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# An Administrative and Faculty Autoethnographic Analysis of Shifting Modalities of Pre-service Technology Education Programming during the Onset of COVID-19

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## Abstract
The COVID-19 pandemic has disrupted our collective normal patterns of behavior in almost all aspects of our personal and professional lives. While many K-12 and post-secondary subject area curricula lend themselves more easily to a migration to online and remote learning, technology education faces unique challenges. This research paper sought to understand the challenges, benefits, and lessons learned through an analysis of the process of re-organizing a pre-service technology education diploma for remote, blended, and face-to-face learning during the early stages of the COVID-19 pandemic. The investigation followed a collaborative autoethnographic methodology as the authors constructed two narratives based on their roles of administering and instructing in a pre-service technology education diploma program. An interpretive descriptive analysis suggests a number of challenges associated with the organizational changes, but also a number of positive outcomes related to the instructional shifts. Challenges included maintaining equitable access to physical materials and technologies for all students, scheduling issues related to changing pandemic rules and regulations, and a loss of social presence with students. Benefits included more student autonomy, less dependence on group work for technical skill development, and the development of alternative delivery models for pre-service technology education that could be used to expand program offerings to non-traditional students.

## Keywords
faculty perceptions of COVID-19, pre-service teacher education, technology education, COVID-19, autoethnography

## Introduction
The COVID-19 pandemic has disrupted our collective normal patterns of behavior in almost all aspects of our personal and professional lives. While many K-12 and post-secondary subject area curricula lend themselves more easily to a migration to online and remote learning, technology education faces unique challenges. Access to course-specific materials and hardware paired with the range of personal devices used for remote learning has certainly been a learning curve for both pre-service teachers, course instructors, and administrators.

Technical activity at the foundation of technology education has traditionally been delivered in a face-to-face environment. Technology education adopts an epistemological perspective where knowledge is created through dialogic interaction between co-participants while

engaging with tools, materials, and processes. It builds upon constructivism through an emphasis on the production of an external artifact of knowledge. As a result, Technology Education can be situated along a spectrum of established epistemologies as an example of constructionism.

Each year's technology education diploma program cohort forms a community engaged in similar activity where relationships are formed and built into support structures. Within the traditional context, technical skill development is supported by program instructors and pre-service classmates in real time. Troubleshooting problems and timely support have become foundational constructs to assist pre-service teachers in understanding technology education and internalizing their own sense of best practice pedagogies. The COVID-19 pandemic and the transition towards remote delivery of technology courses within the technology education pre-service program changed the established model.

As institutions attempted to move forward remotely in their offerings, courses grounded in technology education required special consideration and planning to transition towards a more virtual pedagogy. Instructors with experience delivering technical courses know that effective pedagogical strategies rest upon the creation of routines, routines that need revisioning to reflect a change in the delivery medium. The following study is placed at the crossroads of an instructional shift forced by the COVID-19 pandemic but might hold potential for remote offerings of technical courses in future deliveries of technology education pre-service programs.

## Literature Review

The COVID-19 pandemic has caused an unprecedented wholesale shift to remote and online learning within educational institutions around the globe. Within days of learning of public health restrictions, post-secondary institutions reacted en masse by postponing, cancelling, and transitioning courses to remote or online instruction. A comparable response was also felt at the K-12 level but the scope of this work remains centered on post-secondary. The lead time of responses varied from a few days to a few weeks (Day et al., 2021), but the administrative outcomes were virtually identical. While the transition allowed institutions to maintain classes and credential completion there were many inequitable challenges for students and faculty (Day et al., 2021). Of particular interest for this study is the reported inequity in the availability of practical, experiential, and hands-on experiences that are the cornerstone of many programs and disciplines (Day et al., 2021; Doreleyers & Knighton, 2020). Doreleyers and Knighton (2020) reported that service, trades, and health care programs saw the highest level of course and program postponements and cancellations during the beginning of the pandemic within the post-secondary context. They speculated that the applied and practical nature of these programs accounted for the findings, as institutions struggled to find ways to replicate these experiences in a remote or online medium. Day et al's (2021) study also supported this finding as they reported on issues related to maintaining the experiential and field-work portions of six geography programs across three countries. Specifically, they found that students and faculty both struggled to maintain a community presence and that inequalities in students' access to technology, lack of quiet study space, and economic difficulty degraded their experience and ability to perform to their full potential. These and other themes have become very apparent as faculty and researchers have turned their focus inward on their own experiences throughout the pandemic.

