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ASSESSING AND PROMOTING CORPORATE INSTRUCTOR BLENDED TEACHING SELF-EFFICACY VIA THE TPACK MODEL

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Dedication

For all those who take on the challenge of self-improvement through education.

Knowledge – not Intuition, but the slow

Uncertain fruit of an enhancing toil.

- Robert Browning, Paracelsus

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Abstract

Corporate training instructors are selected into their roles because of their specific technical and workplace knowledge and skills. These instructors often do not receive additional extensive formal education or training regarding facets of instructional design, course facilitation techniques in multiple modalities, training program management, and the use of educational and other technologies. Technology, Pedagogy, and Content Knowledge (TPACK) is a widely used framework for establishing a baseline of an instructor's knowledge required for effective technology integration into their professional practice. This framework has been used to study several populations including pre-service and in-service teachers in a variety of formal education settings. This current study is the first time TPACK has been applied to training staff at an electrical utility in Ontario, Canada, to support blended learning and the successful integration of newer technologies in teaching practice. The purpose of this study was to adapt a modified TPACK framework for use with Instructors who teach Power System Operators, identifying the specific areas of greatest developmental need for each participant. Self-efficacy data was gathered using the Ohio State Teacher Efficacy Scale, modified for blended learning and for the corporate setting. Purposefully selected participants formed semi-structured focus groups to review questionnaire responses and identify areas of professional development. The outcome of this study suggested limited individualized development plans to close the identified gaps in technology, pedagogy, and/or content knowledge. There were positive suggestions on how to deepen departmental knowledge and skills through knowledge sharing, and for training department leaders to make professional development for instructional staff more accessible. This study can be used by other organizations to evaluate the professional development needs of training staff and the creation of action plans for improved blended teaching self-efficacy.

Keywords: TPACK, Blended Teaching, Corporate Training, Teaching Self-efficacy, Andragogy, Pedagogy, Professional Development, Focus Group, Qualitative, Instructor

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Glossary of Terms

Andragogy

Attributed to Knowles (1980) andragogy is the art and science of helping adults learn. In this research, andragogy invites adult learners to actively participate in defining what needs to be learned to support their work. Andragogy applies intrinsic motivation and a problem-solving approach to learning that permits the learner to integrate personal experiences into their development. Learners are actively involved in planning their own learning (Blaschke, 2012). See also Heutagogy and Pedagogy.

Asynchronous

Person-to-person communications within a text- or graphics-based course that does not occur at the same time and does not require the presence of the instructor in the learning space (Simonson et al., 2012). Discussion forums and wikis, moderated by the teacher, are examples frequently used in online or blended learning.

Blended Learning

A term applied to the practice of providing instruction and learning experiences through some combination of both face-to-face and technology-mediated learning. An example is a course consisting of classroom-based, instructor-led lecture and online components such as computer or internet-based simulation experiments that are completed independently, outside of the classroom, on an online platform (Cleveland-Innes & Wilton, 2018).

Classroom Learning

A course delivery model that has instructors and learners meeting at the same time and place specifically for the transmission and evaluation of skills, knowledge, and experiential learning (Tophatmonocol Corp., 2021).

E-Learning

Abbreviation for electronic-learning where communications technology is used to facilitate interactions between learners who are separated from one another (Kanuka & Conrad, 2003). E-learning invites the active participation of learners in a learning community and communication among the members of that community (Shale, 2003). E-learning may also be asynchronous and offline where the learner downloads lessons and assignments that are completed without connection to the cloud. Assignments can be submitted by mail, email, or learning management system drop box. See also Online Learning.

Heutagogy

Heutagogy is a learning environment that promotes learner autonomy and self-directedness. This approach emphasises the development of learner competencies and is often enabled by social media tools. Self-efficacy is developed through knowing how to learn, reflection on the learning process, communication and teamwork skills, and the ability to apply learning in new and unfamiliar situations (Blaschke, 2012).

Instructor

In this project, an instructor is a person who teaches specific knowledge and practical skills, required in the electric utility's control center, to a minimum standard of competence. An instructor in this study location is responsible for instructional design, teaching, facilitating learning, assessing students, and evaluating program effectiveness (Pediaa, 2016).

Instructor-Led Learning

A course delivery mode often considered being the traditional classroom experience. Class sessions are scheduled and taught by an instructor in brick-and-mortar classrooms and laboratories. May also be an instructor teaching in synchronous learning online or in blended

mode of delivery (Training Industry, 2021).

Learner

An individual who potentially gains additional knowledge and skill through education. A learner may also be known as a student, trainee, or employee who has a requirement for continuing skills and knowledge development (Oxford University Press, 2004).

Online Learning

A concept where course content and forms of evaluation are offered using networks and interactions occur chiefly using some form of communication technology, usually the Internet (Simonson et al., 2012). See also E-learning.

Pedagogy

The art and science of teaching where the teacher has full responsibility over the what, when, and how of learning (Draper, 2001). Knowles (1980) identifies that the teacher needs to be able to prepare and deliver instruction, manage the classroom, and assess learning. TPACK defines pedagogy as a "[t]eachers' deep knowledge about the processes and practices or methods of teaching and learning (Koehler & Mishra, 2009, p. 64). In this research, pedagogy refers to mandatory training and assessment requirements that have been defined for employees in corporate policies or procedures and by regulatory bodies such as NERC.

Professional Development

Learning that takes place to continually increase one's knowledge and skills for a current or future role (Gosselin et al., 2016).

Socratic Questioning

A form of disciplined questioning that can be used to explore complex ideas, analyze concepts, uncover assumptions, or explore the origins of a learner's thinking. In practice, the instructor

assumes an unfamiliar mindset to compel the learner to adopt a high level knowledge (Socratic questioning, 2021).

Self-Efficacy

Learners ability to employ an array of actions to produce a desired outcome in their area of content expertise and pedagogical control (Choi & Mao, 2021).

Synchronous Learning

Scheduled, real time communications that occur in courses or learning interactions where learners do not attend at a physical classroom. Internet-based communications technology is employed to present the course content and course participants discuss the material in real-time. Recording the session allows for future review or rebroadcasting (Simonson et al., 2012).

Technology

Technology is, in this research study, the computer hardware and software required to deliver instruction to adult learners in a utility control center context. These include the Information and Communications Technologies (ICT) such as WebEx conferencing software, a Learning Management System (LMS) which offers asynchronous communications through discussion forums and wikis, and instant communications technologies such as Skype and email (Northcote et al., 2011).

TPACK

An abbreviation for the Technological, Pedagogical, and Content Knowledge framework developed by Koehler and Mishra (2009). The framework focuses on the teacher's mastery of pedagogical content knowledge, the surrounding topic context, and student prior knowledge. Higher TPACK scores indicate the instructor can effectively apply technology in teaching that strengthens a learner's current understanding or creates new knowledge (Koehler & Mishra,

2009; Willermark, 2018).

Chapter 1 - Introduction

In this opening chapter, I discuss the background need for the research, the general research locale, the research problem, goal, and the four research sub-questions that lead to the single main research question. The evolution of the current Technological, Pedagogical, and Content Knowledge (TPACK) model as developed by Koehler and Mishra (2009) has shown to be inadequate for corporate training where adults learn. The expansion and modification of the TPACK framework to include andragogy makes this a new area of research that can aid electric utility training directly and have potential application in other industries where workplace teaching is done by inexperienced instructors. The chapter ends with the significance of the study along with the delimitations of the study.

I conducted an exploratory qualitative, single department study with an element of simple descriptive statistics. Exploratory research typically refers to the design of mixed-methods studies where qualitative data is gathered first, followed by quantitative data (Cohen et al., 2018). Exploratory research in this study is taken to mean an investigation into the use of data gathering instruments to determine if they contribute positively towards the creation of instructor professional development plans. This exploratory research also determined that minor modifications are required to the design, instruments, and other factors that could improve their fitness for use in future studies. The data analysis techniques used identify the TPACK knowledge domains that require further professional development for both seasoned and inexperienced instructional staff. In electrical utility operations training, the instructing staff include instructors and simulator technicians.

The participants in this study, practicing corporate training instructors, were invited from the training department of an electrical utility organization in Ontario, Canada. The research was

designed to assist with increasing their self-efficacy as instructors when using digital technologies in their practice.

The TPACK and self-efficacy questionnaires were modified for the study setting and used to record their current TPACK and teaching self-efficacy scores. This was the first time these instruments are known to have been used in that setting. The emphasis was on identifying opportunities where improvements can be made in individual skills, knowledge, and abilities which may be applied to other utility or industrial training settings in Canada and North America. The study also identified opportunities at the department level where several cross-training initiatives could be offered or arranged for the participants.

Central to the research was the evaluation of data developed using a survey questionnaire that was later informed in greater depth through focus groups. That questionnaire was piloted, before the actual study, with two individuals who were not participants in the study. Personal questionnaire response data was shared with the participants to provide opportunities for reflection on their responses prior to attending the focus group. The questionnaire was used with semi-structured focus group meetings to explore how the study participants chose to use that information to identify specific growth and professional development opportunities.

The participants were purposefully selected into semi-structured focus group discussions to examine the areas of greatest developmental need among department members with similar TPACK profiles. The focus group questions were semi-structured and designed to allow and encourage discussions among research participants and to facilitate data gathering. This approach permitted the participants to interact with one another, exchange views, build upon comments, and interpret the questionnaire data gathered from each of them through a TPACK knowledge area lens (Seale, 2018).

As a researcher, I can appreciate that each person brings to this study their own experiences, knowledge, ambitions, and fears. The need for this study was drawn in part from anecdotal comments from instructors participating in this study. Some indicated lack of confidence in their course designs due in part to an absence of instructional design education. Many instructors also remarked that they are unprepared to teach online or in blended classes as they are not familiar with or do not know how to use technologies for teaching. They also comment that teaching outside of the typical classroom would not be accepted by the learners, suggesting that some form of engaging instructional design development is needed by some of the instructors. This alignment with constructivism, discussed later in the literature review, assists in forming the foundation of this work, which builds upon my own ontology that truth is based on individual experiences and reflection (Cohen et al., 2018).

My epistemology is based on a pragmatic worldview that each person's reality can be evaluated through survey and focus groups (Creswell, 2014). Data must be gathered to examine a problem and its possible solutions. This data needs to be gathered from the people who will be affected by the outcomes. This means that solutions should not be imposed on professional trainers but co-created with them. For my study, participants engaged in two information gathering efforts to determine what new learning needs to be added to their current knowledge, skills, and abilities to make them even more capable as instructors.

Creswell (2007) commented that pragmatism permits the researcher to use methods, techniques, and procedures that assist in answering their research questions. The questionnaires gathered data to determine the instructors current state of technological, pedagogical, and content knowledge. Participants also provided information on their current state of teaching self-efficacy both before and following the focus groups. Through the focus groups, I was able to evaluate the

instructor's current TPACK and self-efficacy profiles. These discussions invited the participants to create a forward-looking plan to improve their knowledge, skills, and abilities to realize personal and collective professional growth. Together, these data gathering approaches assisted in determining that the research design and methods used can produce the desired result of defining professional development plans for the participants. Minor modifications to the research invitations and informed consent documentation are recommended based on the findings gathered through this study. These are discussed in the latter chapters of this report.,

A collaborative examination of individual's ability to employ modern technology-based training design and delivery was carried out (Gosselin et al., 2016). I began from a position of confidence that a professional development plan can be created for each of the study participants. Individual needs or learning opportunities could be grouped together to form generic development opportunities for the department. As an example, one or more instructors took or recommended that they engage in the same developmental course promoting peer-to-peer support and collaboration while learning from each other. This approach to individual development plans was viewed as a form of transformative leadership and an opportunity to inspire staff and provide intellectual stimulation to grow within their role in the department (Hamilton, 2009). Transformative leadership, discussed in greater depth in the literature review, was seen to encourage improvement in departmental capabilities and better approaches to training methods as well as determine changes that are required to achieve these goals. Further, the current state of the instructor knowledge and skill sets may be determined through surveys and focus groups.

Leader-member exchange (LMX) is a form of leadership where the focus is on developing a high quality relationship between the leader and the subordinates (Power, 2013).

Strong continuous leadership support for focused learning towards the divisional goal of increased computer assisted and virtual learning within the organization was included in the conceptual framework for this study (see Figure 2) (Avolio et al., 2009; Letizia, 2014; Power, 2013). LMX theory provides the opportunity for management to express the transformational department goal of increased blended and online delivery. The instructors in turn were invited to describe their views and learning needs to achieve this stated goal. In this conversation, the department exchanged their positions and were able to arrive at solutions that were mutually constructed.

The potential for success can further be advanced through leadership, administrative, and collegial support, increasing knowledge and praxis, while reducing stress that may be present in the change continuum (Dong et al., 2020). This approach also aligns well with the development of self-efficacy through the application of social cognitive theory (Choi & Mao, 2021). It also supports improved teaching enthusiasm and perceived quality (Lazarides et al., 2021), including optimism generated through professional development and peer-to-peer collaboration (Kilinc et al., 2021).

The Need for Digital Pedagogy

There is a constant need for teachers at all levels to continuously upgrade and integrate new technologies and instructional approaches into their teaching practice. The nCOVID-19 pandemic forced many to prepare to teach online (Ma et al., 2021). Preparing to teach in blended or fully online modes enables the instructors to meet the expectations of the employer as well as those of the learners and their managers (Kuusinen, 2016; Northcote et al., 2011). The same need for upgrading skills is true for those who instruct in the corporate setting as new tools, technologies, and processes are integrated into a company’s sphere of influence.

These changes often occur more frequently than in formal educational settings. Staff turnover in corporations, especially training departments, occurs much more frequently than is seen in academia where tenure may be seen to be more important than monetary or hierarchical positioning. Professional development therefore may be one mechanism to encourage staff retention.

In some cases, new teaching technologies bring increased efficiency but only after modifications to existing routines are re-examined, instructions rewritten, and appropriate communications are provided to users. Often missing is the full examination of the changes in work processes and the many steps each individual worker needs to complete to perform a task and how those tasks interact across a business process. Communicating change is often assigned to corporate training departments. Examples of changes include the introduction of new control room technologies, new or modified procedures, and organizational changes which alter the methods of completing work. Each of these changes require that the training department develop job aides, classroom or simulator training, and learner assessment to ensure the staff can function in the new conditions.

Training departments are frequently lacking in resources, knowledge, and experience which leads to stress from increased workload, uncertainty, confusion, and lack of power to influence decisions and timelines (Bandura, 1997). Organizational commitment is needed to assist instructors in gaining knowledge and skills to become more efficient and effective change agents (Gosselin et al., 2016) and to reduce their stress and potential burnout (Schwarzer & Hallum, 2008). Professional development is effective for trainers to maintain the skill sets needed for successful training outcomes by employees and at the organizational level (The Premier’s Highly Skilled Workforce Expert Panel, 2016).

Digital pedagogies may be one solution to extract the instructor from the change effort, when appropriate, through the creation of digital teaching solutions for knowledge delivery versus traditional classroom-based, instructor-centered learning processes (Dong et al., 2020). Digital pedagogies refer to "teaching–learning approaches in which digital technologies change the way we teach and promote learning" (Maor, 2017, p. 72). These approaches to teaching and interaction among the course participants provide richer, deeper, and more engaging learning experiences where interacting with the knowledge as a community of learners becomes more important than the information (Maor, 2017). Digital teaching solutions need to be supported by pedagogically-sound instructional designs and informed by the needs of adult learners in the workplace. These designs, when combined with an effective learning management system, have the potential to remove the instructor from time and place dependant classroom delivery. Blended or fully online course designs make content and assessment available to learners to complete on their own, thus providing more independence to adult learners. Providing learning opportunities in alternative modalities may increase self-direction by learners and permit them to learn when they need to, consistent with andragogical and heutagogical motivations (Blaschke, 2012; Taylor & Hamdy, 2013). These approaches also reduce the direct instructional burden on trainers using reusable learning objects (Boyle, 2003).

At the macro level, the 21st century economy is subject to rapidly changing technology that requires just-in-time learning that is accessible on a 24/7 basis (World Economic Forum, 2019). In 2020, reskilling of workers could vary from 6-12 months in duration and include between 10 to 35% of the workforce (World Economic Forum, 2020). More local and relevant to this study site, the Premier of Ontario, Canada, appointed a highly skilled workforce expert panel to evaluate the situation (The Premier's Highly Skilled Workforce Expert Panel, 2016). The

panel recommended reskilling and upskilling employees using on-the-job training which can be further extrapolated to include blended or asynchronous modalities online. This extrapolation is possible as the expert panel did not specify how training could be improved or how industry, business, and education providers would work collaboratively. Asynchronous or blended modality may be one solution to reach the widest audience when and where they choose to engage.

More granular still, the site of this research investigation bears anecdotal evidence that there is a need for digital self-directed professional development for a variety of reasons (Brinkley-Etzkorn, 2018). These include training projects that lend themselves to an online learning design. An example is to provide reusable content objects, such as job aides, task performance videos, and short e-learning modules, in lieu of formal instructor-led refresher training. Another reason is the opportunity to reduce the number of full-day, room-based, instructor-led sessions with short duration webinars using web conferencing technology. Increasing the periodic review of mandatory operational instructions, as a compliance requirement, and verify basic content retention through testing is a third example. Compliance reviews are a requirement of the Northeast Power Coordinating Council, the Ontario Independent Electricity System Operator, and the employer who all conform to the North American Electric Reliability Corporation PER-005-2 standard for operator training (North American Electric Reliability Corporation, 2014).

At the utility industry level, there are continuous professional development requirements that, in many cases, lend themselves to self-directed learning through a variety of access points and technologies. For electrical transmission system operators, the North American Electric Reliability Corporation (NERC), in 2016, established minimum qualifications for the roles that

operators have in maintaining the reliability of the electrical power system. These roles include Reliability Operator (RC, formerly known as Reliability Coordinator), Balancing, Interchange, and Transmission Operator (BT), Transmission Operator (TO), and Balancing and Interchange Operator (BI). In this electric utility-centered study, Transmission System Operators (TSO) are required to pass the RC exam which is administered as a proctored online exam. Interestingly, the examination pass rate has dropped steadily from a high of 92.3% in 1998 to its lowest rate of 60.0% in 2020 as the examination has undergone several change-iterations over that time (North American Electric Reliability Corporation, 2021).

Once the RC exam is successfully completed, staff are issued a certificate that remains valid for three years. NERC certification for RC qualified operators is renewed when the candidate completes 200 credential maintenance hours in every three-year period. The number of hours for the BT, TO, and BI roles are 160, 140, and 140, respectively to reflect an additional and compounding complexity of the higher certification levels (North American Electric Reliability Corporation, 2016). In the electric utility, from which participants in this study were purposely selected, courses and training modules have traditionally been taught or demonstrated by an instructor. The learners reinforce their own abilities through problem solving or task performance examples, which are later verified through assignments, simulation checklists, or summative evaluation. NERC certification is only part of the training program for the TSO. Company specific tools, processes, and safety requirements that do not fit into the NERC certification maintenance criteria invite the change of those topics to digital teaching approaches (North American Electric Reliability Corporation, 2016). Individual and group work that are not time and place dependant can be moved to the online environment and can improve the overall training cost for the organization; movement away from dedicated classroom learning can be a

difficult change-management issue (Bandura, 1997; Northcote et al., 2011). That also illustrates the need to expand the TPACK of instructors to ensure that the learning modules they create, and the activities they moderate, are engaging the learners in online, blended, or remote modes of delivery (Farmer & Ramsdale, 2016).

The nCOVID-19 pandemic has seen all levels of academic instruction around the world move to the online environment with new problems resulting from the separation of students and teachers who lack online teaching experience (Ma et al., 2021). The electric utility company from which participants in this study were selected has a similar need for online and remote synchronous delivery of new hire and mandatory certification maintenance training experienced the same problems. The divisional response to the pandemic required that staff exercise social distance and minimize interactions that potentially spread the virus. The need for training, especially certification maintenance, did not diminish. New hire training also occurred in the same period. Various forms of online and computer aided instruction appeared appropriate to meet the training need. The employees in the training department, therefore, must develop new knowledge and skills to accomplish the required development of training offerings and to teach the topics in blended modality.

Problem Statement

Corporate training instructors lack a variety of knowledge, skill, experience, and ability in their roles but no two are alike, making their professional development for blended instructional design and delivery challenging.

The professional development challenge, described in this study, is multifaceted. First, the instructors come from unique educational and employment backgrounds. Second, their assigned teaching portfolios and areas of responsibility are different, with minimal overlap.

Third, each instructor may take different viewpoints towards personal professional development. When taken together, the opportunity to use a standardized approach using questionnaires and focus group meetings for information gathering treats all participants equally. This approach successfully identified what the current state is, and to a lesser degree, what professional development is needed to increase individual self-efficacy in blended teaching.

Weak or low blended teaching self-efficacy contributes to the professional development challenge. In current practice, some instructors have been reluctant to adopt online teaching approaches. Some of this is due to the hands-on nature of utility work where the instructors believe that only face-to-face classroom teaching can be used. These instructors need further professional development to inform them of how to create and manage blended courses and the technology associated with teaching online.

Other instructors have more personal experience in blended and fully online course development and delivery. The success of their courses during the pandemic provides an example to emulate. Successful blended course deliveries by the more experienced instructors creates stress in the other teaching staff who are not able to achieve the same outcomes. PD and collaboration therefore can potentially balance and increase the department's skill and knowledge.

Purpose Statement

The purpose of this research study was to investigate the professional development needs of instructors as an intervention to increase their knowledge and abilities and thus improve their self-efficacy for teaching with technology in a corporate setting.

Research Goal

The goal of this study was to investigate whether a modified TPACK framework can aide in defining professional development plans in a corporate training setting (Cohen et al., 2018). The research goal aligned with the purpose statement in two ways. First, the goal is to find out if the survey instrument identifies the developmental needs of the instructors. Second, this research is to determine if focus group discussions provide sufficient opportunity to create professional development plans that can be acted upon. This goal supports the stated desires of the employees in the training department, from which the participants were selected for this study, to improve themselves through specific areas of focus, and a pathway to their achievement and improvement. The completion of a needs assessment and defining pathways to professional development achievement through investment by the employees has not been clearly defined in the past (Neuman, 2011). This gave me an opportunity to explore possible causes, and investigate solutions, through an explanatory research design in a defined study location. Evaluation of the completion of those development plans based on TPACK scores and change in level of self-efficacy are discussed in Chapters 4 and 5. Problems experienced in the execution were evaluated in Chapter 6 and will be used to inform future research studies.

Defining the Study Location

The location which provides the boundary for this study is an electrical utility training department where the study participants work. The exploratory nature of the research was used to determine if the participants from this department can align with the modified TPACK model to potentially extend its use into a new and unexamined industry. The explanatory design used here became a test to determine if this model and the data gathering approach can be applied to the electricity sector, the new and unexamined industry.

This study was an exploratory study using a modified TPACK model that, previously, has not been used in the utility training sector. It is important to note that there are three training departments in the utility where the participants for this study work. The first is the utility operator training department that at the time of the study had a total of eleven staff members including a manager, seven union represented instructors as energy professionals, and two technicians who belong to another union that represent clerical, technical, and skilled trades employees. There was also one administrative employee in this department, who occupies a position that was previously filled by a contract cooperative education student, typically selected from a college or university studying business or human resources. This administrative employee was not invited as a participant in the study, mainly due to fact that they do not instruct staff at the utility company. The focus of this department is primarily on power system operator training and training of professional staff that support real-time electricity grid control operations. The instructors use directives, instructions, and business process documents as the primary sources of operating practices that guide correct execution of work in the operating division.

The second training department in the electric utility company has approximately 60 staff, 45 of whom have instructional design or teaching responsibilities. This department is the largest training department in the electric utility company which focuses on skilled trades training for apprentices and training on mandatory corporate topics such as safety, cybersecurity, and corporate policies. Apprentice training courses range from one to four weeks in duration. These courses are classroom-based for theory and spend much of the course time learning and performing hands-on construction and maintenance work on typical examples of the company's electrical infrastructure, tools, and mobile work equipment.

The third training department is situated in the corporate human resources department. This department focuses on leadership development courses for supervisors and managers. There are five employees in this section who have already moved most of their offerings from classroom seminar style courses to synchronous online delivery.

Examining the Problem

The next sections provide information on the department, at the utility company, through the modified TPACK framework. This lens helps to better appreciate how the model can assist in developing an understanding of the strengths and areas for improvement of individual instructors in the department and the wider needs of the entire instructional team. Historically, the training department has been staffed by employees from the real-time operations environment. Operators or dispatchers have been selected, primarily for their subject matter expertise and workplace experience, which brings credibility among the individuals attending the training sessions (Schulman, 1986). There is, however, a designing and teaching complication regarding past practice and the lack of professional development of these employees in the training department. This is in part due to the reluctance of the individual staff members to engage in formal education or training outside of work hours, on their own time. This behaviour is despite the utility company's decades-old policies to reimburse employees for extracurricular course tuition and books. There is also the long-standing instructional design and teaching practices where instructors follow the methodology of their own learning as the preferred template to follow. Failing to acquire good instructional design and teaching practices has resulted in weak new-program designs, inefficient use of time and resources, and increased workload as changes occur across the organization.

Lack of instructor professional development may not be the sole cause of departmental shortcomings. Training managers of the past were mostly instructors elevated to department leadership, or managers from other departments placed in the role for their own development or management skills, and often with other responsibilities. Without solid education backgrounds or management vision, opportunities to introduce new tools needed to improve performance in line with a contemporary move to blended delivery have been missed.

That is in part because information and communication technologies (ICT) have extended evaluation and acquisition cycles that few have been successful at navigating or persistent enough to see to the end. These include common instructional content authoring software, process mapping and storyboarding software, and audio-visual equipment and editing software. While a learning management system (LMS) is available, it is a 17-year-old platform, lacking in easy-to-use tools for content and assessment development. The current LMS is administratively focussed and is one which many employees struggle to use effectively as a content or assessment management platform. As a result, e-learning and virtual classes conducted by other department instructors, discussed previously in the defining the study location section (see page 13), are often limited to single topics of short duration. Complete training programs for many job families have not been moved into the LMS. This has resulted in the programs being rewritten from the beginning for each delivery and lacking in consistency and standardization. By not moving into a blended learning approach, instructor-led classroom delivery remains as the only workable option at the electric utility company.

More recent decisions for the hiring of experienced and post-secondary education credentialed corporate trainers and instructional designers into the operator training department have borne some fruit. These new employees have brought new and innovative approaches for

design and teaching that have begun to be adopted by the longer-term members of the department. Notwithstanding their immediate value, these new hires need operating content knowledge to reach their full capabilities. While ICT acquisition continues to be slow, employee voices contribute to the call for action and have put more weight to the need for an academic quality LMS. This LMS has now been acquired for the operations division which further illustrates the need for internal PD for trainers to move towards blended courses and program designs.

This study used the TPACK model to generate data driven decisions regarding what professional development for teaching in a blended modality is needed for each instructor and the department. The TPACK questionnaire data, coupled with the focus group transcripts, produced findings that can be acted upon for organizational benefit through individual development. While at present the use of the data and decision-making actions described in this study are reactive, they can become proactive, if a repeatable approach for addressing the developmental requirements in the future for new team members can be found. These data-driven decisions are also anticipated to be more accurate than intuition or individual assumptions. Data informed decisions are potentially more cost effective as only the content, pedagogical, or technology knowledge instruction needed should be provided (Stobierski, 2021). The data identified the specific areas for improvement and individuals to whom the transformative effort should be applied (Price Waterhouse Coopers, n.d.). With the problem described, the TPACK model that was used to analyze the learning needs of the participants is discussed next.

