19 pandemic disrupted traditional, face-to-face delivery approaches yet still provided educators opportunities to think outside the box in order to meet learning outcomes through alternative delivery models (Day, Chang, Chung, Doolittle, Housel & McDaniel 2021). As pointed out by Day et al. (2021), the pandemic provided opportunities to rethink ways of teaching so that students could still achieve the learning outcomes remotely.

Participants shared how they made major shifts or improvements in pedagogy as they adapted their facilitation in the face of virtual, remote, emergency teaching. Essentially, these post-secondary teachers used their developing understandings of TPACK to reflect on teaching strategies, adjust and then implement innovations (modification and redefinition). These intentional shifts impacted how they organized their coursework, supported their students, and engaged them in assignments and assessments. Many of the ways that participants re-conceptualized their practices might not have been new to experienced online educators, but they could have been new to some.

From survey responses, we identified six promising practices that individual participants were exploring to see if they might enhance and improve student learning:

1. Flipping the classroom.

In select remote virtual classrooms, students were expected to come to synchronous lessons prepared to collaboratively discuss, problem solve and reflect based upon previously assigned activities, readings and video assignments.

2. Reducing the number of synchronous classes and building more asynchronous activities into the LMS.

Several participants said that they were giving synchronous instruction at a rate of 1/3 time compared to when they were teaching face-to-face. Students were expected to complete more activities in their LMS in lieu of teacher lectures.

3. Finding alternative ways to connect, communicate and provide feedback.

Numerous participants shared how they used texting apps, social media, online tools, and LMS chat to make students feel more included and aware of deadlines and requirements. Others reported using video to more efficiently and more expressively give assignment feedback to their students. One participant shared the value of simply phoning each student early in the term to establish trust and provide clarity.

4. Incorporating more activity in synchronous lessons.

While face-to-face educators had used online apps like Kahoot and Quizlet to create interactive learning environments, the COVID-19 pandemic saw educators look more closely at how online apps might deepen understanding and reinforce learning through polling, posting, problem-solving and recording apps. Participants in this study shared a long list of applications that they found useful for creating community and breaking up lessons.

5. Building more resources and supports.

One of the ways that participants said they improved with respect to their technological pedagogical practice was in using technology to develop supports for students.

For some educators this simply meant recording their synchronous lessons for students to review. However, a number of participant educators shared how they went beyond simple recordings to pre-recording lectures, making short videos to unpack processes (Life Sciences) or problem solve (Mathematics), using hand-held cameras to make close-up videos, using apps and plug-ins to build interactive quizzes in their LMS, and using online editing and publishing software to make professional looking resources.

6. Moving to a competency model.

Recognizing that their students may have different circumstances and stressors, some participants said they made accommodations that they would have never considered doing in face-to-face situations. Some educators indicated that they started putting less emphasis on attendance and participation and placed more emphasis on task completion. Several participants converted assignments and assessments from percentage marking to completion (pass/fail), and concentrated upon helping each student develop competency rather than on ranking them.

In each of the ways listed above, educators could have made intentional shift from being a content provider/expert explainer to being an instructional designer, community builder and learning coordinator; one who shapes educational experiences and supports the students through their learning. Students were expected to become more independent in acquiring the essential concepts and understandings, while the educators worked to provide frameworks for understanding and opportunities for inquiry, synthesis, application, and evaluation. Moreover, when educators made these pedagogical shifts, they leveraged technology in ways that they did not envision or seriously commit to before.

What might form a new conceptual framework?

According to Hutchings (2000), inquiry questions may lead to the development of a new conceptual framework using the themes that emerged from research. Our study suggests that educators who were more comfortable with their TPACK and online skills had a better transition to virtual remote emergency teaching and learning than did educators who had limited TPACK. However, there were many other extenuating factors that could have impacted students' learning outcomes. Institutional support, student digital competency, student connectivity and access to technology, and student and instructor wellbeing were cited by participants as having significantly influenced the way educators implemented their TPACK to enhance students' learning. The anxieties brought on by COVID-19 fears, illnesses and restrictions affected mental health and cannot be downplayed.

So, establishing a comprehensive frame or building a specific model for responding to educational transitions brought on by crises and emergencies using only the data from this study would be a bit myopic. How teaching and learning will look in the face of emergency remote teaching will depend upon the type of crisis at hand (flood, wildfire, pandemic, political unrest, etc.), the duration of the emergency, and the nature of the conditions created. The COVID-19 pandemic created a variety of stressors upon learning systems, students and educators.

In our sample we had:

- Programs that were immediately and completely shut down, then tried to restart virtually just as our data collection was commencing.
- Programs (especially hands-on labs) that attempted to keep running by having students demonstrate certain skills remotely or attend in-person at reduced capacity respecting COVID-19 regulations (physical distancing, disinfecting, masking, hand-washing, etc.).
- Institutions that provided extensive supports (workshops, resources and coaching) and others that provided little to none.
- Institutions that allowed educators to make their own choices about delivery systems, video platforms and online applications, institutions that mandated certain programs and applications and forbid other applications, and still others that gave little or no direction to their faculty.