Administratively, the pedagogical shift during the COVID-19 pandemic required a coordinated effort. Aagaard and Earnest's (2021) perspective piece on educational leadership during the pandemic noted the importance of offering timely responses to emerging events, a concept they referred to as “operational tempo” (p.183). Their work highlighted that institutions must communicate the guiding principles (i.e. institutional regulations for course offerings during the COVID-19 pandemic) to inform the decision-making processes of subordinate groups (i.e. Faculties). In turn, the institutional ability to adapt to a disruption such as the global pandemic is a testament to its operational resilience. Butler (2018) described operational resilience to be an organization’s ability to “...anticipate, prepare for, and respond and adapt...” (p.104) to any short-term / long-term disruption. Understanding the complex dependencies associated with shifting towards a new pedagogical model aligns with Butler's (2018) business-model work on being adaptive and flexible. In the end, the development of an effective framework can offer a timely solution for the immediate disruption but also when faced with similar disruptions in the future.

From this brief review of the literature, it is apparent that programs of study that rely heavily on face-to-face, experiential, hands-on engagement were harder hit during the pandemic induced transition to remote and online learning than programs that reside in a more conceptual based paradigm. Moving from this broader picture the local context and background of this technology education pre-service diploma program will be discussed.

## Contextual Background

Memorial University’s Faculty of Education offers an eight course diploma in technology education. This diploma is offered conjointly with a second bachelor degree B.Ed. in secondary education. Students enter the program with undergraduate degrees in recognized teachable subject areas within the Newfoundland and Labrador, Canada educational jurisdiction. The technology education diploma gives the students a second teachable and is the credit equivalent of an undergraduate minor. Every spring semester the Faculty admits a new cohort of 20 students into this program, which runs for three consecutive semesters. Curricular content covers everything from philosophy and history of technology education to material processing to computer programming and robotics. Because education is a provincial jurisdiction in Canada, the diploma content is tailored to the local educational needs, but there is still significant overlap with other provincial curricula. Graduates of the program are well prepared to teach technology in many contexts.

Prior to the 2020 global COVID-19 pandemic the primary method of delivering the diploma was a traditional face-to-face design studio setting. The physical location in the Faculty of Education offers a complete design and fabrication suite that is meant to replicate and model the ideal setting for teaching technology within the local education system. Before the outbreak of the pandemic no thought was ever given to the idea of remotely offering our course content, as it had always been assumed that the hands-on nature of the content was best delivered face-to-face. In March of 2020, just two months before accepting our new cohort, these assumptions were strongly questioned. The arrival of the pandemic and subsequent restrictions, lockdowns, and the general halt of day-to-day life as we knew it created a serious challenge for moving forward with the diploma program for the 2020 cohort. Many questions circulated within the first few weeks, including if the diploma could be offered at all. Needless to say, the decision

was made to carry on, but in a modified format. This paper is one effort to rigorously document an unprecedented event in the history of this diploma program and to provide a detailed example of the international effort to maintain high quality pre-service technology education instruction throughout the continuing COVID-19 pandemic.

## Purpose

An understanding of the pragmatic experiences associated with the transition of practical course offerings to remote delivery within the technology education diploma program can offer a foundational understanding and lay the groundwork for other institutional efforts to move forward during the COVID-19 pandemic. Timely research focusing on the challenges, benefits, and lessons learned reduces the potential for limited offerings of technical courses to pre-service teachers as the pandemic continues to reduce face-to-face instruction especially in hands-on programming.

The COVID-19 pandemic was the catalyst that triggered the re-organization of the technology education pre-service teacher diploma for remote, blended, and face-to-face learning. The re-design of technical course offerings required a reimagining of the program from both an administrative and an instructional perspective. As such, this study offers a meaningful, pragmatic perspective from participants engaged at the administrative and instructional levels of the program.

## Research Question

The main research question that guided this collaborative autoethnographic research was: How did COVID-19 impact the delivery of technical course offerings for pre-service teachers? The following sub-questions were used to support the main question:

- To what extent did COVID-19 impact the delivery of technical offerings from an administrative perspective?
- To what extent did COVID-19 impact the delivery of technical offerings from an instructional perspective?