The Evolution of the TPACK Framework

Schulman's (1986) seminal work on pedagogy and content knowledge started with an examination of scholarly practices in 19th century America. He identified that State board examinations of teachers concentrated 90-95% of questions on content knowledge required of the day, and the remainder on teaching practice and the legal requirements of the State's educational system. Schulman commented:

> The person who presumes to teach subject matter to children must demonstrate knowledge of that subject matter as a prerequisite to teaching. Although knowledge of the theories and methods of teaching is important, it plays a decidedly secondary role in the qualifications of a teacher. (p. 5)

Schulman then moved forward to the 1980's and demonstrated that subject matter knowledge of reading, writing, and arithmetic remained and there was a new assessment of the basic skill to be able to teach (Schulman, 1986). He saw a distinct need for content knowledge (CK) as the amount and organization of knowledge in the teacher's mind. A teacher, he explained, must understand the nature and structures of the subject, be able to explain why the topic is worth knowing, and how it relates to other facts in theory and in practice (Schulman, 1986). Similarly, a corporate instructor has the added requirement of explaining the application of the content or knowledge and specific workplace processes. More importantly, instructors should evaluate what needs to be taught along with how the subject should be taught, and not treat the two as mutually exclusive efforts (Dong et al., 2020).

The discussion expands to include a review of pedagogical content knowledge (PCK) where an instructor must be able to explain why a fact is worth knowing, and how it relates to other facts. PCK is also valuable when illustrating to learners the various stages of work

processes and decision making that are often made independently in real-time electrical utility operations. Schulman (1996) elaborated that a teacher must have a solid base of knowledge and experience to be able to provide examples, make illustrations, discuss research, and make demonstrations such that a learner is fully immersed in the topic. Schulman also identified that curricular knowledge was required so the teacher could convey the subject through a variety of experiences that would be appropriate for the level of the material being taught.

Schulman completed his article with an updated version of George Bernard Shaw's statement "He who can, does. He who cannot, teaches" replacing it with "Those who can, do. Those who understand, teach." (1986, p. 14). This new quote summarizes the pedagogical skill set and content knowledge requirements of the instructors. But there is a missing element, namely delivery technology, especially technology used in the craft of teaching via blended approaches that needs to be added to the instructional toolbox.

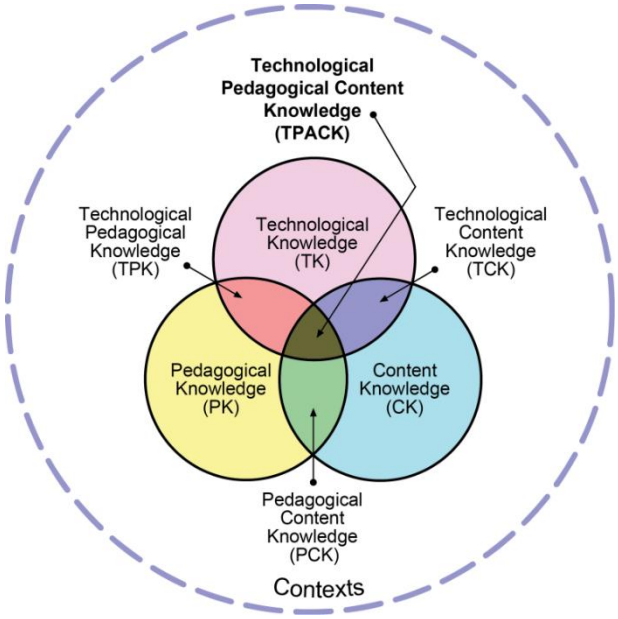
Koehler and Mishra (2009) suggested that good teaching via technology required three areas of knowledge application, content (CK), pedagogy (PK), and technology (TK). As explained above, teachers should be masters of the content they are required to teach. Instructors should also have a solid understanding of how to prepare instruction and select techniques to deliver the content efficiently. In the corporate setting, instructors should be familiar with how to use the technology associated with the discipline they are teaching. There is no guarantee that these expectations are true for each instructor as technologies change, their inner workings are not fully understood, and the underlying mechanisms are not visible to the lay user (Koehler & Mishra, 2009). Over time instructors in the corporate environment lose connection to the application of their area of expertise, therefore, a periodic review of their needs is recommended to ensure they remain current. Most especially, corporate instructors have been hired over time

for their subject matter knowledge and require direct learning interventions to increase their pedagogical skills and knowledge often while assigned training design and delivery responsibilities for immediate delivery. Therefore, an assessment instrument is needed that can examine the current state of these three primary requirements and the inter-relationships between them (i.e., pedagogy-content, content-technology, pedagogy-technology) (Koehler & Mishra, 2009).

TPACK adds technology to PCK in an interwoven framework as illustrated in Figure 1. Koehler et al. (2015) describe technology as a tool to be integrated into the classroom for effective teaching. As such, it is not technology for technology's sake, but a way to invite greater engagement with content knowledge through sound pedagogical considerations. Technology also provides opportunities for students to interact with course content and with other learners outside of the traditional time and place-centered classroom through Learning Management System (LMS) discussion forums, wikis, and digital content repositories.

Figure 1

Components of the Technological, Pedagogical, and Content Knowledge Framework



Note. From *Using the TPACK Image,* by M. Koehler, 2011 (http://tpack.org), Copyright 2012 by tpack.org. Reprinted with permission.

Technology in this study is defined as computer hardware, software, internet and communications media and applications, used for remote delivery of instruction. These technologies may be housed in a LMS and include asynchronous discussion forums, wikis, information sources (documents, video, and audio files), job aides, and procedures stored on web pages or in online content repositories that are accessible to the learners (Graham, 2011). These needs for online technological competencies are reinforced by Ally (2019) identifying innovative pedagogies, lifelong learning, and the move towards open education resources as reasons to develop staff for more independent and self-directed learning.

Koehler et al. (2015) also examine the intersections between the primary knowledge domains which create three subdomains of knowledge. Using examples from the workplace in this study, these are:

- Technological content knowledge (TCK) describes the ways in which technologies and the content domain interact in ways that both impact and restrict one another. As an example, recording customer service call data requires a solid appreciation of how equipment is connected to the customer's place of business which may need to be restated in multiple ways depending on the responses received (Koehler et al., 2015).
- Pedagogical content knowledge (PCK) transforms the subject matter for teaching by adapting the instructional materials to suit the learners' prior knowledge and experience. PCK includes alternative teaching strategies from exploring different ways of looking at the same idea or problem and using engaging learning experiences to expand the learners critical thinking skills (Koehler & Mishra, 2009). In electrical utilities, teaching the process of how to restore a distribution feeder after a momentary fault would be different for new hires than for experienced operators.
- Technological pedagogical knowledge (TPK) is a teacher's knowledge of the ways in which both teaching and learning change with the addition of technology. An example is the remote delivery of instruction via web conferencing software that requires the instructor to alter the discussions or group work to the capabilities of the medium and the student's ability to use it adequately (Koehler & Mishra, 2009).

These six domains overlap one another to form the seventh which is TPACK. This final domain represents the need for the instructors to integrate them all together in the lesson design and delivery. This integration is similar to the online teaching competency matrix created by

Farmer and Ramsdale (2016) which includes five competency areas: Community and Netiquette, Active Teaching/Facilitating, Instructional Design, Tools and Technology, and Leadership and Instruction which can be leveraged for instructor professional development.

It is important to recognize that changes to any one of the primary domains requires that the teacher reflect and re-evaluate their approaches to teaching and improve their practice (Koehler & Mishra, 2009). TPACK is a flexible framework that permits the evaluation of those who instruct others and the decisions they make regarding technology, content, and pedagogy in their classrooms (Koehler et al., 2015).

This study was completed at a time when the need for blended learning was, and continues to be, critical. It was, therefore, important to seek out and apply the latest innovations in the TPACK model to the described problem. Despite the potential, the TPACK framework is missing a vital component, andragogy, for instructional design and teaching in the modern workplace. The need for andragogy is discussed next.

Andragogy Needed

Pedagogy, derived from the Greek words *paid* (child) and *agogus* (leader of), is the art and science of teaching children. Pedagogy proposes that the teacher has full responsibility over the what, when, and how of learning which remains relevant for portions of new hire training, especially safety, policy, and processes, in the workplace (Draper, 2001). An additional element, andragogy, is required in the TPACK framework for teaching adults in the workplace.

Andragogy is derived from the Greek root *andra* (adult) and *agogus* (to lead) and can be traced back to Alexander Kapp in the early 1800s (Frey, 2018). Malcolm Knowles conducted additional research into andragogy in the 1960s and is recognized as the modern father of the model used as the “art and science of helping adults learn” (Knowles, 1980, p. 43).

Knowles suggested that adults are motivated differently than children in six ways:

1. The need to know (Why do I need to know this?).
2. The learners' self-concept (I am responsible for my own decisions).
3. The role of the learners' experiences (I have experiences which I value, and you should respect).
4. Readiness to learn (I need to learn because my circumstances are changing).
5. Orientation to learning (Learning will help me deal with the situation in which I find myself).
6. Motivation (I learn because I want to) (Taylor & Hamdy, 2013).

The second motivation listed above is particularly important in the electric utility industry as those who operate the power system must be able to make, and be accountable for, sound decisions to protect corporate assets and the public from harm. This difference can be met with constructivist learning designs that provide a volume of experience to draw upon in the future (Knowles point 3 above).

Readiness to learn may be the most challenging difference to overcome because adults sometime become entrenched in practice. Some may find it difficult, perhaps even impossible, to accept change. A supportive learning environment that allows them to explore and build upon their knowledge and experiences can attempt to address their orientation to learning and reach the point of recognizing when additional learning is needed (differences to Knowles motivation 4, 5, and 6).

Updating the TPACK framework to include andragogy is required to determine how much of this approach to teaching and evaluating adults is known and is already being applied by each participant in this study. That analysis assisted with aligning the questionnaire to five

assumptions made by Knowles (1980) about the learning environment and instructor skills. These are:

1. The instructor can co-construct learning experiences focused on self-directedness, autonomy, and self-actualization.
2. The instructor can use instructional methods such as experiential exercises, problem- and case-based learning, role-playing, simulations, Socratic questioning, and field experiences to help learners identify gaps between what they know, what they do not know, and strategies to bridge these gaps.
3. The instructor can prepare real-world scenarios, perhaps those that have occurred at the utility, as the organizing structure for the learning process. In the electric utility context, the use of power system simulators that are identical to the tools that are used each day, immediately connect the learner to the execution of policies, processes, and procedures.
4. The instructor can scaffold scenarios according to the desired learning outcomes and current developmental level focussing on the use of cognitive complexity and self-directed learning skills rather than the simple remembering of facts.
5. The instructor can prepare evaluations that use multiple strategies including problem- and task-centered scenarios that objectively assess long-term knowledge retention and the ability to complete complex tasks in simulated events correctly (Frey, 2018). Rubrics and checklists offer immediate feedback to the learner for further use where proper work techniques need to be improved.

The inclusion of andragogy into the TPACK framework does not require major reworking of the existing model. Andragogy was interpreted into many of the questionnaire

statements or added into the knowledge areas becoming intersections at a higher cognitive level of teaching and learning. In short, focused professional development provides an opportunity for teaching staff to blend the pedagogical needs associated with new hire training and develop the self-directedness required for NERC certification maintenance by increasing their own instructional design and teaching skill sets.

TPACK in the Corporate Setting

The TPACK model provides a solid approach to assisting instructors with the adoption of technologies in their teaching practice. The data gathered via this study has identified the specific knowledge area in need of further support. Qualitative assessment of survey data and the focus groups aided the researcher to identify specific strategies for assisting instructors to better appreciate and adopt a student-centered focus when using technology to provide learners with new knowledge and skills. Corporate instructors are expected to be able to assist staff in collaborative problem solving by using creative and innovative thinking. The trainers use available technology applications, or recommend the tools they require to instruct (Valtonen et al., 2017).

Research Design

The study was an exploratory, qualitative, single department study with an element of simple descriptive statistics with participants from a corporate training department. The research was designed to assist with increasing the professional development and self-efficacy of instructors in a blended learning environment. The findings could contribute to action plans that can been set in motion at the conclusion of this study. Follow on research may be conducted to determine the success of this approach to staff development via action planning and towards the development of blended teaching self-efficacy.

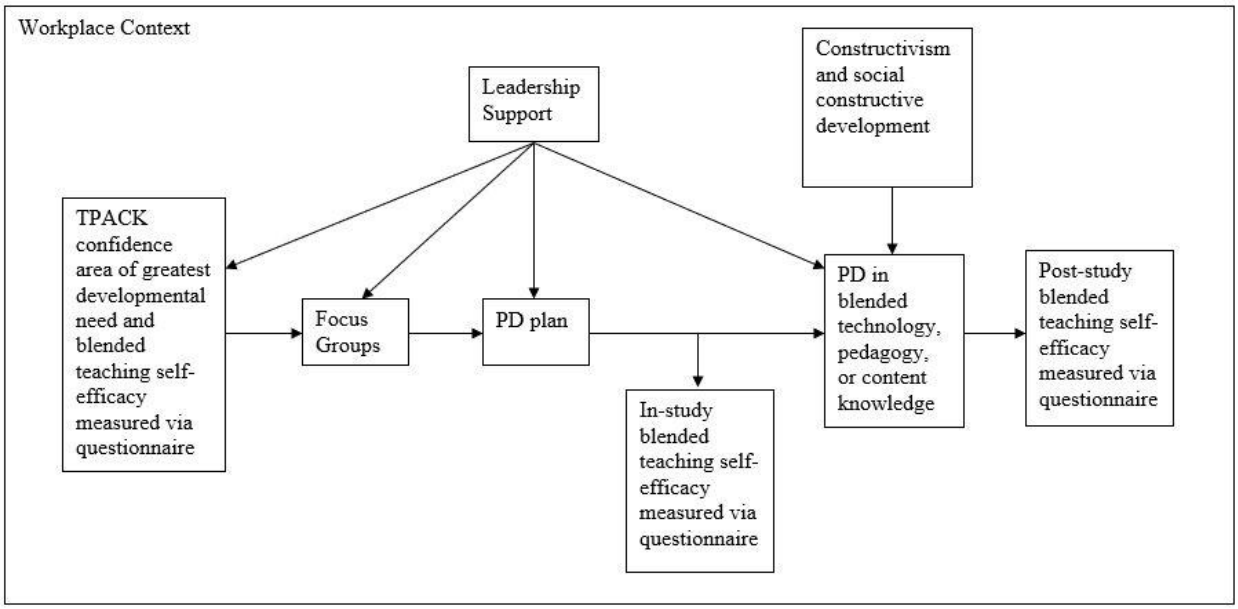
An exploratory design was selected as the survey data was gathered first using a modified TPACK questionnaire in combination with a self-efficacy questionnaire. Later, qualitative data was gathered via focus groups. The qualitative data was used to explain, interpret, and expand upon the basic descriptive statistics as well as the TPACK and self-efficacy scores (Cohen et al., 2018). Restricting the study to a single training department in an electric utility kept the research effort manageable and achievable in a reasonably short period of time. The research design decisions are explored in greater detail in the methodology chapter.

Conceptual Framework

This study was built upon the conceptual framework shown in Figure 2. Staff in the operator training department were invited to participate using the email template shown in Appendix A. The determination of individual confidence profiles using the TPACK questionnaire (Appendix B), and focus group questions (Appendix C), led to the creation of two professional development (PD) approaches for participants with like needs. The creation of the PD plan was generated, in part, using focus group questions to identify the learning need, the time required, and the exploration of available classes or activities where peers and the manager arrive at mutually agreeable solutions that permit them to learn together (Jabareen, 2009). The completion of technology, pedagogy, or content knowledge professional development courses or other learning opportunities based on the PD plan may not guarantee increased self-efficacy. Instructors must also invest in their own development and apply their professional development to their practice (Swaen, 2015). Managerial support for the incorporation of new knowledge and experiences gained through the application of constructivism and social constructive theory are factors that contributed to professional development success. These are shown as supporting elements in the conceptual framework in Figure 2.

Figure 2

Conceptual Framework of the Study



Research Methods and Instruments

The study used a TPACK questionnaire (Appendix B), with question statements modified to suit the corporate training environment in an electric utility, to gather data. In this study, the modified TPACK questionnaire was created from three different questionnaires which are discussed in greater detail in the Methodology chapter. The modified version included both pedagogy and andragogy related questions which are more appropriate for the workplace. Included in this questionnaire was a section that gathered the initial self-efficacy score of each participant. Both questionnaires gathered simple descriptive statistical information that informed the focus group discussions. The focus group discussions provided insight into the reactions to the surveys and how the instructors would like to approach their own professional development. The demographic, TPACK, and self-efficacy data collected, when analyzed for simple descriptive statistics, provided some correlation to the focus group theme data. Survey

information such as gender, age, or educational level did not provide insight to barriers to PD participation but were instead used to identify openness to self-supporting learning opportunities.

The initial self-efficacy score was compared to data gathered following the focus group meetings providing a pre-post non-experimental finding regarding self-efficacy. An increase in self-efficacy was not anticipated following the preparation of the development plan alone which could be seen as a positive outcome. No change may be an indication that the focus group discussions or PD plan alone does not increase self-efficacy. Future research may explore the change in self-efficacy of the study group upon the completion and application of the professional development learning programs.

Microsoft Excel was used to explore the survey data and produce simple descriptive statistics and tabular data. Participant names were replaced with an alias to assist me in maintaining objectivity during the analysis. A table was kept, known only to me, and securely stored, that link the participant's name and alias.

Each participant, prior to engaging in the focus group portion of the study, received a copy of their own survey responses. This permitted them to reflect on their responses prior to the focus group meeting and to have their data for use in those discussions. Aggregate data was not shared with the participants prior to the conclusion of the study. The reasoning was to have the participants focus on their developmental needs and not compare themselves against others or group medians.

To gather qualitative data in this study, purposefully selected participants were invited to participate in a focus group using semi-structured questions. The focus group examined the developmental area of greatest need (i.e., lowest TPACK subcategory score). The purposeful selection sought to delve into one of the three areas of the framework namely Pedagogy

Knowledge, Content Knowledge, or Technology Knowledge. The focus group discussion investigated the participant's responses to their questionnaire data and how they envision improving themselves by documenting a professional development plan. The researcher recorded the plans through inclusion in the focus group transcription. Following the focus group, the self-efficacy questionnaire was administered a second time to determine if there is a change in participant scores. This positioning provided for the following research questions.

Research Questions

The main research question in this study linked the problem, purpose, and goals together. Uncovering the answers to this question is, in part, achieved by posing four sub-questions (SQ) that are answered using the study's methodology. SQ1 and SQ2 were answered through survey data analysis to produce simple descriptive statistics. SQ3 and SQ4 were answered through qualitative data analysis. This approach to research questions was used by Ismil (2020) who determined that teachers struggle with the integration of technology-enhance learning tools in their teaching. His approach to professional development and use of the TPACK framework to resolve this struggle is similar and appropriate in this context as well.

Main Research Question

MRQ: How do training instructors with different technological, pedagogical, and content knowledge profiles vary in their approaches to professional development for blended teaching in the electric utility industry?

Research Sub-Questions

SQ1. To what degree do corporate training instructors possess technological, pedagogical, and content knowledge (TPACK)?

a. To what degree do corporate training instructors possess pedagogical knowledge (PK)?
b. To what degree do corporate training instructors possess content knowledge (CK)?
c. To what degree do corporate training instructors possess technology knowledge (TK)?
d. To what degree do corporate training instructors possess technological content knowledge (TCK)?
e. To what degree do corporate training instructors possess technological pedagogical knowledge (TPK)?
f. To what degree do corporate training instructors possess pedagogical content knowledge (PCK)?

SQ2. Does the teaching self-efficacy of corporate training instructors change with the development of a personal professional development plan?

SQ3. How do corporate training instructors react to their TPACK confidence profiles and self-efficacy score?

SQ4. How do corporate training instructors with different TPACK confidence profiles vary in their approaches to professional development and online training self-efficacy?

Significance of the Study

There is a need for instructional staff to have knowledge of and working experience in technical subjects of the business, instructional design abilities for several modes of delivery, and teaching competency. Employees with operations experience as a minimum may require new knowledge and skills in educational program management, instructional design, and in the

methods of teaching other adults including classroom management. It should also be recognized that some recent hires into the operator training department in this study have extensive instructional design experience in business, leadership, and corporate service, but no electric utility related technical or application knowledge. While electric utility content knowledge is important, so is the ability to develop that content knowledge into superior problem-based lessons and assessment to meet the need for increased blended learning designs (Koehler & Mishra, 2009). The current state of the electric utility business invites research to help solve the staff's need for individualized and collective professional development, transform the department into a learning organization, and position the organization for future success. The creation of development plans through data gathering and analysis should be considered participatory action research which is designed to change and improve the working lives of the participants (Seale, 2018).

The need for professional development is not limited to one company or department in the electric utility industry. The topic of instructor training was raised in a webinar hosted by the North American Transmission Forum. Prevailing belief in the electric utility industry is that there is value in determining approaches to professional development that benefits the industry and its trainers (D. King, personal communication, November 10, 2020). In that webinar, I briefly discussed my research preparation and invited further dialogue. Dialogue may lead to the approach used in this study for the professional development needs analysis, being adopted as a training tool in the electric utility and other industries. This study meets two professional discipline research purposes as described by Mauch and Park (2003). These are "to increase knowledge about a matter relevant to the practice of the profession" and "to create practice, and, generally, to foster and guide the improvement of the profession and its services" (Mauch &

Park, 2003, p. 15). Findings in this study form the initial data set of what may encourage future research in the corporate setting and especially within the electric utility sector (Seale, 2018).

The significance of this study to the industry in general includes two opportunities. First, the conduct of this research has produced findings and recommendations that industry leaders can use to explore the professional development of trainers within individual companies or across the whole industry. Second, this research has produced data that informs other educational researchers who may wish to complete additional investigations in other corporate settings using the methodology described in this report.

For the electrical utility company where this research was completed, the data and findings are the baseline results for the department that participated. Future research, such as longitudinal studies, can be completed that to explore the medium and long-term initiation and completion of professional development. Most important would be an examination of how this study effected the self-directedness of the participants towards their own professional development. Additional investigation can also be initiated that examines the impact on the instructors blended teaching self-efficacy and the use of andragogical approaches in their course designs.

Similar research may also be considered for the two other training departments in the company. It would be interesting to compare the data between the three departments to determine if common professional development needs exist between these departments. This could result in common PD, perhaps as an annual symposium, that all the teaching staff in the company can engage in.

This study will also have value to those in business and in educational settings. Value may be seen from those who are engaged in leadership, change management, and staff

development. Instructors, or those in similar pursuits, may see opportunities for self-improvement through professional development after reviewing the results of this research.

Delimitations

Delimitations are factors that are under the control of the researcher and that serve to limit the study (Mauch & Park, 2003). This study is delimited by investigating the TPACK of instructors in a specific department in a single electric utility company. The study does not examine instructors in other companies in the industry. Given the single department study design, the findings may still be relevant and useful to other instructors or other instructional position titles that teach within the company or other utility companies.

The survey participation window was restricted to a four-week period. Given that the questionnaire may take 45 minutes to complete, sufficient at work time was provided to the participants. Similarly, the focus group was anticipated to require approximately 60 minutes to complete. The time for both these activities was discussed and approved by the director of the division where the study took place (Appendix D).

To address potential for researcher injected bias, my knowledge of the need for professional development was used to guide, but not influence or impact, the study. The scientific method was followed, and researcher impartiality maintained, as an approach to limit bias potentially introduced from my ontology and epistemology (Cohen et al., 2018). To assist, a reflective journal was employed to remind me of the original intent of this study and to identify the need for additional literature investigations. To ensure the best findings and interpretations were made, my supervisory committee was available to be consulted throughout data analysis.

Organization of the Study

This study is presented in six chapters. The preamble and first chapter present a definition

of terms used throughout the study, the background of the problem, the problem statement, the purpose and significance of the study, the research questions, the delimitations, and the limitations of the study. Chapter 2 reviews the literature related to the TPACK framework, the technology knowledge and expectations of formal education administrators, a review of the history of classroom-based technology, 21st century learning and changing classroom pedagogy, barriers to technology implementation, and the professional development and training for teachers and administrators. The second chapter also discusses background information about teacher self-efficacy and several related studies. Chapter 3 provides the research design of the study and identifies the methodologies that were used to conduct the study and collect data. Chapter 4 includes the findings of the study related to the simple descriptive statistics and related data gathered, and present findings related to SQ1. This chapter will also discuss how staff were purposefully selected for focus group interviews in the qualitative portion of the study. Chapter 5 discusses the findings of the study related to the qualitative data gathered to answer SQ3 and SQ4. The self-efficacy questions were offered to the participants a second time after the focus groups which provide findings related to SQ2which are reported in Chapter 5. Resolving the four research sub-questions permits findings to be presented for the MRQ. The final chapter, Chapter 6, includes a summary of findings and presents conclusions, implications, and recommendations for policy, practice, and future research that have been identified through the completion of this study.

Chapter 1 Summary

An exploratory, qualitative, single department study with an element of simple descriptive statistics was completed with participants from a corporate training department. The study goal was to assist with increasing their self-efficacy as instructors for blended teaching. A

modified TPACK model has been discussed that adds andragogy to the framework based on the need to provide training to adult learners that builds upon their existing knowledge and experience. The research design, questions, methods, and significance have been discussed with the goal of improving local instructors using a modified questionnaire that can be extended to a much wider utility audience. The next chapter examines the literature on TPACK and related topics important to this study.

Chapter 2 – Literature Review

The literature review chapter includes an examination of select TPACK and self-efficacy articles and dissertations that compliment my study. Several published articles that challenge the TPACK model are also discussed. Theories that support the TPACK framework and this study are reviewed followed by a discussion of self-efficacy and associated research.

TPACK Studies

TPACK is a relatively new framework with the number of studies available for discussion growing over time. Wu (2013) completed a review of selected journals spanning the period 2002 to 2011. He identified that most studies using TPACK were focused on pre-service teachers. His research contributed to existing knowledge, understanding, and the literature on this topic which can be used in evaluating the developmental requirements of corporate trainers. Wu identified that only two studies were completed between 2002 and 2006 and another 22, completed between 2007 and 2011, where the subject areas were primarily math or science related. The two earliest studies were qualitative-type research while the methodology adopted for the remaining set were a spread of qualitative, quantitative, and mixed methods research. This background shows how simple descriptive statistics and a focus group strategy for the current research is relevant and appropriate for investigating this topic.

Review of Published Studies

One hundred and seven full text, peer-reviewed TPACK studies from the period 2007 to 2011 from the SSCI database were examined (Willermark, 2018). Willermark reported that many of these studies involved an examination of the TPACK among pre-service and in-service teachers and how they used this knowledge for interventions. Researchers, using these interventions, strived to determine the teacher's knowledge or competence when applying their

TPACK ability in teaching practice, especially when adapting to the different situations. The adaptation can be found in three areas (Willermark, 2018). The first is planning by identifying goals and the strategies to achieve those goals including the technology required. Implementation requires the development of an instructional plan along with the ability to adapt the plan when changes occur. The last is evaluating the teaching experience through reflection and using the lessons learned to adapt the plan or its implementation. The planning, implementation, and evaluation process is reasonably like the systematic approach to training (SAT) that has been adopted in the electrical utility sector in North America and in the training department under study here as required by the NERC PER-005-2 standard (North American Electric Reliability Corporation, 2014).