Nevertheless, we can suggest a loose framework that post-secondary educational planners may consider to better support educational staff in suddenly transitioning to online emergency remote teaching due to crises. (see Figure 4) In this framework we ask post-secondary institutions and their instructional or academic leadership to prepare for unforeseen crises by providing professional learning opportunities that help to develop TPACK. Educators who can combine their robust content background with a sound pedagogical base and proficiency in using educational technologies will have a better transition to emergency remote teaching than their colleagues who are limited in any of these areas. However, providing professional learning and support for TPACK is just one part of the equation.

Providing institutional support

As discussed in this article, institutes provided varying levels of support ranging from minimal to adequate. Some institutes provided training on how to use and integrate certain educational technologies in ways that enhance educators' TPACK, skills and professional practice to enhance student engagement and success (figure 4). Institutional support included professional development, how to videos, financial allowances to set up home offices and technological supports when needed. As indicated by one of the participants, "Access to basic "online teaching 101" resources was great, and we have on-campus experts in Ed Tech who serve as our Faculty Developers who are fantastic resources". However, there were some organizations that did not provide enough support during the transition. When asked about the kinds of support they would have wanted, one educator said:

The right to use PD funds to purchase equipment to use at home; reduced class size to help during the transition; support that was pitched at the right 'level'-- much of it was too basic and preached about course design, rather than helping actually transition our already strong classroom practices online. Most of all though, the communication was lacking at times so we forged ahead at home not really knowing if or when supports would be coming.

Those who did not get enough support from their institutes mentioned the following: lack of directions and guidelines on remote teaching, lack of how to videos, lack of financial assistance to upgrade their home technology, no direction on how to setup



Figure 4. Supporting Transitions to Online Emergency Remote Teaching

virtual examinations, lack of pedagogical training on facilitating remote learning and lack of time to prepare for the transitioning.

So, a promising model for coping with sudden transitions due to crisis would need to include the establishment of a support system where educational technologists, instructional designers, educational developers and other academic support personnel work together to build resources, provide workshops, and establish channels for discussion and support.

Addressing overall wellbeing

A common thread of worries by educators concerned their own wellbeing and how it was affected by the COVID-19 pandemic. Some were anxious about their own families getting infected and also about their students. The responses from educators were consistent with research in literature on impact of the pandemic on mental health and overall wellbeing. The KFF health tracking poll of 2020 indicated that 4 in 10 adults in USA reported having symptoms of anxiety or depression as a result of COVID-19 (Panchal, Kamal, Cox & Garfield, 2021).

In our study we found that grace extended by their leaders ("We are all learning."), positive and encouraging messages, emotional support and regular check-ins were significant factor in successfully transitioning to remote emergency online teaching and helped in providing a safe space to work in with their students. Some institutions eased the assessment burden of instructors by moving grading from numeric or lettered values to simply pass/fail, and they also allowed instructors to decide how, how often, and when they met synchronously with students giving flexibility at a stressful time.

Leveraging prior experiences

As pointed out by Pokhrel and Chhetri (2021), "the use of suitable and relevant pedagogy for online education may depend on the expertise and exposure to information and communications technology (ICT) for both educators and the learners" (p137). Educa-

tors who had prior experience and training in use of educational technology had better experiences transitioning to remote teaching as compared to their peers who did not have relevant technological knowledge. For example, one educator said “There is such a steep learning curve with regards to teaching online. I don’t believe I have the time to become an “expert” on this method of teaching, and it is not where my passion lies. I understand the utility of it and the need to be able to teach in diverse environments, but there is something qualitatively different about teaching online”. In our study, several institutions gave the opportunity to those with online teaching expertise to coach and support their colleagues. In some instances, course loads were lightened for these educators in order to provide timely support. This was well appreciated by those educators who were less than confident as they transitioned.

Establishing communities of practice

Following on the idea of leveraging past experience and addressing educator wellness, some institutions provided avenues for discussion, collaboration, sharing of promising practices, and even commiseration. Weekly departmental online meet-ups, message boards and focused mentorship helped some educators cope with the isolation and loss they felt when they could no longer go to a particular place to engage in spontaneous discussion with colleagues and share and compare strategies and approaches. This finding aligns with a study done by Grunspan, Holt, and Keenan (2021) who found that opening communication channels and sharing resources and support helped create a collaborative and resilient community of practice for one post-secondary instructional team dealing new realities as a result of Covid-19 restrictions. Another in-depth case study by Bolisani, Fedeli, Bierema, and De Marchi (2020), suggests that the establishment of a community of practice helps faculty cope with emergency teaching by strengthening the relationships among members, improving the sense of belonging, and empowering the entire group.