## Methodology

This research study is contextualized within the constructivist qualitative paradigm and used a collaborative autoethnographic methodology. This combination was deemed the most appropriate in understanding the lived experience of two university instructors tasked with administering and teaching in a technology education pre-service teacher diploma program during the early stages of the global COVID-19 pandemic. As Roy and Uekusa (2020) have pointed out, qualitative researchers have found themselves in a quandary during the COVID-19 pandemic as much of their research and methodology relied primarily on face-to-face interactions and immersion into the context of their investigations. While this might be the case for the foreseeable future, they suggested that qualitative researchers look to alternative or underutilized methodologies that will allow them to continue to have access to rich data sources. One such methodology is collaborative autoethnography.

Autoethnography has a long history within sociology and anthropology as it combines elements of auto-biography and ethnography to analyze social phenomena from the perspective of the self rather than the other (Anderson, 2006; Ellis et al., 2011). While this methodology may be rooted in sociology and anthropology it has gained popularity in other social science disciplines, including educational research, over the last number of decades (Anderson, 2006; Roy & Uekusa, 2020). The vast majority of research in the vein of autoethnography has been dominated by the evocative and emotional stream promoted and practiced by Ellis and her peers (Bochner & Ellis, 2016; Ellis, 1999; Ellis et al., 2011; Jones, 2016). While the evocative school may be useful in understanding the viewpoint of a single individual within a social context, it has been criticized for a lack of connection with existing theory and a general lack of scientific rigor (Anderson, 2006; Atkinson, 2006; Méndez, 2013; Walford, 2004). Anderson (2006) has pointed out that evocative autoethnography is only one sub-set of the discipline and that there are others that follow the realist and analytic tradition of ethnographic research. As we endeavored to go beyond a simple self-study and would like to place our experiences of teacher education within the larger context of existing theoretical understandings, Anderson's (2006) analytic autoethnography will be our anchor methodology.

“The self-narrative of analytic autoethnography is used, in part, to develop and refine generalized theoretical understandings of social processes” (Anderson, 2006, p. 385). As such, Anderson's (2006) five point framework for defining an analytic autoethnographic study was used to orient our own work. In general, Anderson (2006) contends that any autoethnographic work should consist of (I) CMR – a complete member of the researched context, (II) analytic reflexivity – the ability to understand the reciprocal influence of the researcher on the study, (III) visible and active research in the text -that the voice and thoughts of the researcher have a prominent place within the study text, (IV) a dialogue with informants that goes beyond the self, and (V) a commitment to an analytic agenda. To expand on Anderson's, (2006) fourth point of dialogue beyond the self, we will also be incorporating elements of collaborative autoethnography (CAE) as defined by Roy and Uekusa (2020).

Collaborative autoethnography (CAE) goes beyond the isolated enactment of autoethnography as it allows multiple collaborators to “... combine their energy and data to create a richer pool of data from multiple sources (Chang et al., 2012, p. 89). Roy and Uekusa (2020) reiterated that there are multiple forms of data collection and analysis available for CAE, including personal memory data, interviews, and the analysis of each other’s self-identities. From a data analysis perspective “a built-in process of internal peer-reviewing starts to form through data collection, analysis and interpretation sessions as the mutual scrutiny, interrogation and probing continues (Roy & Uekusa, 2020, p. 388).

The connection between individual and collaborative autoethnography allows for a balance between the individual and their community of context, thus strengthening the analytical nature of the methodology. As both authors share similar education and research backgrounds, they will be the primary collaborative autoethnographic informants for this study.

A quick check of the criteria above firmly places this study in the collaborative and analytic autoethnographic tradition as both authors:

- are full members of the community of inquiry.
- have undertaken a rigorous analysis of their narratives in a framework of mutual reflexivity.
- have included their own thoughts within the text of the study.
- reached beyond themselves for dialogue.
- have included an analysis of their individual narratives and self-identities.
- are looking for connections with existing theory.