Willermark's study (2018) grouped the articles in three general areas labeled general TPACK, specific TPACK, and experience TPACK. Teachers self-reported their general TPACK in the first group of articles was lacking teaching situation reference or context. An example can be taken from one of the first group of articles survey questions "I keep up with important new technologies" (Schmidt et al., 2009, p. 131). Specific TPACK requires that the teacher respond to a teaching scenario and describe how they would adapt to the situation. Experience-based TPACK has the teacher give examples of how they changed their planning or implementation based on personal experience (Willermark, 2018). General and experience TPACK can therefore be viewed as opposite ends of a continuum and the researcher can determine which is most valuable towards the improvements they wish to implement. For this study, discussed in greater detail in Chapter 3, a questionnaire was used to determine the TPACK knowledge area of greatest need(s) for development. Semi-structured focus group questions assisted in identifying and recording the developmental plans and desires of the study participants. A mixed-methods

approach where quantitative and qualitative data is gathered is the second most popular method of research in this area and can reveal richer appreciation of the TPACK in the participants and the interventions that may be applied (Cresswell, 2014; Willermark, 2018). However, for this study, I used an exploratory design where focus groups explained in richer detail the simple descriptive data provided by the TPACK and self-efficacy questionnaires.

Willermark (2018) postulated that TPACK was dependent on understanding of knowledge areas that were difficult to define and, therefore, the research community did not universally accept the framework. However, one of the important aspects explored was the desire to improve teacher knowledge and its application. The TPACK questionnaire can be adapted for other research settings, location, and participants. Lavadia (2017) adapted the TPACK questionnaire to align with the knowledge and technology content areas for post-secondary science instructors. Examples of studies are discussed next.

TPACK Factor Analysis

A study by Shinas et al. (2013) performed factor analysis of the seven TPACK domains using survey data collected from 365 preservice teachers enrolled in an educational technology course in the United States. Results from this study revealed that participants could make distinctions between technological knowledge and content knowledge but were unable to make distinctions between the remaining domains. Shinas et al. (2013) recommended that more effort is required to explain the TPACK framework as part of the survey introduction and to revisit the instrument questions.

Archambault and Barnett (2010) examined the nature of the TPACK framework through factor analysis. The Archambault and Barnett reasoning was to determine if there were three separate domains which meld together to form the four additional domains suggested by the

TPACK model. In that study, responses from 596 K-12 online teachers from across the United States to a 24-item web-based survey were analyzed. Factor analysis revealed that there were three separate factors in the survey: pedagogical content knowledge (PCK), technological–curricular content knowledge, and technological knowledge (TK) and a strong connection between content knowledge (CK) and pedagogical knowledge (PK). Respondents also reported weaker connections between technological content (TCK), technological pedagogy (TPK), and technological, pedagogical, and content (TPACK) questions. Archambault and Barnett (2010) found that technology, as a knowledge area, stands separately from the positions of teachers that content cannot be separated from the way the subject is taught. Archambault and Barnett supported that the TPACK survey instrument was well developed; the problems existed in how the participants interpreted the questions.

Pre-Service Teacher Confidence

TPACK confidence was measured using the survey instrument with 86 first-year pre-service teachers at a Finnish university (Valtonen et al., 2020). This study used lesson plans with integrated technology requirements that were evaluated using the TPACK framework to determine where the novice teachers were confident and where challenged. The researcher's goal was to assist the teachers in evaluating their own lesson plans and to express their thoughts qualitatively on performance-based tasks done by pupils. The results indicated that TPK was the most challenging area with 39 responses and that PK showed the greatest variation among the participants. The results were further elaborated with statements for each of the domains related to confidence or challenges in application.

Overall, there is value in the importance of content knowledge when incorporating the use of technology in teaching and, also, a quantitative instrument for measuring this is limited

by items and scales (Archambault & Barnett, 2010). In this study, I focused on specific questions about an electric utility company, collecting survey data, and qualitative perspectives gathered through focus groups.

Dissertations Using TPACK

The following dissertations completed by terminal degree scholars provide additional input to various aspects of this study including the example uses of the TPACK framework in dissertations. These examples also demonstrate the approaches other researchers took with respect to the need for professional development and the value of social learning networks in the teaching profession.

Technological Leadership and Professional Development

Depew (2015) identified that teachers, students, and parents in the public-school system had an expectation that technology needed to be integrated into learning. This was in part to compete with private and charter schools and to prepare the learners for the digital and technology-centered future. Depew also identified that innovative teaching was seen as a teacher-level phenomenon noting that it was the principal, politicians, and board administrators who decided the when and how of professional development and the deployment of resources that permit teachers to carry out the change effort. This study uses a different approach where corporate instructors, as professionals, are asked to define their own development plans based on data gathered through a TPACK questionnaire.

Depew (2015) modified and expanded the questionnaire to gather TPACK and technology leadership capacity data from K-12 public school principals using the Principal TPACK Survey and the Technology Leadership Inventory (TLI). TLI measured the leadership skills represented in the International Society for Technology in Education Standards for

Administrators. Depew articulated that principals, the administrators, and the politicians above them, did not receive training in 21st century schooling. He further acknowledged that principals with technology integration experience were often more capable in managing successful programs in their schools. Depew also identified that the TPACK framework can identify the professional development requirements for administrators in a manner that the same framework has identified opportunities for the teachers.

The classroom technology situation in the Depew study location in California is like that of my proposed study, in Ontario, where technology for online teaching has been sparingly adopted (2015). The items listed from Hew and Brush (2007) including the lack of resources, technology knowledge and skills, teacher attitudes and historical traditions regarding teaching in the corporate setting, have a recognizable influence on the failure to adopt technology in their instructional practices. Depew also identified that transformative leadership could change the level of classroom technology adoption to the vision of the future.

The non-experimental descriptive design produced by Depew (2015) used a sample of principals from two counties in the San Francisco Bay Area. Scores for TPACK items that were technology related were lower than those where technology was not a factor (i.e., CK, PK, and PCK) and showed that principals were comfortable with traditional classroom management and instruction. The findings also suggest that females were less comfortable with technology related topics and more comfortable than their male colleagues on pedagogy-related factors. When age was considered, there was a significant finding that the older or longer service as an administrator, the lower the technology score.

Depew (2015) provided several findings that can be applied in the corporate setting. First, TPACK questionnaire data informs about professional development needs. Second, while

principals could advocate and provide funding for technology, they were not equipped to help others with technology adoption and teaching approaches in the classroom. That may be in part due to their own weak participation in learning communities. Third, principals with strong TPACK may also possess strong technology leadership traits. If the leader has strong technology attributes, the teachers and learners may, more readily, adopt technology use (Depew, 2015).

Social Learning Networks

Forssell (2011) investigated the TPACK of 307 board certified teachers in California using an online survey instrument. That focus was on the personal use of technology by teachers and its use with their students. The participants were selected from a variety of grades and subject areas. The investigation was on the learning networks that supported the participating teachers in their learning to use technology in their practice. The findings suggested that their ability to use technology for teaching was different than their confidence in using technology more generally. Higher TPACK confidence was connected to more frequent classroom use of computers and exploration of 21st century skills activities.

In particular, the presence of computers and other technology in the classroom, along with technical support to use the technology effectively, yielded higher TPACK scores. Technology can be viewed as supportive to the learners, and to the teachers too. Forssell (2011) indicated that most support for teachers was in the school setting. That support ranged from knowledge sharing, modelling, and the communication of a vision for the uses of the technology in the classroom.

Well aligned with the goals of my study is the nature of peer and leader support for the development needs as expressed by the teachers themselves (Forssell, 2011). The associated professional development should include collaboration between the research participants, direct

technology instruction, and the formation of supportive networks inside the instructional setting as a means of inviting new approaches into the classroom. Engagement in professional development has the potential to expose the study participants to the practices of other teaching professionals. Such engagement invites the sharing of practices and pitfalls that would not be obtained if additional learning were not attempted.

PD Model for Technology Integration

A case study was used to investigate if professional development, combined with the time to implement new knowledge, would change the way technology was used in the K-12 classroom in a public high school in central Texas (Odajima, 2019). Odajima used a similar, small case study, with an explanatory design and agreed, indirectly, with Depew (2105) and Forssell (2011) that teachers are the primary drivers of change in the classroom. Odajima focused on determining if a TPACK-based PD model influenced the decision-making process (2019).

Teachers in this school participated in regularly scheduled, 45-minute professional development seminars, which were used to gather the qualitative data for the study. All teachers attended the weekly training sessions and completed the Technology Proficiency Self-Assessment from which teachers were placed in high, medium, or low efficacy groups and further grouped by ranges of years of service. Nine participants where then randomly selected from the efficacy and service length criteria for interview. Eight in total agreed to participate in the observation portion of the study.

The findings in the study (Odajima, 2019) suggested that to integrate technology into instruction, the teacher needed to pair instructional strategy with the technology. This integration causes the students to engage with the technology for some creative or collaborative requirement.

This instructional design tactic invites the teacher to shift from a teacher-centered instructional approach, to one that is student centered. Higher rates of adoption were also found with the use of mobile technology for formative assessments and reflective practice. Perhaps of greatest importance was teacher self-identification of a personal growth mindset that aided their ability to make learning more engaging.

An anecdotal observation was made in location of this study that the participating instructors see the need for active learning and problem solving by the learners. This observation illustrates that the use of the TPACK framework can be used to improve the content knowledge, pedagogical knowledge, and then technology knowledge of the staff, preferably in that sequential order (Odajima, 2019). The CK, PK, then TK sequencing is important as the technology cannot instruct or design. Teaching or training must be done by the person designing the course by considering what must be taught, then how, and using which technological approach (Mishra & Koehler, 2006). Instructors need to know how to move from learner-teacher and learner-content foci to one where learner-to-learner interaction exists to explore the content, and how knowledge application is explored through problem solving (Borup & Evmenova, 2019). Concentrating on how technology can be used for instruction, and not on the specific technology, will help with meeting the expectations of the adult learners in the workplace and the blended learning setting (Odajima, 2019).

Related Theories

There are several theories that support the TPACK framework which provided a solid foundation for my study. Graham (2011) was critical of the lack of precise definitions and weak connections between theory and model elements. To aid a stronger appreciation, the TPACK framework pre-supposes that a teacher is a content expert in their chosen field (Schulman, 1986).

A teacher in a formal education setting may have also attended some teacher preparation courses to prepare them for lesson development, teaching, and assessing students. Teaching in the modern classroom also has an additional requirement to add technology into their practice as directed by principals and administrators (Depew, 2015; Koehler & Mishra, 2009). As a result, the teacher must learn how to use and apply teaching technologies, and in this study workplace technologies for power system operations, into their existing knowledge and skills. These supporting theories are discussed next.

Constructivism

Constructivism is seen by some as a theory about how people learn. It draws from the fields of philosophy, psychology, sociology, and education and is important in teacher professional development (Bada, 2015). Others see constructivism as an epistemology and yet others see it as a learning principle or philosophy due to its lack of explanatory power to make it a theory. Constructivism is the foundation of various pedagogies and models employing five principles to provide learners with valuable learning experiences. The principles are (Chan, 2010):

1. Posing problems of emerging relevance to students.
2. Structuring learning around primary concepts.
3. Seeking and valuing learners' points of view.
4. Adapting curriculum to address students' suppositions through mediation.
5. Assessing student learning in the context of teaching.

These principles align well with Knowles' motivations for learning where the learning is active rather than passive in design.

Theorists

Constructivism takes the position that knowledge is constructed in many ways including through the unique experiences of individuals. Vygotsky, Dewey, and Piaget are considered pioneers in this area of cognitive development where they separately encouraged teaching through problems over the memorizing of facts (Frey, 2018). The learning experiences include the interaction of the environment in which the learning takes place, and the social engagements that occur (Schunk, 2012). Piaget is considered a radical constructivist where cognitive development is dependant on the individual's subjective interpretation of their active experience (Brau, 2018).

Piaget (1896-1980) began his research into cognitive development by applying structured observation of his children in the 1930's (Babakr et al., 2019; Egan, 2012). He felt these observations of phenomena were essential to draw out facts identified through regression analysis. His goal was to determine through the scientific method the answer to his question "What conceptions of the world does the child naturally form at different stages of its development?" (Piaget, 1989, p. 1). He kept notes and conducted small experiments such as moving a bottle when the child cried to determine if that child had a good understanding of the existence of the bottle if it could not be seen (Egan, 2012). These observations resulted in his seminal theories on infant and childhood cognitive development by focusing on the child's notion of reality and of causality which change as they advance through the stages of development (Piaget, 1989). He believed that learning occurs by structural reorganization of the mind to resolve cognitive conflicts. The reorganization occurs in four stages of development namely sensorimotor, preoperational, concrete operational, and formal operational, which are ways children view the world (Schunk, 2012). Each of these stages "extends the preceding

period, reconstructs it on a new level, and later surpasses it to a greater degree" (Piaget & Inhelder, 2019). Active learning for children and adults can be achieved through hands-on activity and the creation of incongruity in existing mental models. This challenges the learner to explore different paths and use mistakes as learning opportunities (Schunk, 2012). Piaget's work has been criticized for neglecting social and cultural influences as part of child development and the clear ethical and bias problems associated with studying his own children (Babakr et al., 2019).

Lev Vygotsky (1896-1934) was a social constructivist who believed that knowledge development occurs through social interactions (Brau, 2018). Knowledge is derived from resolving the mental contradictions that result from interacting with the environment and the people within it. A fundamental viewpoint is that humans have the capacity to alter their environment to suit their purposes, which differentiates them from other animals (Schunk, 2012). The developmental change includes the way the previously separate concepts are integrated into the mind which is adaptable (John-Stiener & Souberman, 1978). Vygotsky is quoted "Higher psychological functions are not superimposed as a second story over the elementary processes; they represent new psychological systems" (1978, p. 124).

Constructivist teaching is based on the conscious effort to move from the traditional teacher-centered, transmission oriented, and memorization heavy model to one that is more student-centered. In the new approach, teachers and students collaborate and practice the key skills of summarizing, questioning, clarifying, and predicting. Through these skills, the teacher's role is reduced over time (McLeod, 2018). Such collaboration requires the use of speech which Vygotsky observed is an essential element in problem solving when combined with physical manipulation of the environment. He stated "Children, with the aid of speech, create greater

possibilities than apes can accomplish through action" (Vygotsky, 1978, p. 26). Teachers should not expect adults to verbalize their thought processes during problem solving. In the corporate training setting, instructors can create problems whose complexity, and use of three-way communication as an error prevention tool, encourage interpersonal communication.

The zone of proximal development (ZPD) is probably one of the most widely known aspects of Vygotsky's social development theory (Moll, 1991). Vygotsky described ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (1978, p. 86). The social nature of cognitive development is clear when one identifies the learning that can be achieved through the guidance of a more knowledgeable person. The instructor, or a more experienced peer, is the person who helps bridge the gap between what a person knows and what they could know with assistance (Brau, 2018; Vygotsky, 1978). Social constructivist learning has been criticized because of its reliance on communication which may not be relevant in all cultural situations. In these settings, observation and practice may be more appropriate (McLeod, 2018).

John Dewey (1859-1952) was a psychologist whose perspectives are drawn from the radical and social constructivism camps (Brau, 2018). He felt the world could be made a better place through education and reform (Williams, 2017). His work identified that the existing practice of having children learn in rows and columns, and recite literature from memory, was antiquated. He recommended that learners engage in real-life activities, and solve problems using creativity and collaboration (Gibbon, 2019). He also advocated that school should be seen as a social environment and the student learning needs should drive teacher instruction. Although his

reforms were not always appreciated at the time, he may be one of the most influential philosophers to date (Gibbon, 2019; Williams, 2017).

Constructivism is based on the idea that knowledge can be increased by building upon what is already known (Schunk, 2012). This knowledge creation can be accomplished by solving problems and through the direct use of technologies where the instructor gradually reduces their direct interaction with the student causing them to solve problems on their own (Frey, 2018). In the workplace, these problems frequently involve solving the problem using departmental and corporate processes and procedures. Applied to the instructing staff, the problem can be the creation of the workplace challenges or tasks for the learners, encouraging the attempts to solve the problems themselves, and adapting the lesson or task instructions to ensure there is an appropriate amount of challenge for the learner to overcome (Schunk, 2012).

The adult "need to know" is an important andragogical concept to build upon in the corporate training environment. The need to know is derived from the desire to be able to apply new knowledge to problems in the workplace (Ferreira & MacLean, 2017, p. 11). This need to know is particularly important for online or remotely delivered training where the learners are separated from each other in time, place, or both. Without a frame of reference for the training, the learners may not engage fully in the activities and therefore experience a reduced value from the training effort.

The TPACK questionnaire can be used to determine what knowledge and experience the instructor has now. The data can then be utilized to invite the participant to self-evaluate what new pedagogical, content, or technical knowledge, or mixture of these, they need to acquire. With their supervisor, this extends to the creation of a development plan to increase their ability to apply new knowledge, skills, and attitudes through application.

Social Constructivism

Appreciative Inquiry, discussed later, employs the principles of social constructivism (SC) to create, not discover, a view of reality jointly through experiences with others. Social constructivism and constructivism share the same underlying theoretical roots. SC is primarily associated with child development (Powell & Kalina, 2009). Social constructivism can also be used in the corporate learning setting through the appreciation of several assumptions that can be leveraged while learning in groups. These include (Kim, 2001):

1. Reality is constructed through human activity.
2. Knowledge is a human product and is socially and culturally constructed through interactions with each other and with the environment they live in.
3. Learning occurs when individuals are engaged in social activities.

Vygotsky is the primary theorist who expanded the cognitively focused constructivism by adding the social nature of learning to the work by Dewey and Piaget. This theory, known as the zone of proximal development, has its application in workplace learning as many tasks in the electrical utility setting are not achievable in blended learning settings due to technology, physical security, and cybersecurity limitations. SC emphasises the social nature of learning that is co-constructed by a community of learners who may explore case-based learning in real-world settings (University College Dublin, n.d.).

ZPD is the learning that the student can achieve beyond what they already know or problem solving they can perform independently. Learners must be supported, or scaffolded, as they explore the new material and associated experiences (Powell & Kalina, 2009). Vygotsky and Dewey believed that learners do not gain new knowledge independently or in isolation, they work collaboratively to achieve results. The instructor’s role is to guide learners and establish

opportunities for reflection and social negotiation (Huang, 2002). They also help students become active participants in their learning and provide opportunities to make meaningful connections between past knowledge and experiences, new knowledge, and the processes involved in learning a subject (Bada, 2015).

Learning in a SC classroom is as much about what topic was learned and discussed collectively as well as who the learning took place with during the class (Amineh & Asl, 2015). This approach has been used in health care settings where learners are shown how to carry out their responsibilities in a specific manner as modelled for them, then later adopt them in practice (Mukhalalati & Taylor, 2019). As example in an electrical utility setting, a power system operator is learning how to place in service a large, high voltage electrical transformer. The learner receives instruction on the process and is shown a demonstration of the steps to complete and the telemetry to observe on the control system display. The learner must also be instructed about the alarms to anticipate along with the correct responses to those alarms. The operator then completes the task in a simulation environment before proceeding to real-time operations. For this person, they may connect or retain specific memories of the instructor or their communication along with who was in the class with them while learning.

For instructors, especially those who move from an operations environment to one of instructing, the loss of social connections may reduce their recall or currency of stored experiences. Therefore, providing opportunities to expose them to the company specific operations environment from time to time may stimulate the capture of experiences to share with others in the formation of an instructional community of practice (Wenger-Trayner & Wenger-Trayner, 2015).

Social constructivism provides opportunities for instructors to work together to ensure

designs are of high quality and provide for engaging activities for learners to explore together (Frey, 2018). These problems should be like those the learners will face in the workplace and reasonably replicate the complexity and multi-dimensionality of those they will encounter after training. These opportunities create shared learning experiences which can be applied across the organization, foster teamwork skills, and develop trust through cooperation versus competition (University College Dublin, n.d.; Yang et al., 2004). Such situated cognition provides a frame of reference for the learner to connect what was learned and applied to a problem, in addition to with whom and where the learning occurred (Brown et al., 1988).

Transactional Leadership

Transactional leadership has been discouraged in formal education as this approach often ignores or disregards contextual factors when communications are required to achieve collective goals (McCleskey, 2014). Transactional leadership does contain valuable aspects for the corporate training environment including conformance to standards and procedures, training project management, managing crises, and setting expectation for training programs (St. Thomas University, 2014). Higher education and corporate settings alike are particularly ineffective in creating opportunities for shared leadership often due to distinct differences in decision making and accountability (Kezar & Holcombe, 2017). This can be extended to the responsibility for initiation and organization of the work, providing context and resources, and stating deadlines (Bass, 1990). In many training settings, the leader is in an excellent position, and may also be disciplined enough, to be able to identify opportunities to redirect effort when goals or approaches to delivery are not meeting expectations. Transactional leadership can also be used to ensure reasonable equity in a training department and to balance knowledge and experience of employees through direct training on topics where new knowledge is needed. Reasonable equity

in this context is the offer of a similar amount of training to each instructor, possibly in different topics, to achieve abilities in what they "need to know" to be an effective blended learning instructor (Ferreira & MacLean, 2017, p. 11). Such is the nature of this study where the training department, at the electric utility company where the participants work, has been reluctant to participate in developmental opportunities and grow in specific areas of need. A study has therefore been conducted to involve staff as participants in their own development through the exchange of conversation and for the greater good of the department (Amanchukwu et al., 2015).

Transactional leadership should not be dismissed outright as an old approach to leadership. This leadership approach is particularly appropriate when the leader sets organizational objectives, provides guidance and direction to the team, and leads change efforts when time is short (McCleskey, 2014) while also honouring fairness, responsibility, and respecting commitments made (St. Thomas University, 2014). Exchanging ideas and perspectives between organizational levels can produce positive results in the achievement of goals determined by the leader especially in a high team enablement setting (Wei et al., 2010).

The design of this study uses questionnaire data to identify focus groups where participants may influence others to embrace new values, attitudes, approaches, or technologies for use by the department. The focus group discussions, as a form of leader-member exchange, may generate group agreement for action which the leader can then put in motion as a group action plan (Hogg et al., 2005). Leader-member exchange can be linked to transactional leadership when the leader sets the department goal for the move to blended learning (McCleskey, 2014). Inviting input is not weakness or laisse-faire, instead, the leader is appealing to the reward aspects of the instructors as a way to mold them into the new vision (Bass, 1990; Walumbwa et al., 2008).

Instructing staff in the corporate as well as the academic environment are too often transactional activities. Lessons, modules, courses, and programs are scheduled and taught with an understanding that the learner requires the knowledge and skills to meet their end goals. The instructor receives rewards, often in the form of salary, for delivery of the content as contracted (Bass, 1990). Having a wider knowledge and skills base invites additional rewards. These transactions have the risk that if followed explicitly the instructional materials and approaches, including blended delivery, will likely not change unless influenced by external pressures. Such pressures can include government policy, regulation changes, and local or global health events such as the nCOVID-19 pandemic. New technology or processes can also introduce the need for new knowledge. Another factor is the desire of the learner to be able to complete their studies in alternative formats, modalities, and at non-traditional times of the day. To create the potential for a successful transition to blended learning, a different approach, transformative leadership, is required.

Transformative Leadership

Bass (1990) describes transformative leaders as ones who inspire their staff to look beyond themselves and the current situation towards the future. That future requires intellectual stimulation to find new ways to solve old problems. The extra instructor commitment invested through professional development has the potential to reduce the effort required to complete the work and thus make the department more efficient. Shields (2010) expands upon this requiring the leader to develop an understanding of the organization, its culture, and setting out to redesign it through the development of the staff. Such organizational change must be applied equitably and with a common purpose. TPACK can be the tool used to evaluate what each instructor needs

to know and plan for what they need to do to achieve personal and departmental goals (Liu & Li, 2018).

Appreciative Inquiry

Appreciative inquiry (AI) is an approach to organizational development grounded in social constructionist theory (Orr & Cleveland-Innes, 2015). AI has been used in this study as a method of encouraging the participants through focus groups to describe what in their practice is working and what they are interested in improving. Those desires can then be dovetailed into the overarching departmental goals, at the electric utility company, that evolve over time. This latter statement applies appreciative leadership through the engagement of the leader who participates directly, on issues of direct importance to the staff, and in the change effort (Orr & Cleveland-Innes, 2015). The use of principles from participative theory and leader member exchange theory reduce the power dynamics in the leader-worker relationship during transformational change (Amanchukwu et al., 2015; Power, 2013).

In practice, AI seeks to discover what works in an organization and can be a positive contributor to identifying teacher professional development needs. This is done by examining the lived experiences of teaching staff through reflection that strives to identify common experiences that drive collaborative and collective action (Clarke et al., 2006). AI has also been used as an intervention to assist a higher education lecturer in rediscovering their passion for teaching producing a personalized action plan for their professional practice (Giles & Kung, 2010). A third example is highlighted where a Canadian school district used AI as a means of examining teaching practices in a contentious unionized labour environment. Participants in the study were asked to provide 4 to 5 peak learning experiences one of which was later selected as an exemplar and catalyst for district wide improvement efforts. Like Depew (2015), Burke's (2010) study

identified that the engagement and enthusiasm of leaders produced positive changes in student engagement and empowerment. Transformational effects were also seen through the creation of common identities between teachers and the emergence of informal leaders in individual schools.

Participative Leadership Theory

Participative leadership uses a team-based democratic approach to solving business-related problems. The initial concept of the approach was applied in the Hawthorne experiments in the 1930's led by Mayo which focussed on employee motivations. Rather than employing a top-down approach, members of a company work together to make decisions (Western Governors University, 2021). In other studies, made in the 1930's, Lewin identified that higher levels of participation in the decision-making process resulted in improved performance. Lewin also identified that there are three different leadership styles, democratic, autocratic, and laissez-faire. In the autocratic style, the leader makes decisions and subordinates may be listened to in the process. In the democracy approach, the leader encourages participation, but the final decision-making authority remains with the leader (Belyh, 2020). Laissez-faire leadership is at the other end-of the spectrum where the leader exerts minimal concerns towards their workers, eroding trust and confidence in the organization (Tayfur Ekmekci & Tosunoglu, 2016). Additional positive aspects to the participative leadership approach is increased morale and instructor retention, which would advantageous following an investment in professional development (Western Governors University, 2021). Given the focus groups that were used in this study, participative leadership provided an opportunity for the instructors to have a say in their professional development plans (Yukl, 2011).

Leader-Member Exchange

Leader-Member Exchange (LMX) theory is focused on the relationship between the leader and the follower. LMX may be considered transactional in nature as the leader and subordinates exchange social and material resources to maintain equity and meet the goals of the leader (Hogg et al., 2005; Uhl-Bien et al., 2014). The central principle is that the leader develops different exchange relationships with the followers that impact the quality of those relationships. Effective relationships result in mutual and incremental influence on each other (Avolio et al., 2009). LMX has primarily been focused on the individual level. When groups are evaluated, the ability of some group members to influence others has been identified as reliant on the group identification (Hogg et al., 2005). The focus group discussions in this study are formed based on identifying instructors with similar TPACK scores indicating they may have similar professional development attitudes and goals. An effective leader may be able to assist the group in adopting common developmental pursuits that drive group action. Personal professional development may improve instructional effectiveness which may also increase teaching self-efficacy. A description of self-efficacy and related studies are discussed next.

Self-Efficacy

Self-efficacy is defined as the "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). A teacher's self-efficacy, therefore, is a motivator for long term career success, a factor in reduced stress, and effective toward the use and adoption of new instructional strategies in their practice. Equally, perhaps more importantly, self-efficacy is positively associated with the success of the learners in their classes, regardless of the mode of delivery (Barni et al., 2019). Self-efficacy plays a role in planning, organizing, and teaching, and also influences teacher resilience in the profession

(Tschannen-Moran & Hoy, 2001). Teachers with low self-esteem frequently suffer from low self-efficacy, while those with higher self-efficacy set higher goals and enjoy higher levels of achievement (Schwarzer & Hallum, 2008).