Encouraging student engagement and success

Educators highlighted several challenges faced by their students. The challenges mentioned include technology access and use, internet bandwidth, time management, social isolation, limited access to institutional support, motivation, anxiety, space to learn/study, family care, financial problems and general dislike of remote learning. When asked about challenges faced by students, one educator said:

Several students mentioned they did not sign up for on-line (remote learning) so it was a challenge for them. Emotional challenges, being away from home/family, isolation, uncertainty about job prospects once college is finished [are also challenges]. Several students indicated that they are ‘slow readers’ and so reading and writing everything on line is challenging. The volume of assignments and reading.

Though student survey results that were part of this study are reported elsewhere, it was evident from educators’ perspectives that students faced challenges that could have impacted their learning. For example, some students were expected to record themselves demonstrating certain skills and experienced problems as they had to learn to record themselves and share the recordings. Educators also mentioned issues of loneliness

and anxiety that impacted students’ wellbeing and mental health—sentiments shared by other researchers. For example, Son, Hegde, Smith, Wang and Sasangohar, (2020) did a study in the USA and found out that college students indicated an increase in stress and anxiety because of the COVID-19 pandemic. A survey carried out by YoungMinds (2020) in the UK showed that 80% of the youth believed that COVID-19 restrictions resulted in isolation, feelings of anxiety and loss of motivation that impacted their mental health since most of them lacked coping mechanisms.

CONCLUSIONS AND RECOMMENDATIONS

The main themes that emerged from this study emphasize the importance of teacher knowledge (TPACK) and institutional preparedness to support faculty and staff as they ventured into uncharted territories of remote teaching and learning. The sudden shift to emergency remote teaching (what was) pushed educators and students to adapt to new modalities. The effect was profound, almost 60% of our respondents said that the quality of their practice had declined. The experience of these educators and their students was greatly impacted by:

- Limited TPACK and remote learning facilitation skills
- Varying levels of institutional support
- Over-reliance on traditional, face-to-face ways of teaching and assessing
- Loneliness and anxiety

The study revealed some of the ways that post-secondary educators adapted their practices (what worked) and faced the challenges of emergency remote teaching by:

- Exploring alternate ways of communication with students to build relationships
- Implementing non-traditional alternative assessments.
- Focusing on key learning outcomes and on building competency rather than on granular practices in grading.
- Changing how they scaffolded learning through session recordings, asynchronous work, online apps, flipping the classroom and other responsive teaching practices that support collaborative learning.
- Building supports like tip sheets or videos that supported students unable to regularly attend.

When moving to a virtual remote learning environment, we suggest that educators should consider (a vision of the possible):

- Developing their TPACK knowledge and readiness. Educators who had more background and experience in teaching and in online teaching were better equipped to make the transition required by the conditions brought about by COVID-19.
- Reexamining learning outcomes and ways to demonstrate competence and achievement. Having a better understanding of the what, how and why of course programming allowed educators to make sound pedagogical and technological decisions around planning, presentation, support and assessment.
- Shifting expectations.

Simply moving face-to-face practices remotely with little modification is not effective; the virtual remote environment is more suited to those who see themselves as instructional designers rather than as content presenters.

- Exploring online models and strategies. Although different from emergency remote teaching, online educational theory may provide ideas on how to build an online community of inquiry (e.g. Anderson, Rourke, Garrison, & Archer, 2001)
- Embracing institutional support and making their needs known when possible. Educators who accessed tools, resources and applications reported greater success and confidence.
- Creating safe spaces for learning. Educators who used LMS and video conferencing platforms as powerful tools to support, engage, and challenge learners more quickly adapted to the remote environment.
- Attending to student wellbeing. Educators who reached out to students, adjusted expectations and assignments, and advocated for their students felt less disconnected and isolated themselves.

Finally, in order to better prepare for the stresses and shifts brought about by teaching in response to a crisis situation (flood, fire, pandemic, war, etc.), post-secondary institutions should be advised to:

- Provide adequate TPACK training and experience to all instructional staff. While content area competency will always be a primary focus for post-secondary institutions, more work needs to be done in providing teaching faculty with a more developed understanding of the technological and pedagogical considerations in educational planning and practice.
- Establish or further develop wraparound faculty supports that might address instructor needs regarding planning (curriculum development), facilitation (educational development), teaching modalities (educational technologies), and assessment.
- Identify and enlist TPACK leaders as informal instructional leaders who may serve as champions when encountering rapid changes in educational practice.
- Provide supports and services (both technological and psychological) for both students and educators and develop awareness of these in order to lessen the feelings of isolation and anxiety.
- Cultivate faculty communities of practice so educators might share promising practices, discuss learning challenges, collaborate and problem solve, and build a supportive learning network.

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