## Data Collection Methods

As a collaborative autoethnographic methodology has been adopted as the lens of this inquiry, the primary source of data were self-reflective narratives. While this does coincide with the spirit of the methodology, it is not without its faults. Human memory and recollection have limitations that can skew the facts and are inherently biased towards individuals' viewpoints, opinions, and experiences. Yet it is our own recollections that offer the only avenue for us to understand anything. Therefore, human recollection may be the best we have for understanding our own and others' perceptions of reality. As Audi (2010) pointed out, without memory we would not be able to form perceptions of events at all and that there is a difference in believing something happened and recalling an actual event. In recognizing the inherent strengths and weaknesses of self-reflective narratives other external sources of data to support or refute the recollections in addition to the shared analysis and critique of each narrative were used. For the purpose of this study the external sources of data were exclusively of a written and documented variety. Specifically, pre and post COVID-19 course outlines, occupational health and safety reports, access to campus plans and requests, email correspondence, scheduling drafts, and university news releases were all utilized. These external data sources increased the validity of the self-reflective narratives. In addition to these various data sources the validity of the participants themselves had to be addressed. While everyone may have an opinion, not everyone has the ability to give a qualified one. To again increase the validity of the data, the next section briefly discusses the characteristics of the participants within the context of administering and teaching in the technology education pre-service program.

## Participants

Following the collaborative autoethnographic methodology of the study two participants were tasked with developing individual narratives of their experiences related to the sudden shift in the administration and instructional practices of a pre-service technology education diploma program. The narratives were reinforced by a systematic analysis of their self-reflections with artifacts and documents as indicated in the previous section. Below are too brief character descriptions of the participants that illustrates their unique and qualified positions within the context of the study.

### Participant 01

David is an Assistant Professor in the Faculty of Education, Memorial University, and the current program coordinator for the Faculty's technology education diploma program. He is a former K-12 technology education teacher with over 15 years' experience teaching in both the K-12 and post-secondary level. In addition to his teaching role, David has six years of informal and formal

administration experience related to the diploma program and therefore has intimate knowledge of the program's internal administration. His combined experiences make him a rich source of data for this study.

**Participant 02**

Thomas is an Adjunct Professor in the Faculty of Education, Memorial University, teaching as a per-course contractual instructor in the Faculty's technology education program. His technical, face-to-face courses focusing on programming, physical computing, and robotics for pre-service teachers shifted to remote offerings during the COVID-19 pandemic. Thomas has experienced the challenge of re-designing practical course offerings as a program instructor. Outside of his post-secondary commitments, Thomas is also a technology education teacher at Eric G. Lambert School, Churchill Falls, Newfoundland and Labrador. His perspective is based upon pragmatic experience in COVID-19 and pre-COVID-19 course offerings provides valuable insight.

## Data Analysis

A process of interpretive description was the primary data analysis method used in this study. Thorne et al. (1997) described the data analysis of interpretive description as moving beyond simple sorting and coding of discrete data chunks that can overwhelm and oversimplify to a more holistic interaction with the data. Repeated immersion in the data prior to coding, classifying, and creating linkages are key for allowing researchers to reach higher levels of synthesis, theorizing and recontextualizing within context (Thorne et al., 1997). Interpretive description requires researchers to become intimately knowledgeable about individual cases in order to abstract relevant themes and knowledge that can be applied back to similar cases (Thorne et al., 1997). For this study the methods of interpretive description were applied to each of the narratives. The common themes and relevant abstractions that emerged from the data were the biases for the theoretical and practical analysis that follow the narratives below.

## Findings (Self-reflective Narratives)

As collective autoethnographic studies rely on analyzing self-reflective narratives of participants that are entrenched in the context of the cultural phenomena that is taking place, in this section of the paper two distinct narratives are presented. First from an administrative vantage point and second from an instructional vantage point. In keeping with the collaborative autoethnographic methodology, the narratives form the core of our data, but at the same time, draw on the external sources mentioned in the preceding section.

**An Administrative Narrative**

By the middle of March 2020, Memorial University was entering into the suspension of most normal public activities due to the arrival of our first cases of COVID-19. While this was later than many other provinces it was only a matter of time before COVID-19 became a reality in Newfoundland and Labrador. With the suspension of all instruction in the K-12 system, post-secondary institutions soon followed suit, with the added caveat that classes would continue, but through online and remote methods. While early news releases from the university made it sound like everything would be fine by moving to an online environment, they did little to recognize, except for medicine, nursing, and pharmacy, the inherent issues of moving programs with significant practical components from their traditional learning spaces to online and remote learning spaces (Newfoundland, 2020). With seven pre-service technology education

courses, spread between two cohorts of 20 students each, scheduled to start a little more than a month away, the sudden restrictions imposed by COVID-19 raised some significant administrative hurdles, the first of which was a clear lack of guidance.