Given the continuing need to adopt blended teaching capabilities, in part due to nCOVID-19, and because of the demands of current and future business requirements, self-efficacy in teaching via new modalities is an imperative for self-preservation. The continuation of blended teaching development need not end once the electric utility staff return to the workplace at the end of the current nCOVID-19 pandemic. Investments in laptops for shift workers and e-learning courses should be leveraged towards blended learning when possible. Professional development may enable instructors to develop new competencies with technology and with teaching in the new modes of delivery (Gosselin et al., 2016). While the developmental efforts can be taken alone, Bandura recognizes that peers can be a potent force in intellectual self-efficacy by modelling academic proficiencies and through direct support of each other in the learning process (1997). When explored with other like-minded learners, teaching staff can investigate and adopt new instructional concepts, that once appreciated, open gateways to additional online learning and teaching (Northcote et al., 2015).

Attempts to measure teacher self-efficacy has been studied by many researchers. For instance, Tschannen-Moran et al. (1998) described a study conducted by researchers at the RAND organization which suggested that strong teacher self-efficacy had positive outcomes for students, and also on the amount of change a teacher was willing to accept. The RAND measure, developed in 1976, had its list of forced choice questions expanded by other researchers who focused on reinforcing students through the teacher's efforts. These instruments were known as Teacher Locus of Control, Responsibility for Student Achievement, and the Webb Efficacy

Scale. Later, Likert-type scale instruments were developed to delve deeper into more global teaching efficacy including motivation, instruction, planning, and enlisting student support outside of the classroom.

Bandura (1977) attributes positive teacher self-efficacy to a person's ability to exercise control over oneself as a response to social and environmental factors that imped personal progress. Positive attitudes are not enough. Self-development also relies on pedagogical concepts about teaching in the classroom, in blended or fully online courses, the technology, and the skills to manage the resources and activities in digital teaching spaces (Gosselin et al., 2016). Professional development courses or seminars on the technology delivered via just-in-time courses can assist the instructors in the their online teaching and have a positive influence on perceived self-efficacy (Northcote et al., 2015).

Tschannen-Moran and Hoy (2001) identified that measuring teacher self-efficacy required an instrument that was specific to the teaching setting that the participants could relate to the questions and respond accurately. The same instrument must also be broad enough to permit generalization of the findings. The Ohio State Teacher Efficacy Scale (OSTES) instrument meets both requirements. It has high reliability and is supported by studies that support its use in this research effort. The OSTES is well organized to gather self-efficacy data from those who teach in a formal or workplace educational setting. The OSTES gathers data on teacher efficacy in areas of instructional strategy, classroom management, and student engagement which are equally important in workplace learning settings and are an aid to examining the professional development in these areas.

Professional Development Studies

In a multi-phase mixed methods study, the learning needs of the faculty at the Avondale

College of Higher Education was evaluated. The participants in the study were classroom teaching staff who were asked to teach courses online. The goal of the study was to develop a tailor-made professional development program, in various forms, for the faculty (Gosselin et al., 2016). The first three phases of the study have been published and are described below.

Northcote et al. (2015) highlighted that in Phase 1, faculty concerns centered on technology adoption and confidence among the participants that face-to-face instruction could be moved online. The faculty saw themselves as unable to manage technology and highlighted infrastructure problems while still encouraging student support and enrollment. To better enable the faculty, professional development courses were provided to address the practical aspects of preparing to teach online. Workshops, mentoring, and support sessions were used to focus on this area of need. These supportive efforts were informed by reflective journals and questionnaires recorded by the faculty (Northcote et al., 2015). However, teaching online was found to severely challenge the theoretical and pedagogical beliefs of the faculty. Online teaching technology added additional cognitive dissonance to the lecturers who were more familiar with campus-based teaching. This disruptive effect also led to course design innovations, and changes in teaching practices and attitudes. To overcome these barriers, the university committed to robust support of the faculty during the change effort (Northcote et al., 2011).

In Phase 2 of the project, data was analysed. That data was gathered through reflective journals that were reviewed monthly to examine online and face-to-face teaching experiences (Northcote et al., 2015). Observations of other faculty teaching online were also recorded in the journals. The data analysis led the researchers to areas of concern and confidence. The data was used to inform the developmental courses offered to the staff. The journal entries indicated that

faculty had conceptual, skills-based, and attitudinal concerns. Increased awareness of infrastructure issues such as technical support, workload and time issues, and lack of clarity of administrative and staff roles that have impact on course efficiency and effectiveness were also noted. These concerns shifted from infrastructure-centered to more student-centred if faculty had more online teaching experience.

The Phase 2 also resulted in a readministered Online Teaching Self Efficacy Inventory (OTSEI) to 17 participating faculty. The result was analyzed to re-evaluate the impact of the professional development programs over the first two phases. The repeated test of the faculty members who participated in both phases of the study showed a significant difference in the mean score for the virtual interaction scale. There were no statistically significant increases in selecting technological resources, unit content migration, online course alignment, and web-based unit structure mean scores although increases in all scales were noted. When comparing across all participants in both phases, minor differences in the results existed (Northcote et al., 2015).

Gosselin et al. (2016) focused on Phase 3 and examined faculty just beginning to teach online. A mixed-methods design was considered as an appropriate approach to provide guidance in investigating what might be constituted as evidence-based decision making when approving professional development courses. Threshold concepts, attitudes, and skills appeared in the findings which were gathered from 38 participants using a 46 question OTSEI (Gosselin et al., 2016). The mean scores for each scale showed an overall increase moving into Phase 3 and a general decrease in standard deviations when comparing across the three phases.

Gosselin et al., in Phase 3, also found that the participants could be further clustered into three categories named enthusiastic embracers, fearful sceptics, and fresh entrants. These terms

are reminiscent of Rogers' (1983) early adopter, innovators, and laggard categories found in innovation diffusion. The findings further indicate that online teaching confidence and self-efficacy are closely tied. Those who show interest in teaching online should be encouraged, and appropriately resourced, to continued experimentation. The qualitative findings also revealed that engaging instructional strategies built a sense of community among the online course participants (Gosselin et al., 2016).

Contribution to the Literature

This study contributes to literature on professional development through the expansion of the TPACK framework in three ways. First, this study expands the framework by including andragogy as part of the pedagogy knowledge dimension which is required in the professional, post-formal education, work environment. Second, the enhanced TPACK framework engages department leaders in investigating and formulating a professional development plan for training instructors to increase blended teaching abilities using data driven decisions. Third, this research becomes the starting point for measuring instructor TPACK in a corporate setting, and more particularly in an electrical utility company setting, through the integration of 21st century technologies in the learning environment (Valtonen et al., 2017). This study also provides input into literature about blended teaching professional development of non-academic teaching staff and the effect educational planning plays in encouraging improved self-efficacy.

Chapter 2 Summary

In this chapter, I explored literature associated with the use of the TPACK framework and self-efficacy measurement in formal education which is used to inform its use in a corporate training setting. The components of the TPACK framework were discussed as well as the need for the use of technology for blended teaching in an electrical utility setting. Several theories

were presented as foundational knowledge that inform this research project toward improving the instructional capabilities of the staff. The concept of self-efficacy was also presented along with a discussion of research studies related to improving teacher self-efficacy through professional development. Together, these collectively prepare us to examine the instructors at an electrical utility and enhance their abilities to teach using technology by building upon what is positive in their current practice and defining those areas that can be improved through professional development. The methodology to gather and analyze the data is discussed next.

Chapter 3 – Methodology

Research Design

This study was an exploratory, qualitative, single department study with an element of simple descriptive statistics of participants from a corporate training department. A single department study is a research study where the data is drawn from a group of participants in a workplace. The design approach is exploratory as the modified TPACK, self-efficacy questionnaires, and focus groups have not been used in a utility setting previously to assist with the development of professional development plans.

This study gathered data from a defined organizational department, with a forward looking viewpoint instead of an examination into the past (Neuman, 2011; Seale, 2018). In this study, the instructors in a single training department in an electrical utility were invited to participate. This study is primarily qualitative in nature as focus groups were used to gather information about how the instructors respond to their TPACK and self-efficacy scores. The survey data establishes a baseline of TPACK and instructional efficacy, as a form of self-analysis, and is further explained by focus group transcript analysis (Cohen et al., 2018). The survey data grouped participants together based on area of professional developmental need which could be one or more of technology knowledge, pedagogical knowledge, or content knowledge.

A focus group is a small group discussion, led by the researcher, that explores a particular topic. This approach has been used in the social sciences, including organizational studies, since the 1940's. The interactive qualities of a focus group, including social exchanges between participants, is a key feature in addition to its ability to generate data quickly (Seale, 2018). Creswell (2007) recommends that a maximum of five open-ended questions be used and narrow

towards the central question in the research study. This recommendation was applied in this study where focus groups were formed to permit discussion about technology, pedagogy, and content knowledge and how the members of the group would carry out professional development together to improve their teaching practice. The same approach was used for participants who required additional power system operations content knowledge or foundational instructional design and teaching skills for blended learning. The focus groups discovered what professional development might be completed with peers. These meetings revealed causal mechanisms that have created barriers to professional development attempts in the past potentially resolved, as part of the professional development solution.

Rejected Research Approaches

Other qualitative research approaches namely Case Study, Narrative, Phenomenology, Grounded Theory, and Ethnography were considered and rejected. Each are discussed below with the rejection rationale.

Case Study

Case study research originated in clinical medicine often identifiable as the patient's case history. When applied in psychology, case studies are often confined to the study of a particular individual and may be atypical or an extreme example behaviour or variation (Creswell, 2007; McLeod, 2019). Case studies are in-depth investigations of a single person, group, historical event or community where data are gathered from a variety of sources and by using several different methods (McLeod, 2019). Data gathering methods include observations, interviews, documents, and records (Creswell, 2007) which are used to examine a specific moment in time to illustrate a more general principle as interpreted by the researcher (Cohen et al., 2018; McLeod, 2019). The information may be primarily biographical and frequently related to

historical experiences (McLeod, 2019). Case study was considered inappropriate in this research effort as the entire department under study was invited to participate and is not biographical or historical in nature (Creswell, 2007). Also, the findings would not be suitable for averaging of the participant data in hopes of generalizing towards other departments or companies (McLeod, 2019).

Narrative

Narrative studies, in qualitative research, are focused on detailed stories told by individuals in oral or written form. This form of research study centers on one or two individuals. The researcher gathers data through the collection of stories and experiences, and organizes them chronologically (Creswell, 2007). Narrative approaches may identify how people construct identities in what is happening around them on multiple social levels (Neuman, 2011). A narrative research design is not suitable in this study as more than two individuals in a department were involved. A chronological history of staff professional development would not be appropriate because the history may be from multiple perspectives.

Phenomenology

Phenomenology is used when the researcher identifies that the first-hand lived experiences about a phenomenon as described by the participants will be suitable for answering the research question (Creswell, 2014). In this approach, multiple interviews are conducted with the same individuals (Creswell, 2007) to determine what things mean to them, and how they make meaning of them (Seale, 2018). This study used a single focus group for each of the TPACK knowledge areas. A phenomenological approach is therefore not suitable as multiple interviews about a common experience for all the participants in this study were not used. Additionally, the participants have not experienced the same phenomenon associated with

corporate professional development and have different general learning experiences up to the time the study was conducted.

Ethnography

Ethnography is a field of research that produces detailed descriptions from the viewpoint of an insider of a particular culture through the lens of the researcher who is investigating content relevant to that culture. Cultural knowledge, including symbols, sayings, facts, and ways of behaving are described to convey an infinite feeling for the setting and how people live within it (Neuman, 2011). Field notes, interviews, and observation are used to gather data (Creswell, 2007). This approach to the study was not suitable because the instructors do not share similar culture or areas of instructional responsibility. The lack of cultural homogeneity, in part from new hires to the department during nCOVID-19 pandemic, was not expected to lead to a common approach to professional development as the newer instructors have not been fully assimilated into the department culture.

Grounded Theory

In grounded theory studies, the researcher strives to derive a general, abstract theory about a process, action, or interaction that is grounded in the views of the participants (Creswell, 2014). In this approach, 20 to 30 people, composed of a homogeneous sample, are interviewed to identify the central theory, based on the actions taken or participated in (Creswell, 2007).

In this study, grounded theory was not suitable as the typical sample is larger that the population of the department under study. Additionally, this study focussed on creating a professional development action plan. The participants would not have completed the actions that are the product of the research effort, therefore, a theory would not have yet emerged.

Research Questions and General Approach to Data Gathering

Survey data was gathered first using an internet-based questionnaire that was sent to all instructors, following informed consent agreement, in the department for two reasons. First, questionnaires gather data quickly for analysis (Creswell, 2014) and provide findings for the main research question and some of the related sub-questions. The main research question is: How do training instructors with different technological, pedagogical, and content knowledge (TPACK) profiles vary in their approaches to professional development and online training self-efficacy at an electric utility company?

Research sub-questions 1 (SQ1) and 2 (SQ2) are also answered using survey data:

SQ1. To what degree do corporate training instructors possess technological, pedagogical, and content knowledge (TPACK)?

SQ2. Does the teaching self-efficacy of corporate training instructors change with the development of a personal professional development plan?

The second reason for using an internet-based questionnaire was that the findings were anticipated to identify knowledge areas of strength and those for improvement. Areas of strength and improvement were then explored more deeply through qualitative semi-structured focus group questions providing confirmation of the survey data. The exploratory, qualitative, single department study design of this investigation was confirmed to be appropriate due to the limited TPACK research into instructor professional development in a corporate setting found via the Athabasca University library database and general internet searches including Google Scholar.

The TPACK and self-efficacy questionnaire was sent to the training department staff by email with a link to the survey instrument. The email included information about ethics approval for the study and a statement that they are free to not participate, and may withdraw until data

gathering is completed, without risk (Athabasca University Research Ethics Board, 2004). Starting the survey was considered agreement to participate (Creswell, 2014). Following questionnaire data analysis, an invitation was sent to invite staff to participate in semi-structured focus groups to explore research sub-questions 3 (SQ3) and 4 (SQ4) more deeply. These questions are:

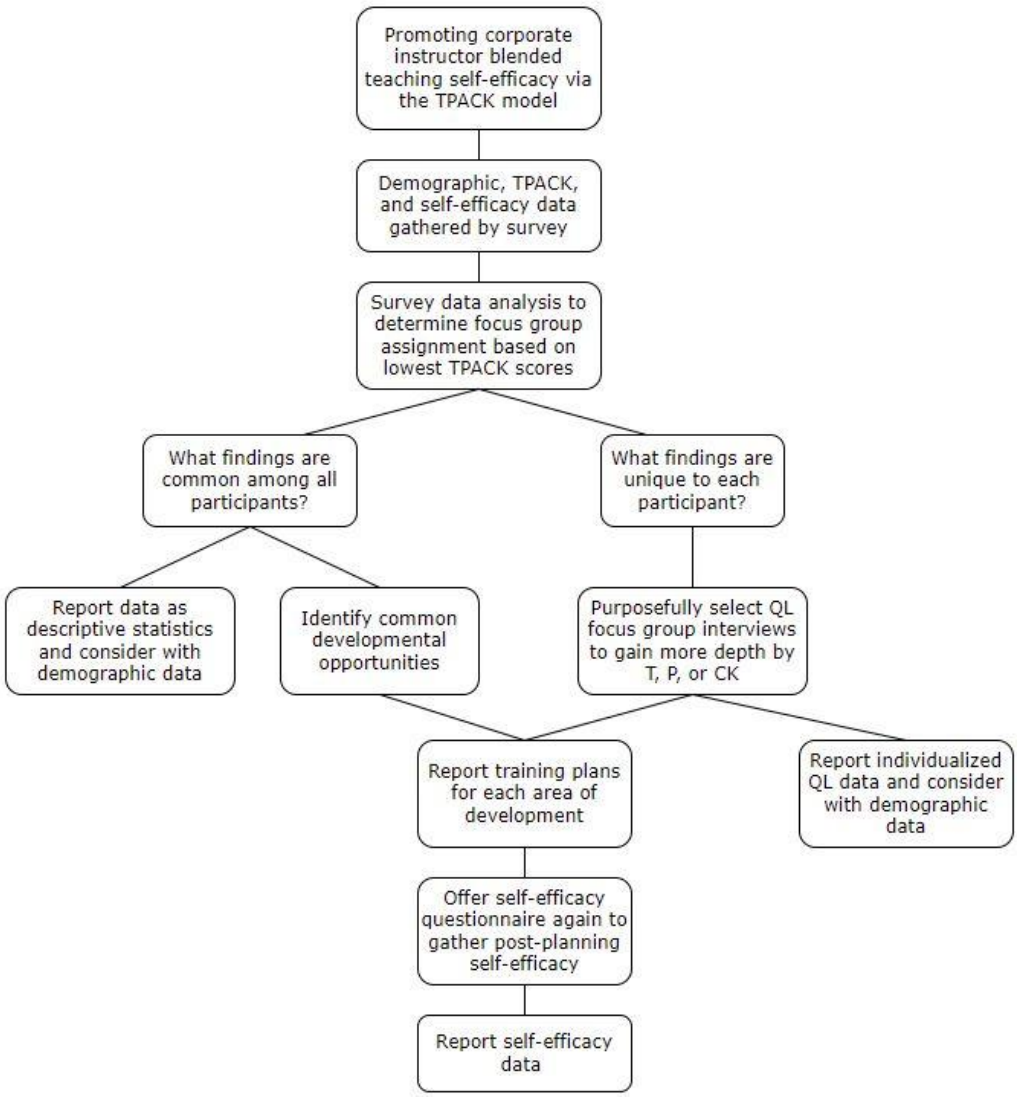
SQ3. How do corporate training instructors react to their TPACK confidence profiles?

SQ4. How do corporate training instructors with different TPACK confidence profiles vary in their approaches to professional development and online training self-efficacy?

Graphically, this study progressed as shown in the flow chart shown in Figure 3.

Figure 3

Flow Chart of the Research Design



Participants

The participants in this study were employees in an electric utility company training department located in Ontario, Canada. There are eight staff members with the Training Instructor job title. Each of these individuals are responsible for performing needs analysis, design, delivery, and assessment of new hire and refresher training programs. These staff

members also work closely with the Operations Division (OD) managers, at the electric utility company, to evaluate training program effectiveness and plan for the introduction of new technologies and work processes to the OD staff. The instructors, at the time of recruitment to the study, have been working in the training department from nine months to over ten years.

The target audience for their training products are approximately 130 twenty-four-hour x seven-day shift staff who operate the Ontario electric power system in roles such as dispatchers, distribution operators, and transmission system operators. An additional 100 technical and engineering staff members can also benefit from the training materials and classes including Outage Planners, Information Technology staff, and Engineering Support staff. The latter two groups have typically not participated in training as the historical concentration of training efforts have been for OD shift staff. This illustrates an opportunity for training delivery through synchronous online, asynchronous e-learning, or blended learning modalities. The instructing staff follow a systematic approach to training that is generally accepted across North America due to the continuing education requirements of the transmission system regulatory body, the North American Electricity Reliability Corporation (NERC) (2019; 2020).

There are also two Simulator Technicians in the training department who have traditionally been responsible for programming, operating, and troubleshooting the distribution training simulator (DTS). For this study, the Simulator Technicians were considered under the instructor title. The DTS is used to conduct hands-on, scenario-based simulations of protection, control, and telecommunications system responses to power system problems that range from simple momentary power line faults to partial or complete power system blackout. Examples of large disruptions that can be simulated include the 1998 Eastern Ontario-Quebec ice storm (Bonikowsky & Block, 2016) and the northeastern US and Eastern Canada blackout in 2003

(U.S.-Canada Power System Outage Task Force, 2004). The job description for these technicians also allows them to design, develop, and implement training instruction as well as administer and grade assessments.

It is important that the needs of the two technicians recruited to this study be investigated. Identifying their professional development needs may assist them to develop their full teaching skill set such that they can contribute to instructional delivery with their colleagues. The technicians have been in the training department for one and two years respectively. They have shown excellent adaptability to program, use, and present simulations remotely via web conferencing technology, in part, due to their use of complex DTS and associated database technologies in their daily work.

Until the nCOVID-19 pandemic, training had been typically delivered through instructor-led sessions in a traditional classroom setting. This approach has not been challenged due to approved access of the instructing staff to the control center and its technologies, and the preference of the teaching staff as well as those receiving instruction, for in-person learning. The requirement for social distancing during the pandemic has driven the need for additional technology mediated learning. This study is well aligned to determine the current state of blended teaching self-efficacy and to investigate solutions that will aid the recruited participants in improving their teaching skillset.

Given the small number of staff in the training department, all nine instructing staff members were invited to participate. These nine represent a purposeful sample, with specific experience in operations training, of all the training staff in the company to whom this research could be extended to in the future (Cohen, et al.; 2018). The same extension is true for operations

instructional staff at other utilities or corporations who may benefit from the approaches used in this study.

Instrumentation

There are many iterations of TPACK instruments available via the internet and journal searches performed through the Athabasca University library. These include Saubern et al. (2020), Valtonen et al. (2017), Kabakci Yurdakul et al. (2012), Archambault and Barnett (2010), and Schmidt et al. (2009). The TPACK-21 instrument was deemed to be most suitable as it includes questions focussed on information and communication technology (ICT) applications and is grounded in the twenty-first century skills and knowledge required by corporate training instructors. The TPACK-21 questionnaire has been validated using confirmatory factor analysis to ensure high internal reliability (Valtonen et al., 2017). The TPACK-21 questionnaire was enhanced by questions from Kabakci Yurdakul et al. (2012), and Archambault and Barnett (2010), and is discussed in Part 2 below.

There are four parts to the survey questionnaire which are described here and available in Appendix B.

Part 1 - Demographic Questions

Eight demographic questions were presented to gather background information that could be used in the analysis. The first questions determined the participant's first name, number of years in the electric utility training department, and the total number of years they have been instructing in any capacity. The participants were also asked to select the highest level of education they have completed, the number of self or professional development instructional training courses completed, and their area of specialization within system operations training. Gathering age and gender information is important to the second research question as how the

participants react to their TPACK and self-efficacy scores, which could be influenced by gender, age, experience, or professional development (D. Wilton, personal communications, November 21, 2020). Aliases and data aggregation, to maintain anonymity and to remove identifiers, were used to prevent possible identification of specific participants when the data and findings are reported in this study.

Part 2 – TPACK Questionnaire

Three TPACK instruments, used in studies conducted by Depew (2015), Tschannen-Moran and Hoy (2001), and Valtonen et al. (2017) were revised and combined to focus on the knowledge areas appropriate for electrical utility operations training. There were no permission requirements to use these questionnaires from the instrument creators (Tschannen-Moran & Hoy, 2001). The questionnaire used in this study was designed with the same number of questions in each knowledge area which provides for the same maximum possible score in each area. The reasons for taking this approach are explained in the Treatment of the Data section. The content knowledge area included electric utility workplace examples that are generalized and common to dispatch, distribution operations, and transmission operations. These are the content areas that an instructor uses to design, teach, and assess the learners, and when evaluating the effectiveness of the training programs. The technology area used company specific examples to better ensure understanding by the instructors.

Adaption of the instrument is recommended by Valtonen et al. (2017) and consistent with other studies (Depew, 2015; Forssell, 2011). To strengthen the technology knowledge area, specific questions from the TPACK deep scale used by Kabakci Yurdakul et al. (2012) were incorporated. To address the addition of andragogy into the model, questions about adult

instructional design and teaching and the interactions with technology and content knowledge, were added to the questionnaire.

The TPACK questionnaire, modified for the proposed study is included in Appendix B; it employed a six-point Likert-type scale as found in the TPACK-21 instrument. A score of one indicates that the participant needs a lot of additional knowledge about the topic and a score of six indicates they possess a great deal of knowledge on the topic (Valtonen et al., 2017). The knowledge area total score is discussed in greater detail in the Treatment of the Data section below. The different five-point Likert-type scales used by Depew (2015), and Jang (2012), were considered not suitable for this study. A neutral position may generate satisficing to self-protect, be ambivalent, or avoid deep self-analysis (Cohen et al., 2018; Seale, 2018). The six-point scale used the opening statements ‘I need’ and ‘I have’ illustrate the areas of developmental need and where the participant has knowledge that requires less or no development as shown below (Valtonen et al., 2017):

1. I need a lot of additional knowledge about the topic.
2. I need some additional knowledge about the topic.
3. I need a little additional knowledge about the topic.
4. I have some knowledge about the topic.
5. I have good knowledge about the topic.
6. I have strong knowledge about the topic.

It remains possible that participants answered with false or misleading responses. The study instrumentation and invitations communicated that accuracy and truthfulness when answering the survey and focus group questions would provide the most accurate data to support their professional development (Seale, 2018).

Part 3 – Self-Efficacy Questionnaire

To determine the teaching self-efficacy of each instructor at the start of this study, the Ohio State Teacher Efficacy Scale (OSTES) instrument was incorporated into the questionnaire (Appendix C). This instrument may be used without copyright restrictions for scholarly research (Tschannen-Moran & Hoy, 2001). The questions in this part of the data gathering replaced "student" with "learner" and "classroom" with "blended teaching". "Coursework" was replaced with the word "learning", and "families" was replaced with "manager" to respect the workplace application of this study. Similar replacements were also done by Robinia (2008). Consistent replacement of these specific words should have no effect on the reliability (Tschannen-Moran & Hoy, 2001).

The OSTES was included to gain a better understanding of the phenomena that create challenges for workplace instructors in their classroom management, instructional strategies, and efforts towards student engagement. The data was used to answer research sub-questions SQ2 and SQ4. The Likert-type scale was used twice in this study to gather pre-post non-experimental findings at the start of the study and after the focus group interviews to determine if there is any change in self-efficacy following discussion and participation in the research. The participants responded by indicating their opinion about each of the questions, selecting any one of the nine responses ranging from (1) "None at all" to (9) "A Great Deal" each representing a degree of self-efficacy on the Likert-type scale.

Part 4 – Open-Ended Questions

Two open-ended questions were posed to the participants in the final section of the questionnaire to provide richer data to the study via free-form text responses. These questions

probed deeper into individual intentions for the use of technology and barriers to adoption as seen by the participants in their current situation.

The questionnaire concluded with a message that individual questionnaire responses would be analyzed and shared with each survey participant. Aggregate data of all the participants in the study was not discussed with interested study members at this stage as sharing individual responses would not be appropriate. The questionnaire ended with a message that semi-structured focus groups would be scheduled with select participants to discuss the data and their responses to the information.

Ethical Requirements

The director of the support division at the electric utility company gave permission for me to conduct this study at their location. An email response to formalize this agreement is attached in Appendix D and was provided to the Athabasca University Research Ethics Board (REB) for their consent to proceed with the study.

In this study location, at the power utility company, there was and continues to be, an influence dynamic which was declared. Discussed below is the nature of my role compared to the participants, the existing power dynamic, potential bias, and related ethical issues in this study.

Researcher Role and Power Dynamics

I am the senior manager and immediate supervisor of the participants. In this role, I control work assignments, time off requests, and equipment and technology purchases. As a manager, I am a step in the approval process for internal corporate training and extramural education or training requests that are compensated by the company. As a manager, I must follow the corporate code of conduct as well as human rights legislation to treat each employee

fairly and equally. This means that I cannot engage in any action that may negatively affect the employee for non-participation in a voluntary activity. I am also bound to the limits of existing policies and procedures when determining what professional development might be approved. Throughout this research, I took an objective position to separate this research from the daily operations of the department. As required by corporate policy and research ethics, I did not overpromise or approve training opportunities that I could not follow through on.