Within the first 24 hours of learning that all on-campus activities would be halted a flurry of activity began to ripple through the university community. Students, professors, staff, and administrators all looked in multiple directions for guidance and from my perspective it became apparent that for the next little while the information and direction would be very fluid. While no actual diploma courses were in session at this time, we did have one elective course running that required attention. Based on the guidance from the central administration and our provinces' Chief Medical Officer (CMO) I was able to submit plans to return to class while the scope of the pandemic was still unfolding. On two occasions, within minutes of submitting my plan, guidelines were released by the CMO that made my contingencies obsolete. A third plan was approved and although the students and instructor were able to have one or two more sessions in person, the next round of announcements from the CMO explicitly ended all face-to-face interaction on campus until further notice. Fortunately, it was so late in the current term that students' experiences were not impacted in a major way, but it did increase my awareness of the issues that would now be presented to our returning technology education students.

The issue of returning students was twofold. Not only did we have our current cohort returning from their teaching internships to take their final two courses, but we also had our new cohort of students already accepted and ready to start their program. The acute issue was our returning students, as their first course (Computer Numerically Controlled design and fabrication) was due to start in a little over three weeks. Emergency meetings were coordinated with the instructor, instructional assistant, and the office of undergraduate studies and a plan to transition the Computer Aided Drafting (CAD) portion of the course to a remote model was proposed and the instructor agreed to shoulder the burden of the transition within the very short window of time that we had remaining. The bigger issue with this course was that we were still in a position of not being allowed any physical access to our facilities. Questions were raised as to whether the students actually needed to physically access our facilities in order to complete the course. I responded to these questions by indicating that if our students could not learn to use the CNC machinery that they would not be qualified to receive their course credit or their actual diploma. At this point another plan was proposed and adopted that would see the physical aspects of the course postponed until the very end of the term. The plan would call for one-on-one instruction for each student with the instructor and instructional assistant and fell within all the existing CMO and university guidelines. Being able to finally communicate this to the students relieved a lot of anxiety for them as they knew their graduation depended on receiving this course credit. After dealing with this acute issue, scheduling for the remainder of the program became the top priority.

As the university was still developing procedures for accessing on-campus facilities and time was not on our side for the new cohort's start, the decision was made to evaluate the typical program schedule in relation to which courses might be more conducive to remote instruction. We typically start the new cohort with a basic materials processing course and later in the term move to residential construction and systems. In addition to these two courses, students also

take communications technology and computer technology courses during their first term. In consultation with the instructors, the decision was made to move both the materials processing course and the residential construction course to the fall term. These courses would be replaced with general education courses and the communications and computer technology courses would be moved to a remote model. While these two courses were more conducive to the move to remote learning, there was still a major amount of preparation needed. Each instructor was tasked with developing kits that would be sent to students. These kits were composed of components, tools, and accessories that they would normally have onsite to work with. While the kits were not as complete as the resources available onsite, they were deemed to be sufficient to offer each course remotely in this emergency situation. Again, our instructors agreed to shoulder the burden of not only re-designing their courses for remote learning, but also resourcing their courses with very little lead time and within the context of the major supply issues created by the pandemic. While we were able to create equitable access to the technology we provided, there were still questions of equity with students' personal technology as we soon learned that there was a large spread in student technology. The courses that were moved to the fall had their own issues, which primarily revolved around onsite capacity in relation to physical distancing restrictions and instructor retention.

While we limped through the spring and summer semester there was time to plan for the fall. By now the university's framework for submitting and evaluating on-campus activity was mature enough to give some level of certainty for planning. At this point the physical distancing requirements became the biggest hurdle. The capacity of our facility was hampered by the six-foot physical distancing regulations and we were therefore put in a position that required us to re-think the cohort structure. In order to stay within the COVID-19 regulations and still offer the courses the cohort was split into two separate groups of 10. While this separation was fine in theory, in practice it presented other issues – mainly related to scheduling and instructor course load. First, splitting the cohort in half created two slots for each course where in the past the schedule was designed to work with general education courses throughout the spring and summer semester. Second, this move effectively maintained each individual student's class time, but doubled the course load for each instructor. This doubling of course load had contractual implications for our instructors as they are all employed through per-course contracts. Balancing between their collective agreements and maintaining their interest for teaching a double workload was the final piece of the puzzle that allowed us to offer the program during the pandemic.

Regardless of the issues faced, it was reassuring that all administrative levels of the university recognized the importance of maintaining practical and experiential programming that included our technology education diploma. Without the consultation and cooperation of faculty and university administration, instructors, instructional assistants, and our students our ability to maintain our programming would have been very questionable. Going through this experience in an administrative position has reinforced that positive outcomes are still truly possible in trying times.

**A Teaching Narrative**

From an instructional perspective, the transition from a face-to-face pedagogy to a remote offering within the domain of computer science and robotic systems created a lot of work

leading into the course. Re-designing for a technical remote offering required a revision of how to deliver a hands-on course through virtual interaction without modifying the content. The following courses were offered remotely over two consecutive semesters (Summer / Fall 2020):

> ***ED3752 - Teaching Communication and Computer Technology Systems II*** *- This course examines the application of various communication and computer technologies related to hardware, software, and the required infrastructure. Students will engage in activities that will provide insights into how current teaching and learning strategies can be blended with fundamental computing principles and processes within a framework of project and problem based learning. Topics include: computer architecture, block-based programming, text-based programming, software development, interfacing, and physical computing.*
>
> ***ED4752- Teaching Robotic Systems*** *This course is designed to provide students with an understanding of key concepts in robotic development and control applications. Students will complete practical activities that promote development of the skills necessary to deliver a comprehensive program in this area of study. Topics include: the study of electrical energy, analog and digital electronics; fabrication techniques; object oriented/event driven programming; and wireless robotic control over virtual network computing (VNC).*

An early challenge was a logistical one, combatting supply issues that arose during the beginning weeks of the COVID-19 shutdown and disruption. Accessing technical supplies that were not considered essential nearly left the course offerings without appropriate resources. Working with vendors to find the appropriate electrical components and accessories was difficult for two main reasons. First, finding a vendor to source 22 full kits for the course was problematic as supplies were low across Canada and the lead time for re-stocking was affected by the pandemic shutdown in many countries. The reality that many “in-stock” items were not physically onsite but actually with their suppliers who were often located overseas created longer lead times on receiving the items. The tight timetable to resource technical components became quite the learning curve for procuring electronic materials during a global pandemic. Second, the materials had to be received on-site at the university then sorted and redistributed to students. Thankfully, the course was supported by an instructional assistant who was able to coordinate the redistribution but the shipping of materials to students across the province and country meant more time.

Developing a functional, pragmatic course website that would effectively guide pre-service teachers through technical processes posed the second challenge. In preparation for the course offering, a web-based resource was developed to communicate every aspect of the technical content. The resource relied heavily on pre-posted examples and screencast videos. The development of such a media-rich resource took time leading up to the course which meant a greater demand on the instructor’s pre-course schedule as many program instructors work full time in K-12. Fortunately, the course website could be used in future offerings and will offer a resource for program graduates moving into technology education positions. The resource has already been useful for those pre-service teachers who taught similar topics during their internships during the Winter 2021 semester.

Supporting technical activity during a remote offering was the third, and perhaps the biggest challenge. Assisting pre-service teachers navigate the hands-on content through synchronous and asynchronous dialogue proved problematic at times. Instructors of technical courses often overlook the amount of time spent troubleshooting physical issues that can arise with hardware resources. The ability to see the problem in situ and work with circuits / code in a direct manner was not possible when working remotely. ED3752, for example, was an offering that, at one point, focused on the setup, installation, and use of a single board computer (Raspberry Pi). Coordinating the physical setup for 20 students, many of whom with no prior experience, became a mid-course hurdle. From students using different types of computers to those who had little understanding of general hardware (i.e. micro SD cards, card readers, computer ports), issues arose in bringing all students to the appropriate setup point for physical computing. Foreseeing this issue, tutorials were incorporated into the course website along with links to any necessary software (MAC and PC versions) and similar web-based resources (i.e. Python library documentation) that would be required throughout the offering. A similar challenge arose when students were required to connect their prototypes into the general-purpose input/output (GPIO) pins of the Raspberry Pi and ensure their Python code referenced the appropriate pins. Troubleshooting issues with a coded prototype became a challenge as students would often communicate the issue via asynchronous methods as it arose without including the code, a visual of the physical pinning, or even a detailed account of what actions were already taken to troubleshoot the issue.