Questions could be raised about participants in a corporate setting freely giving consent by to participate in the survey and focus group meeting. To address this, I followed the recommendation of Athabasca's Research Ethics Board (2004), by including in the invitation to participate letter (Appendix A) and in the questionnaire informed consent section (Appendix B), an explicit statement that the decision to participate or not will have no impact on any aspect of their employment now or in the future. Similar messaging was repeated in the focus group invitation (Appendix E) and focus group informed consent and further articulated that the participants should view me as a student researcher and not as an employee of the company. Participants were free to withdraw from the study up to the time when data gathering was concluded. Given the opportunity to work with the participants directly, and with the aim of assisting them with establishing development action plans, the benefits of using a transformational leadership approach in this exploratory study outweighed the risks. The net value of the research exceeded minimal risk to participants (Athabasca University Research Ethics Board, 2004).

Potential Bias

Seale defines bias as "any error that obscures correct conclusions about the subject being studied" (2018, p. 584). Bias may be injected by my own judgements or interpretations about

data gathered from the survey and the focus group meetings. In the survey data, simple descriptive statistics were communicated as individual and aggregate scores, means, and standard deviations requiring me to be clear when I made interpretations of the numerical data. Regarding the qualitative data, I used direct quotations from the focus group transcripts to clearly delineate where I am making comparisons or connections between participant statements. Above all, I included full descriptions of all the facets of professional development choices being stated without injecting my own preferences above those of the participants. Using a reflexive approach, reporting the exact statements and desires ensures the retention of the findings and acknowledges that such information has been shared through a constructivist relationship between the researcher and those contributing to the study (Reid et al., 2018).

Privacy

Each of the focus group participants had and continues to have the right to privacy. When responding to survey open-ended questions or focus group questions, the participants could state as much or as little as they wished. The in-person focus groups were conducted in a meeting room where there was no potential for eavesdroppers or observers to gain insight to the proceedings. When participants joined the focus group by internet conferencing software, the list of attendees was monitored to ensure that no uninvited persons joined the discussion.

In the focus groups, there was the occasional need to ask someone to explain or rephrase a response to gain a better understanding of their point of view. As a researcher, I made efforts to ensure the discussion also stayed focussed on the question and not drift into other areas. I was prepared to caution against speakers revealing personal information that may leave feelings of stress. To ensure that all had the opportunity to provide their point of view, I asked silent participants to add to the discussion if their viewpoint, perhaps delayed by the need for reflection

or contemplation, could be provided. Since the focus group membership appeared familiar with each other, such requests for engagement centered on ensuring each participant made comment even if to agree with another speaker.

To assist the participant in matters of privacy, they had the opportunity to member check the focus group transcripts they participated in and adjust the record to suit their level of comfort. Member checking is discussed further in the qualitative data gathering section.

Confidentiality

To ensure confidentiality of the participants names gathered through surveys and the focus groups were changed to an alias (i.e., Participant 1). I maintained a table of the participant names and the aliases. The table was treated with the same data security requirements discussed in the next paragraph below. Additionally, corporate specific software applications and other information were discussed at a high level and generalized to ensure there was no confidential or customer specific information inappropriately revealed.

Data Security

All data has been stored on an encrypted and password protected USB flash drive storage device. The portable storage device employs 256-bit AES hardware-based encryption and enforces complex password protection with minimum characteristics to prevent unauthorised access (Kingston Technology Group, 2021). The password is known and accessible only to me. When not in use, the device is stored in a locked cabinet. The data will be retained for five years past the conclusion of my dissertation. The data will be destroyed by deleting the files and the flash drive reformatted to ensure it cannot be recovered.

The Athabasca University REB approved my direct participation in all aspects of research data gathering giving me the opportunity to capture verbal and non-verbal

communications of the participants in my notes (Seale, 2018). Non-verbal indicators have the potential, when interpreted and acted upon, to encourage participation and limit the domination or influence of speakers in the conversation (Tecau & Tescasiu, 2015). Merrill (2021) describes, "professional development is hard to do remotely." The professional development of others is difficult to do remotely too.

My participation in the data gathering aligns closely with my own ontology and epistemology where I can demonstrate my philosophical outlook and genuine interest in their development while not making judgements based on verbal or non-verbal responses or behaviours. My participation was key to demonstrate leadership support of the professional development effort present in the data gathering and professional development planning steps of this study as illustrated in Figure 2.

Data Collection

Survey Data Gathering

Survey data collection was done using the web-based tool Checkbox (www.checkbox.com). Checkbox uses individual logins meaning only the researcher had access to the survey and the data which ensures participant privacy. This data collection service is already in use by the electric utility company and was available to me at no cost. The platform uses computer servers and systems in Canada and all data transmitted between users and the host are encrypted and cyber-secure. The data from this service was exported in CSV format to permit additional statistical analysis using Excel.

The TPACK and self-efficacy survey instruments are included in Appendix B. Each question of survey had its own page in the web-based tool to allow the participant to concentrate on and answer that question before moving onto the next question. The survey also permitted the

participant to move to previous questions allowing them to change a response as they move through. The survey employed save and return functionality, but no participant was seen to stop and resume the survey later. A questionnaire that can be completed in a short period of time reduces survey fatigue which could potentially reduce the number of completed questionnaires and the accuracy of the responses made (Davies, 2019).

The survey was piloted with two people outside of the study. They evaluated the survey presentation and provided advice on the size of font, the organization of the questions and responses, and other formatting possibilities. The Checkbox application provides an accurate indication of the amount of time to complete the survey, averaging approximately 31 minutes in this study, which can be used for additional refinement of future research. The pilot survey-takers provided suggestions for minor improvements to the questionnaire which were incorporated into the final version.

Qualitative Data Gathering

Three semi-structured focus groups were used to gather responses to research sub-questions SQ3 and SQ4. In the focus groups, one for each of the TPACK knowledge areas of technology, pedagogy, and content knowledge, permission as sought from each participant to record the conversation with the automatic transcription software Otter (www.otter.ai). There was only one focus group for each TPACK knowledge area as all five semi-structured questions were answered in that meeting.

The aim of each of the focus groups was to examine the instructor's reaction to the survey data as a means of gathering views and opinions when used with survey questionnaires (Seale, 2018), to explore the areas of greatest professional development need, and perceived barriers to adoption of blended delivery. To illustrate how the TPACK survey locates the lowest

knowledge area and the intervention that can be initiated, purposeful selection to each of the focus groups was used as a means of validating the data (Mauch & Park, 2003). The transcript of their comments stated in the focus group meeting were provided to each participant. The participants were asked to member check the transcript to verify the accuracy of the statements recorded, correct any inaccuracies, and provide any clarifications to the transcription they felt expressed their position on professional development (Birt et al., 2016; Hagens et al., 2009). Member checking has been suggested as an approach to increase rigor, reduce researcher bias, and validate participant experiences in qualitative data gathering (Birt et al., 2016). The participants were provided a Word file to edit using tracked changes which could be returned to the researcher by email if changes were required. An editing period of one week was provided to ensure the study could proceed to the analysis stage.

nCOVID-19 Protocols for Focus Groups

Athabasca University's Research Ethics Board recommended during the nCOVID-19 pandemic that research, where in-person activities are planned, should utilize remote communications technology to conduct any meetings. Cisco WebEx conferencing software was used as work-from-home provisions were still in place at that time. None of the study participants indicated they were uncomfortable in participating face-to-face in the focus groups either in-person or remotely. The participants in this study were well versed in the WebEx conference technology and experienced no problems attending their meetings. A total of five instructors attended via web conferencing software, two in the PK focus group, one in the TK, and two in the CK which is elaborated on in Chapter 5.

Treatment of the Data

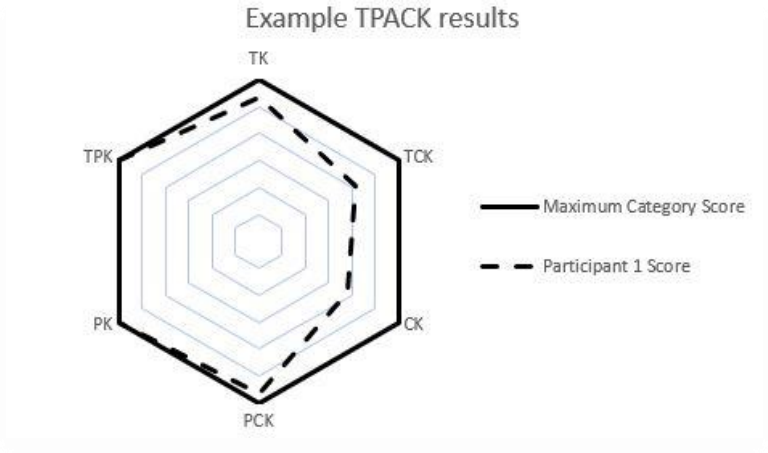
TPACK Data Management

Survey data was analyzed on an individual basis using statistical software to generate scores for each TPACK knowledge area. The scores for each question in a knowledge area (i.e., pedagogical knowledge) were added together to give a total for that area. This approach was repeated for each area to produce seven scores (PK, CK, TK, PCK, TCK, TPK, and TPACK). The data for each participant, less the TPACK score, were illustrated as a radar graph preserving the scores in each knowledge area which may be high or low. Averaging the scores for each knowledge area would potentially hide the extremes, especially when a single low or high score answer is selected. It was anticipated that the graphs would not be centered but have some eccentricity towards the area of highest scores for knowledge areas that have high total score. The eccentricity was assumed as operations trainers are selected based on technical content knowledge. Experience has suggested that pedagogical and technology knowledge are limited. Note that the TPACK score value has not been included in the graph to permit observation of each knowledge area as a separate nominal value. TPACK scores were also examined in tabular format and compared with the other knowledge areas.

Low scores appear closest to the center and were easily identifiable and form the basis of the selection to a focus group. An example of a radar graph for maximum scores on all questions, and data from Participant 1are shown in Figure 4. The Participant 1 data has lower content knowledge (CK) and technological content knowledge (TCK) which illustrates how low scores in an area of the TPACK model can be identified by observation. The example data tends towards the center of the graph only in two content knowledge related categories and therefore is the area of greatest developmental need.

Figure 4

Example TPACK Scores Radar Graph



Aggregate data is shown in tables and analysed for simple descriptive statistical information such as mean, standard deviation, and range, and for the identification of common developmental requirements in the trainer role and area of specialization.

Self-Efficacy Data Management

Self-efficacy data is gathered via a survey that has three areas of focus which are instructional strategies, blended learning management, and student engagement. Each area of focus has eight questions. Each question has nine possible responses which are equated to a numeric value from one to nine. The eight questions in each area add to give a total score, the maximum possible score is 72. These scores were used for basic descriptive statistics which could be considered for correlation with demographic information.

Qualitative Data

Focus group transcripts were first examined by open coding, in the form of provisional codes, to reduce the volume of data into categories and provide interpretation of the responses in conjunction with the survey data (Seale, 2018). Axial coding was then carried out to identify

concepts or conditions that group together for the individual participants, by focus group, and across all the attendees (Neuman, 2011). Selective coding was the last pass through the data to look for themes or broad generalizations that may be present (Neuman, 2011). NVivo version 12 software was used to assist with the analysis and theme generation.

Chapter 3 Summary

This research study investigated the TPACK of a corporate training department using an explanatory, qualitative, single department study design. Nine participants in two job titles, referred to as instructor in this study, were asked to complete a modified TPACK-21 and OSTES questionnaire. The data from the survey portion of the study was returned to the participants for their consideration and used as a means of selecting individuals for focus group interviews. Preference in selection was for participants with a low technology, pedagogy, or content knowledge score, to be grouped together. Three semi-structured focus groups were conducted to determine the reactions to their scores and what new professional development they would like to pursue. The interview was transcribed, verified, and coded with the goal of identifying themes that would be generated to explain the thoughts, feelings, and proposed actions of the participants. Findings, including any correlations that appear, will be reported in the next two chapters of the study report.

Chapter 4 – Questionnaire Data and Findings

Overview

This chapter describes the survey questionnaire data collected during the study. Chapter 4 includes the purpose statement, the MRQ and one research SQ that are associated with the TPACK and Ohio State Teacher Self-Efficacy Scale (OSTES) questionnaires portion of the study. A description of the research methods and collection procedures used, a summary of the population and sample, and the data gathered are presented. The findings based on the questionnaire data is discussed to illustrate how the TPACK results were used to form three focus groups namely pedagogy, technology, and content knowledge. The qualitative research methodology, data, and findings are discussed separately in Chapter 5. The two-chapter approach was used as data gathering, analysis, and documenting these findings was completed as two separate activities and as two separate engagements with the study participants. Future research could be conducted using one or both data gathering activities, depending on the available time and the nature of the data the researcher is interested in using, to make professional development (PD) related decisions.

This study employed two instruments in one survey questionnaire that was made available to the population. The survey questionnaire included demographic questions, a modified TPACK questionnaire, the OSTES, and two open ended questions (Appendix B). These were made available via a web-based survey to gather demographic information about the research sample and the TPACK and blended teaching self-efficacy as self-assessed by corporate training instructors. The data from that analysis is presented in this chapter.

Purpose Statement

The purpose of this exploratory qualitative, single department study was to investigate whether a modified TPACK framework can aide in defining professional development plans for blended teaching in a corporate training setting.

Questionnaire Related Research Questions

This study seeks to answer the following main and sub research questions:

MRQ: How do training instructors with different technological, pedagogical, and content knowledge profiles vary in their approaches to professional development for blended teaching in the electric utility industry? Answering the main research question is achieved in part through the first research sub-question which is stated below.

First Research Sub-Question

SQ1. To what degree do corporate training instructors possess technological, pedagogical, and content knowledge (TPACK) for blended teaching?

a. To what degree do corporate training instructors possess pedagogical knowledge (PK)?
b. To what degree do corporate training instructors possess content knowledge (CK)?
c. To what degree do corporate training instructors possess technology knowledge (TK)?
d. To what degree do corporate training instructors possess technological content knowledge (TCK)?
e. To what degree do corporate training instructors possess technological pedagogical knowledge (TPK)?

f. To what degree do corporate training instructors possess pedagogical content knowledge (PCK)?

It is important to note here that data is presented related to the second research sub-question which was SQ2: Does the teaching self-efficacy of corporate training instructors change with the development of a personal professional development plan? The initial set of self-efficacy data was gathered via part 3 of the questionnaire, the modified OSTES instrument, and reported later in this chapter. This research question cannot be fully analysed in this chapter as the OSTES was offered a second time, following the focus groups, as discussed in the conceptual framework of this study (see Chapter 1). Full treatment will be made later in this study.

Research Methods and Data Collection Procedures

This study employed two instruments in one survey questionnaire that was made available to the population via a web-based survey tool known as Checkbox (www.checkbox.com). The survey questionnaire included demographic questions, the modified TPACK questionnaire, the modified Ohio State Teacher Self-Efficacy Scale (OSTES), and two open ended questions (Appendix B). The data from that analysis is presented here.

A research invitation message (Appendix A) was sent by email on October 26, 2021, to all the training department staff who had teaching or instructional design responsibilities. The invitation contained general information about the study, informed consent statements, and a link to the survey instrument. The population included seven with the Training Instructor job title and two Technicians who program and operate the Distribution Training Simulators that support task-based learning. The invitation was also sent to one instructor who is on temporary assignment in another department.

The questionnaire remained open from October 26 to December 3, 2021, to accommodate the full-day teaching schedules of several of the participants who were engaged in training courses that were several weeks in length. A reminder email was sent on November 30, 2021, to those who had not yet participated. Overall, the research invitation and questionnaire were sent to ten employees with teaching responsibilities.

Population

The population of this study was power system operations instructing staff in an electric utility company training department located in Ontario, Canada.

Sample

Seven instructors and two technicians in the department responded to the questionnaire. One instructor on temporary assignment outside the department did not participate. Eight of the questionnaires were fully completed. One of the questionnaires had all parts completed except for Part 3, the OSTES, which was partially completed. Unanswered questions in the OSTES portion of the questionnaire were not scored. To preserve anonymity, the alias Participant, followed by a number assigned based on the order in which the questionnaire was completed, is used when describing specific responses. Anonymity is further preserved through the aggregation of responses and discussed as group analysis.

Questionnaire Completion Time

The research invitation (Appendix A) suggested the questionnaire may take between 45 to 60 minutes to complete. The low value of this range was based upon the average time required by the two people outside the study who attempted a trial of the questionnaire plus a 50% margin. The average of their completion times was approximately 29 minutes which was

rounded to 30 minutes plus a margin of 15 minutes. The high value of the range was determined by doubling the average trial completion time.

The participants completed the questionnaire in an average of 31 minutes and 8 seconds. The shortest completion time was 12 minutes and 44 seconds, the longest was 52 minutes and 37 seconds. This suggests that the estimated time completing the questionnaire could be reduced to 30 to 45 minutes if used in future research.

Demographic Data

Participants were asked to respond to several questions asking for demographic information and professional history to better describe the sample. Data from these questions is summarized in Table 1 and in following paragraphs.

Table 1

Participant Demographic Data

Characteristic	N (9)	%
Age range		
25 – 34	1	11.1
35 – 44	2	22.2
45 – 54	5	55.6
55 – 64	1	11.1
Gender		
Female	3	33.3
Male	6	66.7
Highest level of education		
College 3-year program	2	22.2
Some university courses	1	11.1
University 4-year degree	3	33.3
Some Master’s courses	1	11.1
Master’s degree	1	11.1
Some doctoral courses	1	11.1

Table 1

Participant Demographic Data

Characteristic	N (9)	%
Area of specialization		
General topics	1	11.1
Distribution dispatch	2	22.2
Distribution operations	3	33.3
Supervisory and leadership development	1	11.1
Transmission operations	2	22.2

The participants were also asked to supply information regarding the number of years they had been teaching within the department, the number of years teaching in any capacity, and the number of previous professional development (PD) courses they have completed. This data is summarized in Table 2.

Table 2

Participant Teaching and Previous Instructional Professional Development Courses

Characteristic	M	SD	Range
Teaching, in department (years)	3.11	4.00	0 – 14
Teaching, any capacity (years)	16.44	8.93	3 – 33
PD courses (number)	6.22	5.63	1 – 20

Analysis and Discussion of the Demographic Data

At the department level, the demographic data informs us that most of the teaching staff are in the age range of 45 - 55 years old. Age is coupled with the number of years of teaching in the department (Mean (M) = 3 years) which is skewed as one instructor has been in their role for 14 years. This is illustrated by a large standard deviation (SD) of 4 years and a range of 0 to 14 years as some staff have been in the department for only one or two years and have had limited direct teaching responsibilities. This is the case for the simulator technicians who traditionally

have not taught but supported training. Professional development (PD) would assist them in achieving their full capabilities for blended teaching.

The training personnel are assigned to the different subject areas that the department is responsible for. There is one instructor each in general topics such as safety and one who focuses on supervisory and leadership courses which, due to the infrequency of delivery, are prime subjects for blended or fully online delivery. Dispatch and distribution operations instruction is the major area of delivery. The greatest number of instructors are working in distribution and transmission operations training areas. The higher volume of distribution dispatch and operations training are due to recent operations reorganization and merger of two positions necessitating a large cross training program between these two functions.

The demographic data provides information regarding the formal education level achieved by the participants. These range from the completion of three-year college diplomas to three participants who have started or completed graduate level studies. The data provides an interesting observation that those participants who completed graduate level courses or programs are more likely to have completed professional development courses. Those who complete graduate level courses were also seen to report their age in the 45-to-54-year range but had not worked in the department for longer than two years. As examples, one participant with some Master courses has completed more than ten PD courses. The participant who completed a master’s degree, has taken eight PD courses. The instructor who has completed some doctoral courses, has also completed over 20 PD courses suggesting that higher education levels consider life-long learning an essential activity. In contrast, those who had completed college and/or undergraduate programs had between one and six professional development courses credited.

TPACK Questionnaire

The questionnaire used in this study consisted of six questions in each of the seven TPACK domains (PK, TK, CK, PCK, TPK, TCK, and TPACK) for a total of 42 questions. To answer each question, the participants were presented with a series of first-person statements on a six-point Likert-type scale. A score of one indicates that the participant needs a lot of additional knowledge about the topic and a score of six indicates they possess a great deal of knowledge on the topic. Table 3 provides a summary of the responses grouped by TPACK domain. The combined mean and standard deviation (SD) for each TPACK domain are included.

The six-point scale employed in the questionnaire used the opening statements ‘I need’ and ‘I have’ to illustrate the degree of developmental need as shown below (Valtonen et al., 2017):

1. I need a lot of additional knowledge about the topic.
2. I need some additional knowledge about the topic.
3. I need a little additional knowledge about the topic.
4. I have some knowledge about the topic.
5. I have good knowledge about the topic.
6. I have strong knowledge about the topic.

Table 3

Summary of TPACK responses

Sub-Scale/Question	M	SD
Pedagogical Knowledge (PK)	4.48	0.36
PK1: I can select a particular strategy best suited to teach a specific concept related to the learner's job description.	4.78	1.31
PK2: I can use a variety of teaching strategies to relate various concepts to learners.	4.89	1.20
PK3: I can support learner's reflective and critical thinking.	4.56	1.17
PK4: I can guide learners in planning their own learning.	3.89	1.37
PK5: I can guide learners to make use of each other's thoughts and ideas during group work (2-8 learners).	4.11	1.59
PK6: Supporting learners' task related problem-solving skills.	4.67	1.15
Technological Knowledge (TK)	4.18	0.36
TK1: I can solve ICT and related problems.	4.22	1.13
TK2: I am familiar with technologies for teaching and their features.	3.56	1.50
TK3: I can use new teaching technologies.	4.22	1.62
TK4: I know several websites about new teaching technology.	4.22	1.55
TK5: I know how control room technologies work.	4.56	1.07
TK6: I can use control room technologies.	4.33	1.41
Content Knowledge (CK)	3.70	0.23
CK1: I have sufficient knowledge to develop content for power system operations.	3.78	1.75
CK2: I can plan the sequence of concepts taught within my class.	4.67	1.05
CK3: I know the history and development of important theories and practices in power system operations.	3.56	1.57
CK4: I am familiar with recent research in power system operations.	2.78	1.31
CK5: I am familiar with power system outage planning.	3.44	1.26
CK6: I am familiar with control room work processes.	4.00	1.25

Note. The sub-scale/question mean and SD are presented in the order that the questions were asked in the questionnaire.

Table 3

Summary of TPACK responses

Sub-Scale/Question	M	SD
Pedagogical Content Knowledge (PCK)	4.26	0.25
PCK1: In power system operations, I know how to guide learners' content-related problem solving in groups (2-8 learners).	4.00	1.15
PCK2: In power system operations, I know how to assist learners in noticing connections between various concepts in a curriculum.	4.67	1.15
PCK3: In power system operations, I know how to guide learners to make use of each other's thoughts and ideas in group work (2-8 learners).	4.33	1.33
PCK4: In power system operations, I know how to to anticipate learner's misconceptions within a particular topic.	4.33	1.41
PCK5: In power system operations, I know how to guide learners in planning their own learning.	3.89	1.37
PCK6: In power system operations, I know how to guide learners' problem-solving skills.	4.33	1.41
Technological Pedagogical Knowledge (TPK)	4.03	0.20
TPK1: I know how to create an online environment which allows learners to build new knowledge and skills.	3.67	2.00
TPK2: I know how to use ICT in teaching as a tool for learners to plan their own learning.	4.11	1.45
TPK3: I know how to use ICT in teaching as a tool for sharing ideas and thinking together. TPK4: I know how to implement different methods of teaching online.	4.22	1.13
TPK4: I know how to implement different methods of teaching online.	4.22	1.23
TPK5: I know how to use ICT in teaching as a tool for learners' problem solving in groups (2-8 students).	3.89	1.52
TPK6: I know how to use ICT in teaching as a tool for learners' critical and reflective thinking.	4.11	1.52

Note. The sub-scale/question mean and SD are presented in the order that the questions were asked in the questionnaire.

Table 3

Summary of TPACK responses

Sub-Scale/Question	M	SD
Technological Content Knowledge (TCK)	3.98	0.64
TCK1: I know websites with online materials for studying power system operations.	3.67	1.25
TCK2: I know ICT-applications which are used by instructional staff in power system operations.	3.44	1.17
TCK3: I know ICT-applications which I can use to better understand the topics of power system operations.	3.22	1.40
TCK4: I know technologies which I can use to illustrate difficult concepts in power system operations.	3.89	1.52
TCK5: I know how to use technological representations (i.e., multimedia, visual demonstrations, etc.) to demonstrate specific concepts in power system operations.	4.89	0.87
TCK6: I can implement job and task related curriculum in an online or blended learning environment.	4.78	1.13
Technological Pedagogical Content Knowledge (TPACK)	4.15	0.21
TPACK1: In teaching power system operations, I know how to use technology as a tool for encouraging online interactivity among learners.	4.22	0.79
TPACK2: In teaching power system operations, I know how to use learner assessment technology to modify online instruction.	4.11	0.87
TPACK3: In teaching power system operations, I know how to use technology through online learner feedback to modify instruction.	4.11	0.74
TPACK4: In teaching power system operations, I know how to use technology to predict learners' skill/understanding of a particular topic.	3.89	0.99
TPACK5: In teaching power system operations, I know how to use technology to create effective representations of content that depart from theoretical knowledge.	4.56	0.83
TPACK6: In teaching power system operations, I know how to meet the overall demands of online teaching.	4.00	1.25

Note. The sub-scale/question mean and SD are presented in the order that the questions were asked in the questionnaire.

Analysis and Discussion of the TPACK data

Responses to the TPACK questions from a low of 2.89 (CK4: I am familiar with recent research in power system operations) to a high of 4.89 (PK2: I can use a variety of teaching strategies to relate various concepts to learners, and TCK5: I know how to use technological representations (i.e., multimedia, visual demonstrations, etc.) to demonstrate specific concepts in power system operations. Mean scores for the TPACK domains tied to content knowledge (CK and TCK) generally scored lower than those not related to content knowledge (TK, PK). PCK, TPK, and TPACK domains appear to be in the middle of these two extremes for unknown reasons. In the aggregated data, no score exceeded 5.00 suggesting that the instructional staff have some knowledge in each of the knowledge areas that could be improved though some form of PD.

Individual question standard deviations range from a low of 0.74 (TPACK3: In teaching power system operations, I know how to use technology through online learner feedback to modify instruction) to a high of 2.00 (TPK1: I know how to create an online environment which allows learners to build new knowledge and skills). The lowest standard deviation for the TPACK3 question raises concern about participants' understanding the question. It is true that feedback is gathered during instructor-led training, but that feedback is usually gathered on paper forms. Occasionally, learners provide their feedback by submitting the form to the instructor by email, which may provide an explanation. The highest SD of 2.00 can be explained by the department generally not teaching online although two of the participants have greater experience and higher post-secondary education, from demographic and teaching experience data, related to this mode of delivery.

During the continuing nCOVID-19 pandemic, only a few courses or course segments have been taught via synchronous sessions. This is particularly true of classes that employ specific operations technologies for outage management and power system control. These technologies have security restrictions and large bandwidth requirements that would be challenging to use effectively outside of specifically approved training facilities. However, these statements contradict the mean score for TCK question 6 (TCK6) of 4.78 (I can implement job and task related curriculum in an online or blended learning environment) with a SD of 1.13. This suggests that half the respondents require some development in the technology content knowledge domain as illustrated by the median shown in TCK1 through TCK4. It is interesting to note that if the reader considers the TPACK questions from the general technology use for training such as PowerPoint and the technology used in power system operations, the instructing staff have skills that can be expanded.

As previously discussed, the large SD for each question averages 1.28 across all questions and TPACK domains. The large variability of the scores is further illustrated by the small SD in each sub-scale of approximately 0.32 except for TCK where the SD is 0.64. Such variability of the data requires that we approach each participants TPACK profile individually to determine their professional development in the domain of greatest need. The approach was previously described in the section TPACK Data Management in Chapter 3 where TPACK domain scores are added together. Using Participant 1's data as an example, the domain totals are shown in Table 4.