Overall, students did develop a strong foundational knowledge within the technical areas of the course offerings despite many of the challenges. Final student evaluation within the course offerings were noted to align with an academic standard consistent with previous semesters. The reduction of some traditional support structures pushed many students to work through issues where classmates would often intervene too early. Peer support has always been an important structure within the technology education diploma program as an emphasis is placed on a constructivist epistemology. As courses transitioned to a new, virtual environment, pre-service teachers no longer had their peers beside them working on a similar task. It is also important to note that within the technology education diploma program, many of the pre-service teachers are not acquainted prior to their admission and completed several courses during the COVID-19 transition before being enrolled in a blended offering. The forced independence associated with remote learning became a push factor for the development of a stronger technical identity in technology education. Having to work through obstacles independently / remotely removed the tendency and temptation for students within a shared physical environment to call on their peers before working through the issue themselves.

## Analysis and Discussion

### Thomas' Analysis of David's (Administrative) Narrative

David's narrative described the challenges of shifting course offerings from traditional, face-to-face pedagogy to remote and blended models from an administrative perspective. While challenges were highlighted throughout the narrative, the importance of communication between institutional administration and program leadership was clearly identified in David's description. He mentions early experiences in relation to the institution's operational tempo and the fluidity of institutional direction. David described the difficulty with aligning plans with

ever-changing information. This administrative perspective paralleled Aagaard and Earnest (2021) assertions that highlighted the importance of clear lines of communication between administrative leadership to successfully navigate the impact of pandemic-related hurdles on educational offerings.

The suspension of all on-campus activity posed a significant hurdle to technical course offerings within the technology education diploma program. David described the challenges associated with balancing COVID-19 regulations and maintaining the integrity of course offerings while also working within tight deadlines. Aagaard and Earnest (2021) described these as the hard decisions associated with planning for select course outcomes to be met virtually and planning for practical outcomes to be accomplished in-person. David described adjusting through the early offerings during the pandemic which aligned with Butler's (2018) notion that the technology education program offerings were in survival mode when presented with such a significant disruption.

As course offerings during the first term were re-designed for remote delivery, David emphasized the importance of instructors. He noted their role in re-designing courses for remote delivery and developing kits of necessary components for student use. However, working within tight timelines and navigating institutional requisition procedures did create issues as materials either arrived just in time for immediate redistribution to students or after the offering start date. This closed any window needed to properly test the re-designed workflow, the compatibility of technological components, and ensure a smooth remote offering. Instructors did shoulder the burden and accepted the arrangement with full disclosure but the new arrangement added pressure to course logistics. While equitable access to course technological components was a priority, the reality of student geographical distribution meant a potential delay regarding the distribution and replacement of materials. Anecdotal evidence from instructors and instructional assistants noted the additional pressure associated with the re-design and the potential for coursework disruptions for students who require logistical aid.

David noted the complexity of coordinating in-person fabrication laboratory work while meeting COVID-19 regulations. Splitting the class to maintain social distancing had to occur and therefore increased the course workload for instructors which could have thrown a significant hurdle into the blended delivery of the program. David’s concerns regarding workloads demonstrated an administrative awareness that offerings during the pandemic have the potential to impact the demands placed on instructors. Day et al.'s (2021) work highlighted the potential for faculty inequities to emerge as institutional shifts towards remote offerings are forced upon faculty members.

Ultimately, David’s narrative described the challenge of administering a shift to remote and blended offerings while working within the boundaries and approval structure of the institution; adhering to COVID-19 regulations; ensuring pre-service teachers move forward in the program; and recruiting instructors willing to accept the demands of teaching during the pandemic. His perspective emphasized the continual tight windows and short deadlines to create the action plans for a shift towards course delivery during a global pandemic. David’s experiences are applicable beyond the context of this study and echo lessons learned at other

institutions that sought to adapt practical offerings at the onset of the March 2020 shutdown (Aagaard & Earnest, 2021).

**David's Analysis of Thomas' (Teaching) Narrative**

Throughout Thomas' narrative one theme remained constant -that of maintaining the integrity of his courses to support student learning and achievement. He maintained integrity in three ways. First, while he was faced with multiple challenges at the beginning of the transition, such as the almost complete collapse of normal supply chains for equipment and components, he demonstrated through his narrative that with persistence and tenacity the objective of putting physical resources in the hands of his students were met. Within the discipline of technology education, the manipulation and creation of artifacts is paramount and no transition to remote instruction would be sufficient without this element. These challenges echo Day et al's. (2021) report of similar obstacles for field-work related courses and should not be underestimated, as without appropriate materials and components Thomas' courses would not have met the criteria for credit.