Table 4

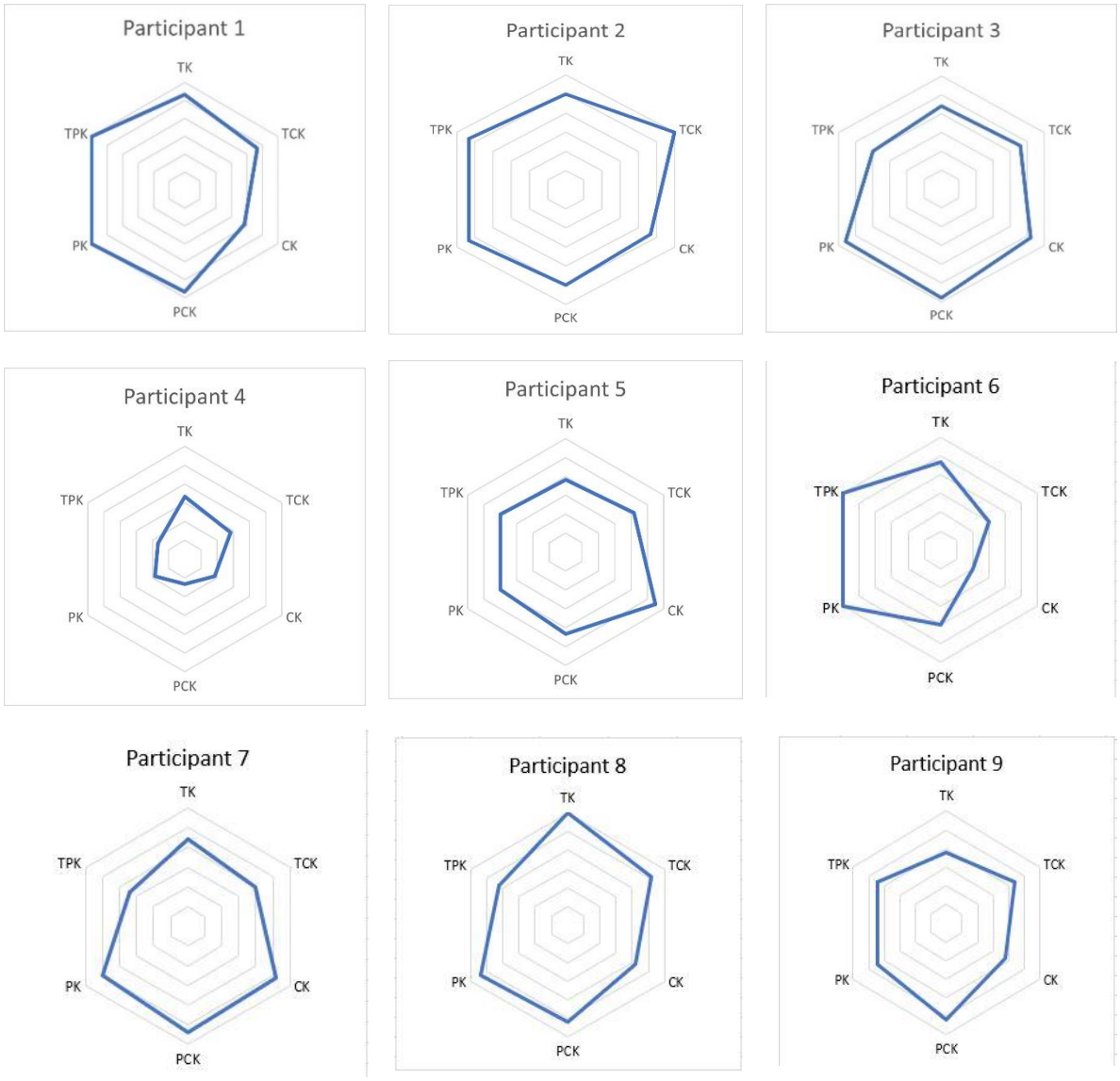
Participant 1 TPACK Domain Scores and Totals

	PK	TK	CK	PCK	TPK	TCK
	6	6	4	5	6	3
	6	6	6	5	6	3
	6	6	3	6	6	3
	6	6	2	6	6	4
	6	4	4	6	6	6
	6	4	4	6	6	6
Total	36	32	23	34	36	25

The totals suggest that Participant 1 has a professional development need related to Content Knowledge as that primary domain total score is lowest. This PD need is also seen in the TCK domain which related to using power system technology to convey its use to learners. The same approach was used to create the radar graphs as shown in Figure 5.

Figure 5

Participant Radar Graphs



Note. The blue line in each graph is the total score that intersects with each TPACK domain axis label. Graph gridlines in grey are scaled at six-point intervals to a maximum of 36 points in a domain.

Focus Group Assignments

Using the radar graph methodology described in Chapter 3, three participants will be used as examples to explain the focus group assignments. Participant 1 has a data shape that tends away from the CK primary TPACK domain and the TCK interaction domain, they were assigned to the Content Knowledge focus group. Participant 3 has a data shape that tends away from the TK primary domain and the TPK and TCK interaction domains. They were assigned to the TK focus group. Participant 5 has a data shape that tends away from all TPACK domains except for CK. They were assigned to the PK and TK focus groups. The focus group assignments of all participants are summarized in Table 5.

Table 5

Participant Focus Group Assignments

Participant Number	PK Focus Group	TK Focus Group	CK Focus Group
1			X
2		X	X
3		X	
4	X		X
5	X	X	
6			X
7		X	
8			X
9		X	X
Total	2	5	6

Table 5 illustrates that many of the instructors believe their pedagogical knowledge is high. This may be a result of them having previous formal education or engagement in extra-curricular activities such as coaching in sports. It is also evident in the demographic data that these study participants have some previous experience teaching in corporate settings.

It is interesting to note that Participants 4 and 5 have the least direct instructing assignments in the department, using the first question from Table 2, and the data shows lower PK related knowledge from their TPACK PK scores. It is also identifiable that Participant 9 has a TPACK profile that is strongest in PCK. This may be due to their current assignment in developing content and lesson planning in the dispatch function where they work with a more expert and experienced instructor. This partnership may be providing knowledge that can be mimicked and used as a frame of reference in that area of work.

The focus group assignments were sent by email to the participants on December 7 and 8, 2021 as the data analysis was completed. The discussion of the focus groups will be provided in Chapter 5 of this study.

Instructor Self-Efficacy

The third part of the questionnaire included a modified Ohio State Teacher Self-Efficacy Scale (OSTES) to determine each participant's self-assessment of their abilities in classroom management, blended learning management, and student engagement. There were eight questions in each of the categories which were scored on a Likert-type scale ranging from a minimum of one (None at all) to maximum of nine (A great deal).

As previously mentioned, Participant 5 has not had direct teaching assignments. They answered the first six questions in the classroom management section of the OSTES, then did not answer any of the remaining 19 questions. In order to not insert researcher bias, Cohen et al. (2018) suggest that the researcher evaluate if the missing data will seriously change the findings of the analysis. It is my analysis that the missing data will not jeopardize the study nor alter the general findings as the full self-efficacy data set is derived from approximately 88% of the participants. The missing data generally increases the mean for the unanswered questions by an

average of 0.7 and reduced the SD by an average of 0.7 illustrating the homogeneity of the responses gathered. The responses to the OSTES self-efficacy questions are summarized in Table 6 which includes a column reporting the number (N) of completed responses for each question.

Table 6

Summary of OSTES Responses

Sub-Scale/Question	N	M	SD
Classroom Management (CM)		7.44	0.43
CM1: To what extent can you use a variety of assessment strategies?	9	7.44	1.26
CM2: To what extent can you provide an alternative explanation or example when learners are confused?	9	7.89	0.99
CM3: To what extent can you craft good questions for your learners?	9	7.44	1.57
CM4: How well can you implement alternative strategies in your blended teaching?	9	6.22	2.25
CM5: How well can you respond to difficult questions from your learners?	9	7.44	1.71
CM6: How much can you do to adjust your lessons to the proper level for individual learners?	9	7.44	1.34
CM7: To what extent can you gauge learner comprehension of what you have taught?	8	7.63	0.86
CM8: How well can you provide appropriate challenges for very capable learners?	8	8.00	1.00

Note. The sub-scale/question mean and SD are presented in the order that the questions were asked in the questionnaire.

Table 6

Summary of OSTES responses

Sub-Scale/Question	N	M	SD
Blended Learning Management (BLM)		7.30	0.48
BLM1: How much can you do to control disruptive behavior in blended teaching?	8	7.25	1.48
BLM2: How much can you do to get learner to follow blended teaching rules?	8	7.00	1.41
BLM3: How much can you do to calm a learner who is disruptive or noisy?	8	7.50	0.87
BLM4: How well can you establish a course management system with each group of learners?	8	6.50	2.24
BLM5: How well can you keep a few problem learners from ruining an entire lesson?	8	7.75	0.66
BML6: How well can you respond to defiant learners?	8	6.75	2.05
BLM7: To what extent can you make your expectation clear about learner behavior?	8	8.00	0.87
BLM8: How well can you establish routines to keep activities running smoothly?	8	7.63	0.70
Student Engagement (SE)		7.16	0.26
SE1: How much can you do to get students to believe they can do well in their learning?	8	8.00	0.87
SE2: How much can you do to help your learners value the process of learning?	8	7.38	0.99
SE3: How much can you do to motivate learners who show low interest in their learning?	8	6.63	1.32
SE4: How much can you assist managers in helping their workers do well in blended learning?	8	7.13	1.62
SE5: How much can you do to improve the understanding of a learner who is failing?	8	7.38	0.70
SE6: How much can you do to help your students think critically?	8	7.25	1.20
SE7: How much can you do to foster learner creativity?	8	6.75	1.20
SE8: How much can you do to get through to the most difficult learners?	8	6.75	1.20

Note. The sub-scale/question mean and SD are presented in the order that the questions were asked in the questionnaire.

Analysis and Discussion of the Self-Efficacy Data

The analysis and discussion of the OSTES data is divided into three sections, one for each of the sub-scale groups of questions. The discussion is presented in the order of the questionnaire.

Classroom Management

The overall mean for this category of questions is high (M=7.44) with a narrow SD of 0.43. Such a high score suggests that the participants generally have a high degree of comfort preparing and using a variety of teaching and assessment techniques in their lessons. The highest scores for questions on a per-participant basis are given by those with higher formal education and with more classroom teaching experience either in this department or other settings.

One question, CM4 (How well can you implement alternative strategies in your blended teaching?) stands out for further examination for two reasons. First, the department has not traditionally taught online or employed blended teaching until the onset of the nCOVID-19 pandemic. As a result, only a few courses or teaching topics have been delivered synchronously using web conferencing software. Also, the instructing staff have not had access to a suitable web-based learning management system (LMS) which could be used for content and assessment management. As a result, the distribution of learning materials has relied on email and SharePoint, meaning there is little tracking of learner engagement with the content and security of assessments.

Second, those instructors with graduate degrees and previous access to LMS during their work score very high on the 9-point Likert-type scale (score range 7-9). In contrast, those staff without previous exposure to LMS and blended teaching gave response scores ranging from 5 to 8. This suggests that previous blended teaching can be brought forward and used in settings

without the resources typically available to academia. This also suggests that alternative teaching and assessment strategies may be unlikely to be adopted if the staff do not have previous experience learning or teaching in blended settings.

It should be noted that the department has recently acquired an academic quality LMS. Instructors with previous exposure to the LMS began to use it immediately. Other staff have begun to explore the LMS and are beginning to identify best use cases as trial opportunities. Since the LMS was not available prior to the initiation of this research, it would be advantageous to repeat the study to identify changes in scores that could be the result of using such systems in the corporate training environment.

Blended Learning Management

The blended learning management sub-scale had responses like the classroom management section. Here the sub-scale mean was 7.30 and the SD = 0.48. Instructors with graduate degrees and previous online experience stand out a little more from their counterparts. Comparing education level data (from Table 1) to their individual OSTES BLM sub-category scores revealed an interesting finding. Those with higher education responded with scores ranging from 7 to 9. The remaining participants gave scores ranging from 5 to 7, with the occasional score of 8. This may illustrate that previous teaching and learning, via a variety of modalities (from Table 2), provides the frame of reference to design and teach using multiple approaches. Providing additional professional development may therefore be key to preparing multimodal designs that best fit the available time and business purposes of the training over past practice.

Two questions in the blended learning management section of the OSTES instrument warrant additional examination due the larger SD reported for each. The first is BLM4 (How

well can you establish a course management system with each group of learners?) having M = 6.50 and SD = 2.24. The lower mean and larger SD may be due to both previously discussed circumstances where the participants do not have previous experiences creating and leading blended instruction.

The second is BML6 (How well can you respond to defiant learners?) M = 6.75, SD = 2.05. The lower mean and larger SD are due to one participant scoring this question as 2. It is unclear if the score was due to a focus on lack of blended teaching experience or difficultly in managing defiant learners, which could occur in any educational or training setting. It is also possible that due to the nature of corporate training that instructional staff are preparing lessons and assessments for adult learners who are likely better able to self-regulate their emotions. These adult learners, who are also subject to internal corporate and external regulatory requirements, may better appreciate the nature of corporate learning focused on job related knowledge and skills, over the rewards associated with achievement of the learning outcomes.

Student Engagement

The student engagement sub-scale had the lowest mean (M = 7.16) and the smallest standard deviation (SD=0.26) of the three sub-scales in this part of the questionnaire. Individual responses varied from 5 to 9, with only one participant consistently providing a maximum score. Interestingly, participants with higher formal education generally score responses lower than in other sections. In the data, Participant 1 provided the most marked reduction in scores compared to other sections of the OTSES questionnaire, with 5 as the average response. It is also identifiable in the data that questions SE3 (M = 6.63, SD = 1.32), SE7 (M = 6.75, SD = 1.20) and SE8 (M = 6.75, SD = 1.20) scored lower than others. These questions deal with student motivation, creativity, and the use alternative instructional techniques. The lower student

engagement scores may be due to the instructors not using a variety of learner-centered approaches to instruction while also having to follow approved practices in the manner work is carried out. These responses will be raised again in data gathered in the content knowledge focus group.

Open-Ended Questions

Two open-ended questions were asked in Part 4 of the questionnaire. These questions asked the participants what technology they were considering for use, and what barriers to the adoption of these technologies they were anticipating. The responses aimed to inform the researcher about what technologies the participants were considering for future use. Future adoption may require the allocation of funding for acquisition and professional development to optimize their use.

Technology

Software was a common reply from the participants. Examples that are not part of the Microsoft Office suite used for content development included Enable Now, Lectora, and InDesign which may output SCORM compliant files. Participants also identified several subscription-based internet applications they felt could assist them such as Session Lab, Canva, Miro, as well as e-journaling sites. Functions that typically exist in learning management systems received several responses. These were discussion forums and other learner engagement tools, H5P, quizzes, and surveys. Last, synchronous communication facilitation technology such as WebEx and WebEx Training received several responses although these technologies were already widely used in the department at the time of the study due to nCOVID-19 occupancy restrictions.

Barriers to Adoption

The barrier to adoption question was critical to this research as it identifies what behaviours and attitudes might need to be overcome. In some cases, the replies were unexpected, in others, the participants were considering how the deployment of new technologies or approaches might be perceived by class participants. The responses included the need to be permitted to enter the control room which has been impossible during the nCOVID-19 pandemic. One participant noted that staff receiving training often avoid engaging in alternative modalities as these require increased training rigor or are simply different than their preferences or previous experiences. Another participant identified that the learners see training as having low incentives for engagement in course activities.

The most frequent response regarded the use of technology by trainees. Study participants identified the trainees struggle with using only one computer monitor. This is a factor as classroom and simulator-based training employs six screen monitor arrays which are identical to the real-time operations consoles. Other participants identified that personnel undergoing training struggle with web-based applications due to browsers or software being out of date. Technology adoption learning requirements, requiring detailed instructions, was also identified three times. These responses suggest that learning to use technology may be as important as using the technology to show how to perform work tasks.

Major Findings in the Questionnaire Data

Research Sub-Question One

The first research sub-question asked to what degree do corporate training instructors possess technological, pedagogical, and content knowledge (TPACK)? This question is answered by

addressing the six knowledge domain questions below plus the seventh group of TPACK specific survey question.

Pedagogical Knowledge

The first sub-sub-research question explored the degree to which corporate training instructors possess pedagogical knowledge (PK). The mean score reported for all the instructing staff is M=4.48 and standard deviation (SD) of 0.36. This suggests that the teaching staff have some, but not a command of, pedagogical knowledge which include processes and practices or methods of teaching and learning (Koehler & Mishra, 2009). The adjective 'some' is used as the mean of 4.48 falls between the survey score choice 4 "I have some knowledge of the topic" and score 5 "I have good knowledge about the topic". This is considered a major finding as a training department relies upon instructors being able to prepare and teach lessons.

Content Knowledge

The second sub-sub-research question sought to determine the degree of content knowledge the corporate training instructors possess. This study's findings indicate that on average, the participants have marginal knowledge in this area illustrated by M = 3.70 and SD = 0.23. This finding is concerning as content knowledge provides the nature and structure of the subject to be conveyed to learners, and especially how it relates to other facts in theory and in practice (Schulman, 1986). This is a major finding as the man suggests that the department on average is report that it has some knowledge about the content they are required to instruct.

Technology Knowledge

The third primary TPACK domain scored between PK and CK with M = 4.18 and SD = 0.36. This finding illustrates that the participants have on average limited capabilities in being able to use, and to explain to others how to use, technologies for instructing and for use in

operating the power system. Given that the mean is only slightly positive as related to the TPACK score definitions, it is apparent that TK needs to be improved within the department.

Interactions Between Primary TPACK Domains

The fourth, fifth, and sixth sub-sub-research questions sought to identify the degree to which corporate training instructors possess technological content knowledge (TCK), technological pedagogical knowledge (TPK), and pedagogical content knowledge (PCK). For PCK and TCK, the average scores for each of these interactive domains fell between the primary scores. PCK (M = 4.26, SD = 0.25) falls between the means of PK and CK. TCK (M = 3.98, SD = 0.21) falls between the means of TK and CK. In these two cases, the findings suggest that weakness in more than one domain knowledge area compound to limit the ability of an instructor to develop and deliver lessons, regardless of modality, if they do not possess the underlying content knowledge of the discipline that includes the nature of the work.

TPK (M = 4.03, SD = 0.20) reported a mean score that was lower than the means for PK and TK. TPK is, by definition, a teacher's knowledge of the ways in which both teaching and learning change with the addition of technology, including the learner's ability to use it adequately (Koehler & Mishra, 2009). This finding is not surprising as the staff have made some progress providing remote instruction but continue to struggle with moving technical instruction to a blended model. The newly acquired LMS may support the move to some quality of blended material, testing, and class management. Indeed, a few of the instructors have embraced such moves. But these changes must be made both through additional instructor development, as well as guided demonstration to the learners to support their adoption.

Interaction Between Pedagogical, Technological, and Content Knowledge

The interaction of all the TPACK subdomains is brought together in the seventh group of questions. These questions primarily asked about the participant's ability to prepare, teach, engage, and modify their courses based on the use of technology, for online instruction. The mean score for the participants was M = 4.15, SD = 0.21. The responses to each questions ranged from 2 to 6. TPACK4 (In teaching power system operations, I know how to use technology to predict learners' skill/understanding of a particular topic) stood out from the other questions with M = 3.89, SD = 0.99. Here, the instructor's own knowledge, if not sound, would likely be unable to determine if the learner could adequately perform a task using corporate technology and work processes. The mean for this question illustrates that on average, the instructing staff have a little knowledge about how to use technology to predict a learner's understanding of the instructional topic.

The final question in this part of the questionnaire also deserves discussion. TPACK6 (In teaching power system operations, I know how to meet the overall demands of online teaching) had a mean of 4.00 and SD = 1.25. The variation of responses was the largest of all the questions in this section. This is not surprising as staff have only begun to teach topics remotely. This finding is positive as it demonstrates increasing confidence to teach online having had opportunities and the experience of trial and the application of lessons learned. Like all the TPACK questions where the mean was slightly above 4.00, TPACK6 informs us that the teaching staff have limited of knowledge about how to meet the requirements for teaching online. It is therefore easy to identify that further professional development would aide most of the staff.

Chapter 4 Summary

The presentation of the questionnaire data was structured to address the first research question and contributes to the second research question. Of all the TPACK questions, PK (M = 4.48) and PCK (M = 4.26) were given the highest scores by the participants. The PK and PCK sub-scale means suggest that the department some ability to prepare lessons related to power system operations. TK (M = 4.18) and TPK (M=4.03) scored in the middle of all grouped responses implying that the instructing staff cannot manage and explain some of the technology related to their assigned area of operations. The mean near the lowest Likert-scale positive response suggests there is much more professional development needed to begin to move instruction towards a blended delivery model. The last group responses to CK (M = 3.70) and TCK (3.98) where the lowest observed. Approximately half of the participants have been in the department for a short period of time with approximately half of the participants reporting less than two years as utility trainers, which is a short period of time. The data also illustrates that professional development is needed to increase content knowledge about power system operations tools and how to prepare to teach those using alternative modalities. Overall TPACK integrated questions (M = 4.15) further identifies that the participants have a little knowledge about how to teach online. This provides a good indication that professional development is needed to grow the skills of the trainers.

The OSTES questionnaire data revealed that the participants had a relatively strong self-assessment of their abilities to manage the classroom (M = 7.44) and engage students (M = 7.16). Their ability to deal with blended learning environments scored somewhat lower (M = 6.22). This is not surprising as the move to remote delivery is new to the department due to nCOVID-19 restrictions. Specific survey questions were identified that show us that employing alternative

teaching strategies, managing the blended learning environment, and coaching learner behaviours provide good places to start professional development.

The participants also identified their initial preferences for understanding how corporate technology is used in real-time operations. Frequently, the technology listed were often the same currently being used in the department. This has been limited for the more recent hires due to the pandemic. They also noted personal and learner barriers to successful learning that were frequently technology age and user preference related. These comments provide some indication of what the instructor must deal with beyond the preparation for direct teaching.

Overall, the approach to selecting participants to focus groups was easy to accomplish using the described data analysis methodology. Two Participants were selected for the PK focus group, five for TK, and six for CK. Reporting of the focus group data and findings is discussed next in Chapter 5.

Chapter 5 – Focus Group Data and Findings

Overview

This chapter describes the qualitative data collected during the focus group portion of the study, and an analysis of any change in the participant's teaching self-efficacy that may have resulted from their engagement in this research. Chapter 5 restates the purpose statement, the main research question (MRQ) and three research sub-questions (SQ) that are associated with the qualitative portion of the study. The research methods and collection procedures used in the second part of the study including a summary of the population, the sample, and the data gathered, is described. The findings based on focus group transcript analysis and self-efficacy scale analysis are also reported in this chapter.

Purpose Statement

The purpose of this exploratory qualitative, single department study with an element of simple descriptive statistics was to investigate whether a modified TPACK framework can aide in defining professional development plans in a corporate training setting.

Focus Group Related Research Questions

Focus groups were used in this study to provide additional depth to the survey questionnaire data. This was accomplished though the analysis of the focus group transcripts to answer the following research sub-questions which are stated below.

Research Sub-Questions

The three research sub-questions addressed in this portion of the research study are:

SQ2. Does the teaching self-efficacy of corporate training instructors change with the development of a personal professional development plan?

SQ3. How do corporate training instructors react to their TPACK confidence profiles and self-efficacy score?

SQ4. How do corporate training instructors with different TPACK confidence profiles vary in their approaches to professional development and online training self-efficacy?

Answering SQ2 will be done last as the change in self-efficacy data was gathered after the focus groups were held.

Research Methods and Data Collection Procedures

This study employed three focus groups, one each for the TPACK technology (TK) pedagogy (PK), and content knowledge (CK) domains. Participant selection methodology to one or more of the focus groups is described in chapter 4. In total, two participants were assigned to the PK focus group, five to the TK focus group, and six to the CK focus group. The data from focus group analysis is presented here.

A focus group invitation message (Appendix E) was sent by email on December 7 and 8, 2021, to the nine training department staff who had participated in the questionnaire portion of the study. The meeting invitations gave the participant the option to attend the meeting in-person, or via WebEx, a virtual meeting conferencing service. The latter option was required due to the university ethics and the corporate social distancing requirements in response to the nCOVID-19 pandemic. In total, seven participants were able to attend one or more of their assigned focus groups. The focus group invitation included a copy of that participant's questionnaire responses which provided an opportunity for them to reflect on their submissions prior to the meeting.

An electronic copy of the focus group informed consent form (Appendix F), which included specific agreement for the researcher to record the audio of the discussion for transcript production, was attached to the email. All participants who attended one or more of the three

focus group either submitted their informed consent by email or completed the form at the start of the meeting.

Pedagogical Knowledge Focus Group

The PK focus group was held on December 10, 2021, starting at 10:00 am and lasted approximately 45 minutes. Two participants, given aliases 4 and 5 attended this meeting through the WebEx conferencing application. There were no other attendees. Two pages of researcher field notes were made as the discussion took place to capture impressions and noteworthy statements that might have value in later analysis.

Technology Knowledge Focus Group

The TK focus group was held on December 16, 2021, starting at 10:00 am and lasted approximately one hour and six minutes. In total, five participants were invited to this discussion. Participant 2 attended this meeting using the WebEx conferencing application and participants 3, 5, and 9 attended in person and followed the company nCOVID-19 precautions. Participant 7 did not return a response to the invitation. One page of researcher field notes was made as the discussion took place.

Content Knowledge Focus Group

The CK focus group was held on December 17, 2021, starting at 10:00 am and lasted approximately one hour and fifteen minutes. Six participants were asked to join this discussion. Participants 2 and 6 attended this meeting using the WebEx conferencing application. Participants 1, 3, 8, and 9 attended in person in a large meeting room that permitted social distancing. All in-person participants wore face masks as per provincial mandate and company policy. Participant 4 responded in advance of the meeting that they were not able to attend the focus group. Four pages of field notes were taken during the meeting.

Focus Group Transcripts and Member Checking

During each focus group, the researcher recorded the audio using the Otter transcription software. The Otter application saved research time by producing an audio recording of the meeting and simultaneously creating a text file of the conversation. The meeting record files were downloaded at the end of each meeting and saved to a secure USB memory device.

Once all focus group session were concluded, I reviewed the transcriptions. In the first pass review, I added participant names to each of the text passages by listening to the speaker's voice in the audio recording. This was to assist each participant in examining their own statements when given the opportunity to member check the transcript. In the second pass through the transcript, I made corrections to the transcription text when incorrect words or phrases were made in the text file. This was done by comparing the audio to the text which may have been too quiet to be recorded or if other noise was present that prevented an accurate transcription. Overall, the Otter application was approximately 85% accurate.

In the third and final pass through the transcripts, I removed repeated words and pause fillers that did not add value to the research (Quora, 2022) . Removing these was an attempt to prevent embarrassment to any of the participants when they reviewed their responses as they thought through their contribution to the discussions while making them.

The completed transcripts were sent to each of the focus group participants as an email attachment on January 4, 2022 (see Appendix G). I requested that participants make necessary changes to the transcripts and return them by January 14, 2022. If no response was received, the transcript was considered accurate.

Participant 2 responded on January 6, 2022, that the review was complete and accurate. Participant 6 responded on January 14, 2022, with an edited copy of the CK transcript. The edits

made were typographical corrections that made the statements more grammatically correct or improved sentence structure. The changes did not alter the nature of the statements made.

With the member checking completed, the audio files recorded during the focus groups were permanently deleted from all storage devices. The participant names recorded in the transcripts were changed to the aliases determined by the researcher. The participant-alias table was securely stored in a digital location, with password known only to me. These changes effectively eliminate the ability of anyone to reconstruct the identity of the participants based on the discussion here by connecting the qualitative data with the questionnaire data presented in Chapter 4.

Transcript Analysis

The member-checked transcripts were analyzed using NVivo 12 software. Provisional codes, known as nodes in the software, were created based on reflections on the focus groups and the preparation of the transcripts. The provisional codes were Technology, Pedagogy and Blended Delivery, Content Knowledge, Blended Delivery, Peer Collaboration, TPACK Confidence, Professional Development, and Researcher Guidance. These codes were based on the research questions, the focus group questions, and the overall study goals (Saldaña, 2016). The last code, Researcher Guidance, was created to extract my comments and questions from the transcript to concentrate on the participant's. The transcripts were then imported into NVivo for analysis.

In the first pass through the transcript, I coded large passages to establish the general nature of the responses given by each participant. These were examined on a per focus group basis using the eight provisional codes treating each transcript separately. Each transcript was then analyzed using descriptive coding to further refine the basic passages of data to identify the

topic being communicated. This second pass resulted in one or more child codes being created within the provisional parent codes. New parent codes were established where a passage did not connect to one of the provisional codes. For clarity, the words codes and nodes are used interchangeably.

As example, TPACK Confidence is related to the TPACK questionnaire data. The child nodes Accurate (13 references) and Struggle (7 references) were created to differentiate if the participant felt the questionnaire results were accurate, or if they struggled with interpreting the result. These two child codes were aggregated to the parent TPACK Confidence which had 24 references in total.

As a second example, Blended Delivery had the child codes Challenges, Instructional Design, Learner Assessment, On-the- Job, Reflection, and Remote Learning. These codes were all related to statements the participants made that related to how they might alter their courses to become more blended in nature, and how they or the learners might be challenged to accept that design approach.

In total, the first pass coding resulted in a total of 14 primary or parent codes. Five parent codes had one or more child codes. The participant responses are discussed where relevant findings appeared from the first pass through the transcripts.

Analysis, Discussion, and Findings from Transcripts by Focus Group Question

This section discusses the analysis of the focus group transcripts by presenting and discussing the responses to each of the questions posed.

Focus Group Question One

The first question posed to each focus group was “What were your initial thoughts or feelings when you received your TPACK and self-efficacy questionnaire results?” The responses

were coded to the TPACK confidence node, and further subdivided as Accurate and Struggle. The Accurate position gathered thirteen references, while seven were connected to Struggle. The Accurate related responses included the statements below, in the order in which they were made.

Pedagogical Knowledge.

These responses are related to the TPACK Pedagogy Knowledge accuracy. When I saw the results, it basically confirmed what I was already thinking. I think the survey did a pretty good job of identifying potential areas for development. (Participant 5).

"I think I have to agree with what [Participant 5] said. It does highlight [where development is needed]" (Participant 4).

Technological Knowledge.

These responses are related to the TPACK Technology Knowledge accuracy. I found the scores were pretty reflective of what I thought they would be, the areas I know I struggled with and identified. Things that I thought I did pretty well, and reflected that as well, as I thought the scores were very valid (Participant 5).

I just want to say that when I looked at it and reviewed the marks, it was as I anticipated, in my comfort level of different platforms. So, I thought it was reflective of my knowledge base and technology. Okay, that's my accuracy to it and how I interpreted it (Participant 9).

"I believe I answered honestly at the time, so I think that it was an accurate reflection" (Participant 3).

Content Knowledge.

These responses are related to the TPACK Content Knowledge accuracy. "I wasn't surprised at all. I knew that was an area that was a weak area for me" (Participant 2).

> The content [knowledge] is not available somewhere else outside the job practice. So, somebody doesn't have the background of that particular job, it's very hard for them to master the content. So, for me, that was an expected result, and I had no surprise at all (Participant 6).

"I expected to show that I had a weakness in this component [Content Knowledge], and so, I wasn't surprised when I got the results back. And it was good constructive criticism and where to develop from" (Participant 9).

One response illustrates deeper self-analysis of the TPACK scores. Participant 8 commented:

> I'm an expert, I would say in one area of actual operations, I would put myself below novice on my understanding of where I haven't worked. So, I'm on the fence on, on where I stand, it depends on what area [of training delivery] we're talking about.

Discussion

These responses show that the TPACK questionnaire generally produced an accurate summary of the participant's knowledge in the TPACK domain of greatest need. Another response similarly shows critical analysis of the focus group question and how it may be interpreted by the participant negatively which was coded as Struggle. Participant 1 said:

> I find it interesting that we're talking about this, like weak areas and criticism. I didn't take it as criticism and just like, yeah, it's a struggle, not like it's not revelatory. I kind of more to [Participant 6's] point. There are things I need to know. And I'm going to need to know them. So yeah, they're no surprises.

Participant 2 then built upon this response with:

> I put down my weakest of all of those advocacies was how to anticipate learner misconceptions. And that, for me, is contingent upon knowing the content knowledge, if I

> don't, if I don't understand. I mean, I think I understand the content knowledge, a lot better than I did. But because [if] you're not in it for a number of years, you don't know where the common misconceptions occur, that comes from just time in the seat as an instructor.

Guiding comments from the researcher regarding pace of change in technology and work methods were made to explore this avenue more deeply. This then led to an exchange between participants that clearly shows how participants with strong learning theory knowledge can invite others to better appreciate developmental need as an opportunity.

Participant 6 said:

> The biggest question is, where is that knowledge? Where does it reside? Like it's in a book or it is documented somewhere, we can all go and dig it out and learn it. But the problem is that most of this knowledge is tacit knowledge emanating from the fact that those people are people who acquired this on the job, but by being mentored most probably by more experienced people who have acquired also in a tacit manner. So, it comes out to the surface only when they are faced by a certain situation. Of course, you can you tell them about it a little bit. But it's just tacit knowledge. It doesn't exist somewhere where we can go and grab it, so that we can package it in a training format and deliver to the people. Even the people who are coming out as experts, as employees, they tell you that after leaving the room for a while, this knowledge fades away because of the new situations. So, I think for me, the bigger question is, where is that knowledge so that we can go and grab it?

Participant 1 added:

> Well, and further to that not only is it difficult to, to record that tacit knowledge, or well,

not impossible, but it becomes very hard to define that knowledge and that expectation of knowledge. Because it's, it's so amorphous.

Participant 1 continued:

The content is about the content is evolving. And how do we rate ourselves on that? Yeah, how do we rate ourselves on that? Because we don't know, what we don't know. And it's really hard to define what we don't know.

Participant 8 replied:

I think [Participant 1] really hit on the head, though, and it's all it's all about the design, because, you don't have to be the content expert, in my opinion, you just have to allow the platform for the experts to kind of come to the top. Meaning that in your design, to allow for that conversation, that discovery. And they'll not do the work for you [individually]. But they'll [will] as a group. That's how I learned all my content knowledge was just by that OJT experience, I'd learned very little, actually, I think in the classroom. I had the framework given to me in the classroom, and then the actual expertise came from on the job.

Self-Efficacy Questions

The OSTES response data was sent to each participant at the same time as the TPACK data. Except for the first question, which specifically asked about both TPACK and the self-efficacy scores, the self-efficacy data received almost no attention during the focus groups. Only Participant 5 made any comment at all which was “For me, I kind of scanned it. And it was I because I'd answered half of it. And then sort of thought, at the time that a lot of the questions didn't apply to me.” Future focus group questions could explore the TPACK and OSTES data separately as an effort to gain better appreciation of why the participants responded as they did.

While this observation may detract from the overall effectiveness of the questionnaire and focus groups, it is important to observe that the survey approach did yield the finding that the results were generally accurate. This viewpoint may also be arrived at through the observation that the participants, in three specific cases, acknowledged they had not reviewed their questionnaire data prior to the focus groups. Further comparison of the pre and post focus group self-efficacy questions may reveal more findings related to research sub-question 2 (SQ2). This will be examined later in this chapter.

SQ3 Finding

The results of the analysis of focus group sub-question three (SQ3) can now be answered based on the participants statements. The approach used in this study offered an internet-based questionnaire to a single department in an electrical utility operations training department. The TPACK survey data were then analysed on an individual basis and the domain scores totaled. The domain scores where then graphed on a radar graph. The resulting figures were analysed to determine the lowest score which revealed the personal area of development. All the study participants completed the survey by the due date. When the data was returned to them, those who were able to attend the focus groups clearly stated that the results described their developmental requirements accurately.

Focus Group Question Two

The second question posed to each focus group was “What ideas did you generate about specific training you might take to improve your abilities as a trainer through professional development?” The responses from each transcript were coded to the (PD) parent node. In total, 63 text passages were connected to the parent or one of the child codes. Additional codes were also made to capture statements made that provide additional meaning and explanation of the

self-reflections made during these meetings. The latter concepts will be explored via axial coding in this section's discussion. The specific PD are discussed below and grouped by focus group.

Pedagogical Knowledge.

Participant 5 sought to increase their knowledge of the specific tools they used. "In my case through building simulations, that it's a step-by-step approach, but there are definite weaknesses in my skills and that could definitely be built upon". The researcher attempted to probe deeper using his own leading question "What am I trying to verify, or change, or improve through using simulation as a technology to help with learning?" to confirm understanding. This led to the discovery by Participant 5 that it is not only learning to operate the power system tools and technology, but also learning how to prepare instruction. Participant 5 commented "I guess it's sort of like a pre-teaching I have to be able to figure out. How to set the stage in order for the learning to even begin".

> Participant 4 likewise expressed interest in professional development by commenting: Going through the survey and thinking through everything, made it clear that the areas of need for me, for example, technology, aside from the simulator, which I would still consider training technology or learning aid. But things like Moodle and different types of … technology to help with our training and learning would be a big area for me to improve.

It is important to note in this response, at first glance, the PD appears to be related to the development of knowledge related to technology tools the department already uses. There is, however, a broader request to begin to explore the larger realm of learning how to develop complete lessons. This is an important developmental undertaking to create additional broad skills in instructional design rather than isolated components of a training effort.

Participant 5 then articulated how previous pedagogical and technological instruction aided them:

> When we took that instructional design course back in the in the summer where I got a lot of value out of that because it made me think of the steps to use but how to get somebody to go from A to Z. There's [sic] all those steps in between and how they, how they, learn each step along the way. But then also another third part for me would also be like the in person, personal communication of that information from the material through me, to the to the learner. That would be something I know I would need quite a bit of work with.

This comment demonstrates that professional development is a continual process for corporate trainers. This is a positive observation that demonstrates the participants, through this research effort and their own self-examination, are beginning to consider PD as an essential part of growth within their current position.

Technological Knowledge.

Interestingly, while the technological knowledge focus group identified similar pedagogical developmental needs including the integration of pedagogy and technology together. Participant 3 stated:

> [W]ith the kind of the new motion to do more blended learning, I see the advantage of being more skilled with these online tools. And [Participant 5] and I [delivered] several courses over the course of the year. With the tools we had and came up with sort of our own solutions on the best way to present material online and get involvement online. But I think we both probably recognize there's room for improvement there. … You have to use those tools wisely in order to maintain that engagement. … This is an area where I'd like to improve because of the direction we're heading and what I saw over the year.

Participant 5 built on this theme by reflecting on their virtual instructional planning and delivery. In the comments are interesting acknowledgements of the social nature of learning in the corporate stetting:

> We got a lot of places for discussion as well for talking so there's lots of time for them to reflect on what we were talking [about]. And to give their own opinion. Discuss with others. I didn't really stop to think about is this, how we're going to structure [the class], we just kind of came up with a format and ran with it and saw what worked and what didn't and tweaked it as we went. It was only after the fact that we start going through the survey. I started thinking did we do that? Yeah, I guess we did. Can we do this? Yeah, I guess. I guess so much of it's just, if it works, we do it. If it doesn't work, we don't do it. I guess instinct to guide us.

The conversation then expanded to discuss instructors' development on the control system tools. Participant 2 stated "We don't necessarily get training on the systems that we are expected to train in." In turn Participant 3 questioned the differences in the technology they can employ during virtual training sessions.

> I would add sort of in our own personal development, that doing these online learning opportunities, there are limitations to our tools and to the tools that the user has. Our personal development might be finding ways to work around the limitations of the tools at the users end where they don't have the same tools, they would in their work environment. So how can we develop ourselves to still challenge the learner remotely in realistic work simulated environment.

Participant 9 added to this:

> There are always glitches. So there needs to be in the training, a portion of time set aside

> to say, okay, if this glitch happened, this is maybe what you've done to get to that glitch, and this is how you're going to remedy it. Because technology does have a way of not working exactly how we want it at the precise moment. So, we need to be able to think creatively, to know how to get around those glitches.

This is an interesting exploration where instructors are considering not only their development related to technology used in the workplace, but how well they can make the training include what to do when the technology does not function as intended. While the discussion ended at this point, how to manage the unexpected when the instructor is not present, should be considered. This will be a further challenge beyond what the instructor may be capable of doing as they are not present inside the learning space. Technology, as a repository of problems and their solutions, may be worth further investigation outside this study.

Content Knowledge.

Responses to question 2 in the CK focus group was centered on how these participants would increase their knowledge about areas of power system operations. Participant 1 and 2 both identified that opportunities to job shadow would assist them. Participant 8 identified that they wanted to attend an internally delivered course, outside of their area of expertise. The goal would be to “build that content knowledge, but also to help with making connections in my own personal courses with my learner, so to get their perspective”. Such an opportunity would assist in developing a common vocabulary which would be beneficial to reduce misunderstandings when cross-training employees in other tasks of their job.

The group also discussed what could be gained by attending conferences with other electrical utilities. Conference attendance was seen by Participant 8 as an opportunity to network to discuss how others prepare and teach their lessons. Participant 2 thought that the opportunity

to visit other utility training departments would be helpful to their development. Participant 9 saw the potential to use a collegial visit to get ideas for presentations and instruction that were new or innovative.

Finally, the group discussed how working together may benefit each other. Experiential learning and co-facilitation were ideas brought forward. This expanded to include the need for creativity and experimentation in the content development process. Participant 6 identified that being given the chance to prepare some instruction, immediately after they were taught, would be a good way to make the experience more personally meaningful. Preparing the lesson would also assist the instructor with appreciating how the learner makes sense of the teaching approach.

Discussion

The second focus group question was asked to determine what professional development individuals wanted to complete. The responses fall into three general areas. The first is to complete training internal to the department. This might include being a learner in an existing offering to allow connections to be established between what they instruct and another part of the various training programs. Another approach may be to attend a conference or another company to see how they deliver their instruction.

The second desire was to job shadow in the real-time operating environment to gain additional understanding about how various tasks are completed. This would give the instructor first-hand experience they could use in their training offerings. Such an approach would also invite collaboration with real-time operators and allow for exchanges of ideas for training. Participant 8 summarized this “We need to connect with their audience more and then maybe it is showing them first what we can offer and then they'll come to us with it.”

Third, there was acknowledgement that previous department training was valuable and supported their knowledge and skills development. This third approach identified that any training taken was often immediately applied in training delivery, which is encouraging from a return-on-investment perspective. However, critical analysis of the comments reveals that the participants are, in general, non-specific about the exact nature of the professional development they want to complete. The participant's desires lack details such as when they wanted to start the PD, how long they would be engaged, what goals were to be achieved, and how the PD would be applied in their practice. These points are raised as axial coding revealed that they felt training should be conducted at work, and not on their own time. Transcript analysis also identified that the department's schedule is very full and frequently lacks periods where the entire group is available for professional development. This identification will be explored more in focus group question 4 analysis.

Focus Group Questions 3

The third question asked to the focus groups was "What approaches to blended teaching or technologies are you considering exploring?" Responses to this question were coded to the Pedagogy Blended Delivery parent node and included child nodes Instructional Design, Learner Assessment, OJT, and Remote Learning. In total, 86 transcript passages were coded to the parent node with Instructional design receiving the most with 26 items. The analysis focuses on the question parameters blended teaching and technology adoption.

Pedagogy Knowledge.

Participant 4 commented "How would you use Moodle with the simulator? That would be kind of combining the two platforms into one kind of lesson plan". Participant 4 added "using simulations to reinforce the classroom theory". Participant 5 built upon this "we're having to

examine the limitations of the technology that every student is going to use. I can see it potentially being used, if done correctly."

Technology Knowledge.

Participant 9 started the responses to this question with "I personally would like to take some kind of a tutorial on creativity for blended learning to keep the participant's attention". Participant 4 commented "Doesn't say very much if I can't use the very tools in an effective way."

This point resulted in the discussion drifting towards learner acceptance of blended delivery. "I want to be sure it's something that will support them" was made by Participant 4 and a short discussion ensued regarding the ability of the LMS to support content delivery when the learner can access it. Participant 3 refocused the conversation and noted "I really want to push our tools to become self-sustainable and have learning opportunities available to users when it is convenient to them without having to schedule instructors to be guiding them through it". While not overtly stated, one can infer that professional development is needed for video creation and editing. Technology will be required in addition to the PD.

Content Knowledge.

"Right now, primary that we're all focused on is Moodle" was stated by Participant 9 as a LMS was newly acquired by the department. The discussion that ensued was largely about how the department might use the LMS for blended delivery, although no PD was directly identified. Participant 1 finally commented "That's why I'm looking at serious game design. how do we use those [control room] tools in such a way as to motivate people?".

This focus group also identified that the LMS could be used for content storage. This may include links to instructions, job aid documents, and PowerPoint presentations that may contain narration. Participant 6 conveyed one approach that been used with success:

> We are going to manage all of these instances of either synchronous or asynchronous, in person or self-directed, learning in one single place. It's not only scaffolded, but it's also being tracked. They are really taking full ownership of their learning. They are self-directed learners and giving them the space to do it on their own.

Discussion

This focus group question gathered only a few specific professional development ideas. However, through the discussion, one can identify a willingness to try out new approaches. The participants were simply unable to state what specific approaches they were going to experiment with. This observation will be explored more deeply in Chapter 6 when transformational leadership, informed by appreciative inquiry, is applied to the professional development needs of this training department.

Focus Group Questions 4

The fourth question asked to the focus groups was “The people in this interview all have the same area of development. How do you feel about learning together?” The responses were generally positive as illustrated with the selected responses below.

Pedagogy Knowledge.

“I sometimes find learning in a group better because different people pick up on different things. That way, I feel like you get more value out of whatever session you're in” (Participant 5).

Technology Knowledge.

"Giving us the same exposure to the same development allows us to develop ourselves with each other. We can all contribute to each others' learning" (Participant 3). Participant 2 continued "We have a lifelong learning culture because we are in training and development. I think we're pretty good for sharing and we could have our own little professional learning community for technology".

Content Knowledge.

"I'd rather learn together … it's more fun" (Participant 1).

"I'd rather do it together. As a group, you get more out at a more advanced level" (Participant 9). Participant 6 built upon this by commenting that "I am a big fan of learning together not to mention how beneficial that is going to be on improving the team communication".

Focus Group Questions 5

The fifth and final question asked to the focus groups was "What timeline, number of courses, and whether campus or online delivery, are you thinking about for your personal development action plan?" The responses are explored by focus group.

Pedagogy Knowledge.

This focus group was not able to articulate specific training they would like to complete. The discussion revolved around the amount of work the department had to prepare for future delivery. Of note was the desire for short learning events that would aid their general development.

Technology Knowledge.

The discussion in this focus group largely centered on the need to be able to create training on everchanging technology. Participant 3 commented “Technologies are going to continue to evolve so our commitment has to be to satisfy our current needs and keep up with the technology as it changes”. This was later reinforced by the need to “become more efficient with our technical tools, that's going to cut down our development time and allow us to do more. So, the investment of training in our staff improves our efficiency as a department”. Participant 5 agreed and said “anything, in my opinion, that we could get always going to help us whether it's on campus or online”.

Content Knowledge.

Participant 9 was the first to respond with previously identified PD and included a timeline of 12 to 18 months. Similarly, Participant 8, saw PD as a continuous effort and wanted to take or co-facilitate in an internal course related to transmission or distribution operations. The goal was to “Just trying to broaden my knowledge base” (Participant 8).

Participant 6 took a different, more self-directed, approach. When time is available, they self-develop by “trying things out and watching videos and reading documents. It involves learning about the content I'm not very familiar with, and it involves communicating with other peers”.

Focus Group Summary and SQ4 Findings

Research sub-question 4 asked “How do corporate training instructors with different TPACK confidence profiles vary in their approaches to professional development and online training self-efficacy?” This is answered through a summary of the focus group findings.

The three focus groups came to the same consensus that the TPACK and self-efficacy questionnaires were accurate in identifying in which area they needed additional professional development. The focus groups also produced several indications of the specific professional development needs of the instructors as well as how that PD might be completed. The participants generally want to learn together and are interested in completing learning opportunities through training offerings and job shadowing that exist inside the division. This is positive as comparisons and some cross training would occur. Attendance at conferences and other venues has the potential to provide examples of how other companies instruct similar topics.

Evidence has been found that the use of the division's LMS is seen as important in the blended learning direction the department has begun to take. Opportunities to use the LMS along with other control system tools is a new and encouraging observation that must be tempered with learner acceptance of these changes. Creativity and game design were seen as courses to be taken to assist with maintaining learner interest.

There is a distinct gap in the PD plans of the participants which is reflected in several comments about the importance of previous learning that was arranged for them. While a few of them could identify a specific learning opportunity and timeframe, remainder could not. Being unable to identify personal PD could be sourced from past practice where specific training was arranged for them rather than self-identifying and self-advocating for personal development. PD will be explored further at the end of this chapter which aims to answer the main research question of this study.

Second Self-Efficacy Questionnaire Results

As detailed in the conceptual framework, the participant's teaching self-efficacy scores were gathered a second time after the focus groups. The goal of this second data gathering was to determine if their self-efficacy changed through discussion with peers and an attempt to self-formulate a personal development plan. The recently completed focus group transcript analysis has indicated that self-defining a PD plan is difficult to achieve.

In total, five participants (56%) completed the OSTES questionnaire after receiving the invitation shown in Appendix H. The pre and post survey responses at the Instructional Strategy, Blended Learning Management, and Student Engagement section total scores, are compared in Table 7. The column Change calculates the difference between the pre and post score totals. A positive value indicates that the participant's teaching self-efficacy increased following their focus group participation.

Table 7

Comparison of Pre and Post Self-Efficacy Questionnaire Section Total Scores

Section/Participant	Pre	Post	Change
Instructional Strategy (IS)			
Participant 2	63	57	-6
Participant 4	24	44	20
Participant 5	60	60	0
Participant 8	60	58	-2
Participant 9	56	54	-2
Blended Learning Management (BLM)			
Participant 2	54	56	2
Participant 4	-	43	43
Participant 5	55	56	1
Participant 8	60	57	-3
Participant 9	54	57	3
Student Engagement (SE)			
Participant 2	61	58	-3
Participant 4	-	45	45
Participant 5	58	56	-2
Participant 8	56	55	-1
Participant 9	56	55	-1

Note. Participant 4 did not answer the OSTES questions in the BLM and SE sections of the pre-focus group questionnaire, therefore, no numerical data is reported in the Pre column.

Discussion

Table 7 illustrates that, in general, there was little overall change in the self-efficacy of these participants when comparing the OSTES questions before and after the focus groups. Participant 2 saw the largest decrease in Instructional Strategy scoring, while the remainder retained the same group total or lowered their self-efficacy only marginally. This pattern remains generally the same for the Blended Learning Management and Student Engagement questions.

Participant 4 is an anomaly in the data as they did not fully complete the OSTES portion of the questionnaire prior to the focus groups. Fully completing the questionnaire may be a result of better appreciating the requirements for instructing staff. Participant 4 required development

in Pedagogy and Content Knowledge and, therefore, lagged the other participants. The results of the OSTES questions continue to demonstrate a need in this area.

SQ2 Finding

Research sub-question two asked "Does the teaching self-efficacy of corporate training instructors change with the development of a personal professional development plan?" The data gathered in this study suggests that in general, their self-efficacy does not change from the examination of their questionnaire data or participation in one or two focus groups. No change in self-efficacy is not a surprising finding as self-examination alone is not likely to improve their knowledge or abilities.

For one participant, there was the positive outcome that they could more fully understand the need for fully completing the questionnaires. As a result, their TPACK and OSTES scores identify the same development area. For the remaining participants their self-efficacy score remained generally the same suggesting that the TPACK scores may provide the best indication of areas for professional development.

Main Research Question Findings

The Main Research Question (MRQ) asked, "How do training instructors with different technological, pedagogical, and content knowledge profiles vary in their approaches to professional development in the electric utility industry?" The response to this question is answered, in part, through each of the research sub-questions as previously discussed. Further answering is achieved first through the TPACK questionnaire open-ended question responses, and then through the focus group responses.

Open-Ended Questions

The open-ended question responses included software training as a common reply from the participants. Examples include those used for content development and blended learning delivery. Technology such as learner engagement tools, H5P, quizzes, and surveys were also identified. These are further refined through the focus groups.

Focus Groups

The focus groups identified that group learning would be beneficial for all the participants which did not vary between the various TPACK profiles. The instructing staff commented that past training arranged for them both met their PD needs and provided opportunity for collaboration between the team members. Participants also thought that technical and content knowledge could be increased through their own participation in courses planned for operators and trainees. Instructors attending department course opportunities would be like auditing a post-secondary course. Several participants thought industry conference attendance would be valuable, while others wanted to explore courses that would assist them in design creativity or alternative delivery approaches. Last, some of the participants felt they could learn what they needed through web-based content such as videos, tutorials, or help files available through the division's LMS. Interestingly, multimedia design was not raised as a developmental desire, nor were concrete and well-defined professional development plans created at an individual level. This will be further explored in the final chapter.

Validity

Triangulation is difficult to establish as this is the first time this research has been attempted in an electrical utility setting. However, the first research sub-question confirmed that

the participant did believe that the TPACK scores were representative of what they consider to be their individual areas of professional development.

The self-efficacy scores can also be used to establish some internal validity in the data. The scores in the first questionnaire offering did not substantively change when the SE questionnaire was offered after the focus groups. Some degree of consistency is therefore established in the short period of time between the two data gathering efforts.

The focus group discussions should be seen as authentic, first because few changes where required when the member checking was requested. This may be due to the accuracy of the transcript text. This could also be due to the transcripts being return within three weeks of the focus groups being completed. The focus group discussion should also be seen as valid and authentic as the participants were seen to build upon each others' comments which in turn suggests that they were comfortable with the direction of the discussion which sought to improve each participant's abilities and collectively, the abilities of the whole training team.

Last, reviewing the data and the way the participants interacted, has caused me to confirm my own ontology and epistemology positions. Data was gathered and confirmed by the participants. This data was also gathered and built upon through beneficial exchanges between the focus group members and between me when I ensured each person had an opportunity to contribute to the discussions.

Chapter 5 Summary

Three focus groups were conducted to further explore professional development for those in need of pedagogical, technological, and/or content knowledge areas. Following the focus groups, the transcripts were returned for verification.

The focus group member checked transcripts clearly articulate that the instructing staff believe that their questionnaire responses, and the way they were grouped together by data analysis, did identify their developmental area of greatest need. Quotations were used to provide greater depth to the responses to five focus group questions. These responses show that they want to learn together, that operator training courses are felt to benefit instructors too, especially if they do teach in that area. Some, but not all participants, felt that they could successfully learn on their own from internet-based resources. It as also shown through comparison of the pre and post focus group self-efficacy responses that participant self-efficacy scores do not substantially change in the short time between data gathering. There was benefit for one participant who was able to complete the second self-efficacy questionnaire with a better appreciation that the need for pedagogical and classroom management knowledge does indeed apply to them in their role.