Second, Thomas reported that developing and providing a supportive online presence was paramount in his successful transition. As Day et al. (2021) pointed out, not all faculty had the technical ability or experience to provide support for their students. From this perspective, our program was fortunate to employ Thomas. While not explicitly mentioned in his narrative, peer and student feedback would indicate that his level of technical expertise in the development and utilization of custom educational technology supports are very highly refined. Some research into the utilization of technological supports for educational endeavors illustrates that a teacher / instructor's level of comfort with the technology may influence their pedagogical practice and in turn may affect student engagement and achievement (Lee et al., 2017; Rakes et al., 2006). In this case the students and program in general benefited from Thomas' command of not only the content-based technology related to the course objectives, but the educational technology needed to move to a pedagogically sound remote iteration of his courses. While this might be the overall feeling reported in Thomas' narrative, there is anecdotal evidence from students that they felt overwhelmed, lost, and isolated at times regardless of the supports provided. These reports provide another avenue to research the impact of such transitions to better understand the nuanced supports that could be provided in the future to ease student stress and discomfort without lessening the rigor of the course objectives. Regardless, Thomas appears to have effectively side-stepped one of the major hurdles identified in the nascent literature on this phenomena (Aagaard & Earnest, 2021; Day et al., 2021).

Third, regardless of the technology or supports in place, no course, whether face-to-face or remote, can be successful without a solid pedagogical approach. Throughout Thomas' narrative there is evidence of the importance he placed on a constructivist pedagogical approach. He mentioned several times the importance of peer-interaction within technology education and how this was a challenge in a remote learning environment. The loss of community and social presence has been reported by Day et al. (2021) and was echoed by Thomas' account. What was interesting are Thomas' thoughts on the benefits of losing such a close-knit social connection as he reported that the lack of this physical network forced students to troubleshoot technical issues by themselves and with the help of Thomas rather than just

allowing a peer to fix something for them. The idea of intentionally limiting the peer interactions at certain points of technical learning to promote the emergence of self-confidence and individual skill development is something that should be revisited when face-to-face instruction resumes after the pandemic. While the idea of producing self-confident learners and future teachers that are able to problem solve effectively within the technological sphere is a main goal of the program, if our students have not experienced design or problem-based learning environments in their past education, this type of transition can be difficult and jarring. Compounded by the situation created by COVID-19 of stripping all of our normal scaffolds, it is now important to empirically investigate how the students experienced the limiting of peer interactions to better design a balanced pedagogical approach in light of this new knowledge.

One final theme that became apparent while analyzing Thomas' account was the amount of dedication displayed by contractual instructors in our program. While I did allude to this in my own administrative narrative, Thomas' narrative plainly puts into perspective that without the willingness of faculty and staff that might be in a more precarious employment category to step-up and do what needed to be done, many courses and programs would not have survived the remote transition. Hopefully university administrations will recognize these contributions in a meaningful way in the future.

To summarize, there were both challenges and benefits to the sudden and unprecedented shift to remote and online learning caused by the COVID-19 pandemic. Challenges included maintaining equitable access to physical materials and technologies for all students, scheduling issues related to changing pandemic rules and regulations, and a loss of social presence with students. Benefits included more student autonomy, less dependence on group work for technical skill development, and the development of alternative delivery models for pre-service technology education that could be used to expand program offerings to non-traditional students.

## Conclusion

The COVID-19 pandemic is far from over and the lessons learned from the first year of dealing with the implications are currently being adapted for the next cohort of our technology education pre-service diploma program. While the findings are contextual, this type of study is commensurable with the understanding and knowledge that is becoming apparent in every institution and to everyone with a stake in post-secondary education. There remain aspects that hold potential value across jurisdictional boundaries and add value to the emergent literature on experiences in education during the early pandemic. The analysis of the data and ensuing discussion highlighted the importance of maintaining the tangible hands-on, minds-on activities that are core to technology education and other disciplines. Moving forward, student perceptions and realities of their experiences should be an avenue for research to gain a deeper understanding of the phenomena and should help with balancing the next iterations of program delivery. It was also worthy to note the unheard-of flexibility of typically inflexible university policies and practices that transpired over the last year as everyone from the president to the janitorial staff shifted gears swiftly to maintain programming for all of our students. In the end, the pandemic may be seen as one giant case study that disproves the idea that post-secondary institutions are rigid, and the path may be open to try new pedagogical approaches in the future based on the experiences of teaching through the turmoil.

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