Focus group transcript analysis allowed research sub questions SQ2, SQ3, and SQ4 to provide answers to the main research question of this study. Overall, the instructing staff's ability to define their own professional development is limited. Implications and recommendations to improve this outcome for the department under study, and for future studies, is provided in the next chapter.

Chapter 6 – Study Conclusions, Implications, and Recommendations

This chapter is dedicated to the discussion of conclusions that can be drawn from the study findings including what was learned in terms of its strengths, weaknesses, and limitations. Implications for practice or decision making, especially for leaders, is explored. The need for future research, including alterations to the methodology, is discussed. The overall goal of this study is also reviewed through the examination of the study purpose.

Main Research Question Findings

The Main Research Question (MRQ) asked, "How do training instructors with different technological, pedagogical, and content knowledge profiles vary in their approaches to professional development for blended teaching in the electric utility industry?" The response to this question is answered through the TPACK questionnaire open-ended question responses and through the focus group responses.

Open-Ended Questions

The open-ended question responses included software training was a common response from the participants. Examples include those used for content development and blended learning delivery. Technology such as learner engagement tools, H5P, quizzes, and surveys were also identified. The open-ended responses were further refined through the focus groups.

Focus Groups

Focus groups identified that group learning would be beneficial for all the participants. This finding did not vary appreciably between the various TPACK profiles. The instructing staff commented that past training arranged for them both met their PD needs and provided opportunity for collaboration among the training team. Participants also thought that their own participation in courses planned for operators and trainees would increase their knowledge base.

Industry conference attendance and courses in design creativity or alternative delivery approaches were voiced. Last, a minority of the participants felt they could learn what they needed through web-based content such as videos, tutorials, or help files available through the division's LMS. Multimedia design was not raised as a developmental desire, nor were concrete and well-defined professional development plans created at an individual level.

Conclusions

The following conclusions can be drawn based on the findings in this study. Alternative explanations are included where relevant.

Participation

The participation in the questionnaire portion of the study by the teaching staff in a utility training department exceeded expectations. The invited instructors had able time to complete the questionnaires and actively engaged in the focus groups. The participants in the corporate setting appeared to accept an exploratory study into their personal professional development needs by an academic researcher. When a participant drifted towards questions that might illicit researcher bias, they quickly appreciated that the study was academic in nature and accepted that that avenue could not be explored.

Likewise, the focus group participation was well attended although two instructors were not able to attend one focus group each. Partial perspectives from one instructor were captured in the pedagogy focus group. The viewpoints of this specific instructor were not gathered in their purposefully selected content knowledge meeting as they did not attend that meeting. Their PD needs and plans can be partially extrapolated from their engagement in the PK focus group and from the other participants. The second instructor missed the TK focus group and recommendations may be extrapolated for PD planning purposes as will be shown later.

Study Purpose and Goals

The purpose of this research study was to investigate the professional development needs of instructors as an intervention to increase their knowledge and abilities and thus improve their self-efficacy for teaching with technology in a corporate setting.

The knowledge and abilities could be required in one or more of the technology, pedagogy, and/or content knowledge domains associated with blended teaching in electrical utility operations. To this end, the objective of the identification of individual knowledge and areas for improvement through PD was clearly achieved using questionnaires. This achievement accomplishes a portion of the goal of this study by demonstrating that a modified TPACK framework does aide in defining professional development needs in a corporate training setting.

Questionnaire Data Findings

The modified TPACK questionnaire responses were converted to radar graphs (see Figure 5) using the commonly available software MS Excel. The technique employed permits anyone using this approach for self or leadership-led staff blended learning skill and knowledge analysis to determine what professional development is needed. Such analysis requires nothing more than comparing the ideal TPACK domain scores to the questionnaire domain response totals.

While a table of the same data may yield the same information, a table does not easily permit comparison of the secondary TPACK interactions. As an example, an intermediate content knowledge (CK) score may also produce intermediate or lower pedagogy content knowledge (PCK) and technology content knowledge (TCK) scores. In such a case, the corporate training instructor may need additional development to become fully capable in preparing and delivering lessons using some form of blended learning.

The TPACK scores were also analyzed using simple descriptive statistics. The mean and SD for each question and for each TPACK domain were reported in Table 3. The data suggest that CK and TCK require the most PD for these instructors. However, when examining all the domains, the mean for many questions is found close the value of 4 out of 6 with small SD. This suggests that some form of PD is needed for some, if not all, of the instructors as they have some knowledge related to each question. This outcome will be discussed further in the recommendations section of this chapter.

Teaching self-efficacy was also examined using the OSTES questionnaire modified for the corporate setting. The training staff generally reported high self-efficacy for blended teaching, although the use of this modality has only just begun due to the nCOVID-19 pandemic. Such delivery was primarily done immediately prior to this study using meeting conferencing software, meaning the blended self-efficacy may be reported higher than it might actually be.

The self-efficacy score did not change in a statistically significant manner when the initial survey and post-focus group questionnaire data were compared. This finding was anticipated as the participants, at the end of the focus groups, had not completed any developmental learning at that time. There was however one positive outcome, that being a participant who did not complete the OSTES questionnaire, was able to fully complete it at the end of the study. Both the survey data, and the comments in the focus group, clearly show the need for pedagogical and content knowledge learning.

Focus Groups

Focus group discussions were used to gather deep responses regarding professional development directly from the participants. The responses given, verified by member checking, provide evidence that the questionnaires accurately represent the PD the instructors feel they

need. The qualitative data gathered from to the focus groups revealed individual intrinsic barriers to the adoption of new teaching approaches, including technology, in their practice (Koh, 2019). These barriers included the desire to learn on company time, and at company expense. While the type, duration, and mode of that PD was discussed, many of the teaching staff could not clearly identify what to complete for their own development. Those instructors with graduate level educations were more able to articulate a plan. As an observation, the instructor who was considering serious game design, has already enrolled and completed that seminar, and is applying that learning in their course designs.

Collectively, the instructors all see value in learning more about the teaching and learning process and the effective use of technology in their courses. Their observation is especially helpful when that learning cross-trains them for the delivery of content that occurs before or after the classes they currently teach. These instructors also see value in building upon what has been offered to them as internal learning. This includes both remote training delivery and learning to use the department LMS more effectively. However, the participants generally could not create and communicate PD plans. This continuing problem is explored next.

Applied Leadership Theories

As described in the conceptual framework, leadership support is omnipresent throughout the study and after when PD is completed by the participants. Three leadership theories were applied in this study namely transformational leadership, appreciative inquiry, and leader-member exchange. These theories were used to gain answers from the participants to assist them in defining with me, what is working and what in the teaching knowledge and skills needs too be transformed such that the department capabilities are expanded. Through their use, the participants were thought to be able to see the department mid-term roadmap in the form of

blended learning. Through the responses to the focus group questions and ensuing peer discussion, that they value the knowledge and experience of each other and are eager to collaborate. For training managers, these are positive outcomes and are relatively easy to achieve through scheduled learning opportunities.

These positive findings must also be considered through the lens of transactional leadership and the realities of corporate training. Like the academic setting, there are a finite number of audit seats available for internal professional development. In the training facilities of this electrical utility company, there only six training consoles for dispatch training, eight for distribution system operations, and five for transmission system operations. As a result, hands-on instructor-led training is not easy to make available, especially for the five-to-eight-week duration new hire courses typically run. However, instructing staff have full access to the LMS and other training materials. They can also identify within the internal supports the exact content they want to learn, meaningfully reducing the total learning time by engaging in only the area which they need to improve their knowledge.

Job shadowing in the real-time environment was identified by several participants. That continues to be a challenge for two reasons. Despite the slow emergence from nCOVID-19, opportunities in the control room require careful planning and agreement from multiple parties. Experienced operators also assist trainee operators with their on-the-job training while on shift. With the real-time operators already assisting in trainee OJT, the opportunities for instructors to those course or topic development sessions when operators and course developers work together to create content is limited. As a result, transactional leadership must continue to be applied in conjunction with transformational leadership to achieve the PD needs through small, well-timed design efforts that capture operating tasks and steps that can be demonstrated using digital

technologies. Training instructors, like the operators they teach, learn by doing. In the instructor's case, it means learning how to use technology to meet their course development objectives while also completing pedagogically related course design work described as TPK in the TPACK framework.

Strengths

The following strengths were identified in this exploratory study:

1. The data gathering was completed in a short period of time.
2. The TPACK questionnaire and data analysis methods employed in this study synthesize a diverse group of participants into three professional development areas.
3. Focus groups were able to gather rich data and engage the participants in exploring their own professional development.
4. The research design used in this single study does appear to produce results that can be acted upon by the participants.

Weaknesses

The following weaknesses were identified in this exploratory study:

1. With the semi-structured focus group questions set prior to the meetings, questions, interesting data, and anomalies identified from the survey data could not be explored.
2. OSTES data did not appreciably change from the completion of pre- and post-focus group data gathering suggesting that focus groups do not alter self-efficacy of the participants.

3. The study design did not explore professional development that could be suggested, recommended, or required by the department manager. These learning opportunities could address PD as well as prepare staff for training projects known to be in the department work plan.
4. While the questionnaires were completed by all participants, there was one OSTES questionnaire that was not fully completed restricting a full exploration of that participant's teaching self-efficacy prior to the focus groups.

Limitations

The focus on a single department and the nature of voluntary participation in this study represent limitations to the generalizability of the findings. Invitations were not sent to other training departments within the company meaning that human resource leadership and development and apprentice trainers were not included in the sample population. The participation of these instructors could provide findings applicable to the company where this research took place. Similarly, electrical operations trainers in other companies were not included in the sample meaning that findings for these instructors cannot be generalized across the industry in North America.

Not all study participants completed the post-focus group OSTES questionnaire. As a result, the findings related to changes in blended teaching self-efficacy cannot be generalized to all the participants in this study, nor more broadly.

Not all participants selected to the technology and content knowledge focus groups attended those meetings. As a result, the findings related to the transcript analysis cannot be generalized to all the participants in this study, nor to the corporation's trainers, or to other utilities.

This being an exploratory study, the transferability of the findings to other departments is challenging. Instructing staff in other departments within the company and in other electrical utilities are expected to have similar diversity in personal backgrounds. This expectation permits some generalization of the need for professional development especially when new staff become instructors. As example, those with technical or trades backgrounds are anticipated to need to increase their pedagogical knowledge. Those with no electrical utility knowledge will need to develop their content knowledge. It is also expected that all instructors will need to learn about new teaching technologies when those systems are introduced to a training department.

Implications

Several implications extend from the conduct of this research study. These are described below.

Professional Practice and Decision Making

Based on the quality of the engagement in this exploratory research by practicing corporate training instructors, corporate leaders need to be open about the need for organized professional development. In the corporate setting, training resources is typically expended on new hires, and once trained, further development appreciably drops off unless another new employee arrives in a department.

Instead, leaders are encouraged to solicit input from those who need training and development, which should become a continuous process. Gathering this information is easily accomplished in annual performance reviews, setting PD goals for the next year. The use of this study's TPACK and OSTES questionnaires can be used to determine PD needs and to diagnose if self-efficacy has changed in a negative way. Such development can also include training and mentorship for those who are identified to assume leadership positions in the medium term. Such

PD need not be a whole working day in length. Instead, short workshops should be considered as these encourage immediate application to current training projects.

Leaders should conduct internal training department PD together, which is an encouraging identification made through this study. Instructors need to develop strong collaborative relationships with their peers. These conversations allow for the free exchange of ideas and practices that assist employees for small investments in time. The involvement of the department leader in the discussion invites supportive exchange and the opportunity for the leader to address concerns as they are developing and before issues become serious problems.

Given that a robust and medium-term professional development plan was not created by each participant, training department leaders should consider having a list of materials and experiences available for instructors to select from. Examples include industry papers, academic literature, technical manuals, and trade publications. Online resources could include videos, webinars, and industry related technical presentations. In person experiential learning should be attempted within the department and within the company. New equipment commissioning and the review of failure analysis investigations are excellent examples to bring problems outside the control center into the learning spaces for robust debate.

Leaders should also openly discuss the future directions of the department as an approach to prepare for ensuing change. Corporate instructors, like other adult learners, need to be prepared and supported through change efforts.

Contribution to the Literature

This study contributes to literature on professional development through the expansion of the TPACK framework in three ways. First, this study expands the framework by including andragogy as part of the pedagogy knowledge dimension which is required in the professional,

post-formal education, work environment. Second, the enhanced TPACK framework engages department leaders in investigating and formulating a professional development plan for training instructors to increase blended teaching abilities using data driven decisions. Third, this research becomes the starting point for measuring instructor TPACK in a corporate setting, and more particularly in an electrical utility company setting, through the integration of 21st century technologies in the learning environment (Valtonen et al., 2017). This study also provides input into literature about blended teaching professional development of non-academic teaching staff and the effect educational planning plays in encouraging improved self-efficacy.

Scholarly Understanding of the Field

Knowledge dissemination is an important aspect of academic and industry research. Following completion of this study, opportunities will be sought to present selected goals, methods, findings, and recommendations to other utility instructional practitioners. Industry conferences, webinars, and journals are examples where academic research and industry need can be brought together to solve the common problem of diverse instructor populations and their professional development.

To assist other trainers and department leaders in appreciating the value of professional development, the need, methodology, and findings from this study should be communicated in industry webinars and conferences. Given the limited information regarding corporate trainer development, exploration should also be made to publish portions of this study as articles in industry, distance education, and blended educational journals as methods to disseminate knowledge. Academic readers may also find value in the study to aid teachers at all levels.

Knowledge Expansion

The TPACK framework, and the modified TPACK and SE questionnaires can be applied in the corporate setting expanding their use beyond the original intent of Koehler and Mishra (2009). The expansion of use also extends the analysis of pre-and in-service teachers that as done by Willermark (2018).

Like Valtonen et al.'s (2020) data, this study's data also suggests wide variation among TPACK scores. However, TPK in this study was not the most challenging domain. Here, CK had the lowest mean and TCK had the largest variation in the scores as evidenced by TCK having the largest sub-domain SD. This may suggest that CK and TCK PD in the corporate environment must be addressed more deliberately than in formal educational settings.

This study also illustrates that corporate teaching staff, through the use of questionnaires and focus groups, can identify the areas where they require PD. This is like Depew (2015) who successfully used two survey instruments to identify the need for TPACK development for principals that emphasizes classroom contexts over managerial functions. Depew's recommendation is further reinforced by Odajima who commented:

> It is increasingly evident that the change sought in teaching and learning will only come about by a change in the pedagogical practice of teachers who are appropriately prepared with student-centered learning activities and content knowledge that utilizes technology as an instructional tool in order to facilitate and impact learning (2019, p. 149).

This research has demonstrated that several leadership approaches can be used to draw out the approaches the instructors want to use for their own PD. This is like Forssell's (2011) findings regarding social learning networks which show the positive influences constructivism and social constructivism can have on instructor self-development.

The blended teaching self-efficacy data in this study was higher than anticipated. This finding appears to contradict the studies by Gosselin (2016), Northcote et al. (2015) and Northcote et al. (2011). What is positive, and aligned with their findings, is that the participants in this study are similarly willing to explore PD while also expanding their sense of community.

Recommendations

Recommendations for Further Research

Further research using the methodology of this study should be conducted, with the permission of those utilities, and their training departments. Such research will increase understanding of the professional development needs and preferences of the instructing staff in a larger part of the business. Additional studies may also increase the potential generalisability of the findings across the industry. If true, generalized findings could potentially reduce unnecessary training by focusing on the exact need, and in the longer term, reduce costs for trainer development.

Limiting this potential is the current situation of frequent training staff turnover, which is only in part due to limited, or ineffective, professional development. In this electrical utility training department, as well as others, there are many opportunities for instructors to return to real-time operations or move to other departments. Competing factors including monetary and non-monetary compensation, and the draw of other employment experiences, must be understood and countered by department leaders. Research into these areas is encouraged to ensure the competing influences are well understood and can be mitigated.

Recommendations for Changing Research Methodology

Questionnaires.

The modified TPACK-21 and OSTES questionnaire provided easily obtained data for this study that was easy to convert to data tables and graphs. In their current form, the questions and structure of the questions are not felt to require modification. The time required for the participants to complete the questionnaire, as shown in the study invitation (Appendix A) can be reduced to 30 to 45 minutes. This may result in larger sample sizes if more utilities or industries are studied.

Focus Groups.

Three focus groups were used to gather rich data from the participants. The time required to complete the meetings was reasonably accurate for groups of up to six participants. Therefore, the focus group meeting invitations do not require major modification. However, if larger samples are obtained, researchers should consider increasing the time required to hold the focus groups to ensure all participants have an opportunity to contribute.

This study identified that some of the focus group participants were unfamiliar with their questionnaire responses. To facilitate meaningful reflective discussion, future research should modify the focus group invitation to include a reminder to the participants to review the data prior to the meeting.

Five semi-structured questions were asked to each focus group, each yielding rich data for in-depth examination. Future research should consider adding or exchanging questions, if needed, to examine interesting data that is discovered in the TPACK or OSTES questionnaires. As example, the lowest TPACK questionnaire score was CK4 (I am familiar with recent research in power system operations, $M = 2.78$, $SD = 1.31$) which suggests that the instructors, in general,

do not keep abreast of the new technology which they may be required to teach in the future. Which research they are aware of and why they don't engage in learning opportunities would permit leaders to provide opportunities for growth.

Additionally, future focus group questions could explore the TPACK and OSTES data separately as an effort to gain better appreciation of why the participants responded as they did. The questionnaire data should be examined in greater detail to determine why each participant felt their efficacy, in each of the three sub-scales of CM (M = 7.44), BLM (M = 7.30), and SE (M = 7.16), was greater than anticipated. Answering this question could reveal if the instructor's beliefs and actions align with Bandura's identification that teachers with high self-efficacy strive to provide mastery experiences, praise success, and encourage social interaction among their students (1997).

Meeting transcripts were distributed to all focus group participants for member checking. While only one transcript was returned with minor modifications, this practice is recommended to be continued to ensure accuracy of the data. The audio-to-text software used in this study to create the transcripts, while functional, required an investment by the principal investigator to correct erroneous and missing text. Other software should be investigated to reduce the time required to format and confirm the transcript.

This study's focus groups were successfully conducted using synchronous in-person and a web-based conferencing application. Future research should be attempted using this methodology which will reduce the time and expenses related to travel to other companies. Not all participants may be familiar with these technologies, which could limit the engagement of the participants. To promote the best engagement, some pre-training for other company trainers may

be required. An alternative could include the use of a facilitator at the remote site to coordinate local activities and the associated technologies used.

Study Conceptual Framework.

The post-focus group OSTES questionnaire did not yield significant change between pre- and post-offerings. Future studies using this study's methodology should consider eliminating this step in the data gathering, analysis, and reporting process. Instead, the post-professional development OSTES questionnaires can be offered as a form of longitudinal study which could reveal interesting return-on-investment data that could further reinforce the value of corporate trainer professional development.

Chapter 6 Summary

The final chapter of this dissertation has been dedicated to a discussion of conclusions that can be drawn from the study findings. These conclusions were made possible using applied leadership theories that engaged training instructors in their own professional development. The questionnaires and focus group transcript analysis used to gather information has pointed out the strengths, weaknesses, and limitations of the methodology employed. Implications to practice and decision making, especially for leaders, have been explored which identify the need for future research within the utility training context. Recommendations including alterations to the methodology as well as future dissemination of this study's findings were made.

Study Conclusion

This research study was conducted to address the problem of identifying and providing professional development of electrical operations training instructors in an Ontario utility. The questionnaires, confirmed by focus groups, were effective in identifying each participants TPACK area of professional development. The focus groups were further able to gather specific

training that some instructors, particularly those with graduate level educations, planned to engage in. Together, the questionnaires and focus groups successfully achieved a portion of the study goal which sought to determine if a modified TPACK questionnaire assists in defining professional development plans in a corporate training setting. These plans were not able to fully fulfill the professional development needs of all the participants, therefore, recommendations are provided regarding how training leaders can further support the development of their instructors for blended teaching. Additional professional development of the instructors is anticipated to maintain, and potentially increase, their high level of blended teaching self-efficacy. Additional research is recommended to determine if the methods used can be applied in other utility training settings and thus generalize the findings across the electrical utility industry.

Initiating new research based on the theories described here has the potential to reduce the management-instructor divide through respectful leadership approaches that strive to transform training departments and expand their ability to teach using blended learning approaches. This study provides to the host company, and to the industry, a research methodology that is grounded in academic research. The data gathering and analysis approaches used in this study are encouraged to be applied in other company departments and utility workplaces which will further inform the field. These efforts may also increase the retention of corporate training instructors who are on the forefront of company innovation and change.

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Appendix A: Invitation Letter

Note: Appendix A contains the text of the invitation letter that will be distributed to all potential study participants. The letter provides information about informed consent and the general study procedures.

Ethics File # 24472

Athabasca University
1 University Drive
Athabasca, AB T9S 3A3

date

As teaching professionals, we often need professional development to keep us up to date on instructional content, technologies for teaching in a variety of modalities, and best practices. The Technological, Pedagogical, and Content Knowledge (TPACK) model has been used by many teaching professionals to determine what area of practice needs the most support. This study is an opportunity to contribute to educational research, learn more about how you learn, and improve your instructional practice.

The goal of this study is to investigate the TPACK profiles of each department member. The data gathered will assist in creating individualized learning plans for each department member particularly when the learning activities take place online or in blended learning applications.

There is a single online survey questionnaire to be completed in this research study which is open now and will close _____. The questionnaire will take approximately 45 to 60 minutes to complete. You will be asked for some demographic information and questions that will help determine your TPACK and teaching self-efficacy profile. Following the questionnaire, your personal TPACK responses will be shared with you. You will also be invited to a focus group meeting where you will be asked about the learning you want to complete to improve your area

of practice. The focus group meeting will take approximately 60 minutes to complete, and should you be uncomfortable participating in the focus group face-to-face because of COVID, you may participate though the WebEx conferencing service.

This study is part of a dissertation research study conducted by Warren Tracz, a doctoral candidate student in the Doctor of Education in Distance Education program at Athabasca University. This study is under the supervision of Dr. Mohamed Ally, Professor and Doctor of Education Program Coordinator, Centre for Interdisciplinary Studies at Athabasca University. It is important that you understand that in this study Warren is a student researcher and not an employee or supervisor at [Utility Name].

If you have any questions about this study or would like additional information to assist you in reaching a decision about participating, please feel free to contact me via email at wtracz1@athabasca.edu, or Dr. Mohamed Ally at 1-866-916-8650, or by email to mohameda@athabascau.ca. In addition, this study has been reviewed by the Athabasca University Research Ethics Board (Ethics File No. 24472). Should you have any comments or concerns regarding your treatment as a participant in this study, please contact the Office of Research Ethics at 780-213-2033 or by e-mail to gleicht@athabascau.ca.

You are under no obligation to participate in the study and there are no known or anticipated risks of harm associated with participating in the study. If you agree to participate, you have the right to refuse to answer any questions and may withdraw from the research without prejudice by sending an email to wtracz1@athabasca.edu by the data collection closing date of ____. There will be no repercussion to your employment status at [Utility Name] if you refuse to participate or withdraw from the study.

Thank you in advance for your interest in this project. To participate, please click on **survey hyperlink** to proceed to the survey.

Yours sincerely,

Warren Tracz

EdD Program Student

Athabasca University

Appendix B: Study Consent and Online Questionnaires

Note: The information included in Appendix B is provided to all those who agree to participate in the study as the initial welcome page in the web-based survey instrument. Appendix B gathers data associated with research SQ1 and SQ2.

Welcome to the TPACK and Self-Efficacy Questionnaire.

Informed Consent: Obtaining a fully completed questionnaire is appreciated. However, participants may opt out from answering any question. As a volunteer, you have the right to refuse to answer any question, and to terminate participation at any time. There will be no repercussion to your employment status at [Utility name] if you refuse to participate or withdraw from the study. Please rest assured that your identity and your responses to be reported in the dissertation will be kept strictly confidential.

By completing this survey/questionnaire you agree that:

1. You have read what this research project is about and understood the risks and benefits.
2. You have had time to think about participating in the project and had the opportunity to ask questions and have those questions answered to your satisfaction.
3. You are free to withdraw participation from the project by closing your browser window or navigating away from this page, without having to give a reason and that doing so will not affect you now or in the future.
4. You understand that if you choose to withdraw, you may request that your data be removed from the project by contacting the principal investigator at wtracz1@athabasca.edu before ___.

Please retain a copy of this consent information for your records.

Clicking “Next” below and submitting this questionnaire constitutes your consent and implies your agreement to the above statements.

When answering all questions, please respond as accurately as possible to permit the best learning plan development for you.

Part 1: Demographic Questions

The section of the questionnaire gathers demographic information which may provide information to create correlational findings. Each question will have a free form text field for the entry of the answer or a multiple-choice type of response to assist in keeping the answers organized.

1. What is your first name? Answering this question will permit your TPACK scores to be returned to you and will be replaced by an alias when reporting any data. *Free form text field.*
2. What is your age range? Answering this question may provide correlational data to be developed. *Multiple Choice.*
    a. Under 24
    b. 25 to 34
    c. 35 to 44
    d. 45 to 54
    e. 55 to 64
    f. over 65
    g. Prefer not to answer.
3. What is your gender? Answering this question may provide correlational data to be developed. *Multiple Choice.*

a. Male

b. Female

c. Prefer not to answer.

4. What is the total number of years you have been designing training, teaching, or assessing learners in any capacity in the SOS Training and Development department? *Free form text field.*

5. What is the total number of years you have been teaching in any capacity? This may include teaching as part of a club or coaching in sports as examples. *Free form text field.*

6. What is the highest level of education you have completed? *Multiple Choice.*

a. Some high school

b. High school graduate (grade 12)

c. High school graduate (grade 13)

d. Some college courses

e. College certificate

f. College 2-year diploma

g. College 3-year diploma

h. College graduate certificate

i. Some university courses

j. University graduate certificate

k. University 3-year degree

l. University 4-year degree

m. Some Master's degree courses

n. Master's degree

o. Some doctoral courses

p. Doctoral degree

7. How many instructional training professional development courses have you completed?

Free for text field.

8. What is area your primary area of specialization within System Operations training?

Multiple Choice.

a. Administration

b. General topics

c. Distribution Operations – Dispatch

d. Distribution Operations – Operating

e. Transmission Operations

f. Supervisory and Leadership Development

Part 2 – TPACK Questionnaire

Note: The questions used here are developed from Valtonen et al., (2017), Kabakci Yurdakul et al. (2012), and Archambault and Barnett (2010).

Some definitions

Reflective thinking – ability to consciously think about one's own studying, learning, and skills.

Problem solving – ability to solve previously unknown tasks and problems by deduction and by combining previous information and experiences in a new way.

Critical thinking – ability to process large amounts of information, to evaluate the reliability of information and to compare different sources of information.

Information and communications technology (ICT) – a wide range of different devices, such as computers, tablets, smart phones, etc., as well as web-based applications and software, social

media services (e.g., blogs, Facebook, Instagram) and online learning environments (e.g., Learning Management System, Office365, WebEx, Skype).

When answering the following questions, use the following Likert scale about your current abilities in the topic area:

1. I need a lot of additional knowledge about the topic.
2. I need some additional knowledge about the topic.
3. I need a little additional knowledge about the topic.
4. I have some knowledge about the topic.
5. I have good knowledge about the topic.
6. I have strong knowledge about the topic.

Pedagogical Knowledge (PK)

First, think how well you believe you know the processes of learning on a general level. Also consider in which areas you feel you need more information and in which areas you feel your current knowledge is sufficient or strong.

Evaluate your knowledge about the given topics.

PK1: I can select a particular strategy best suited to teach a specific concept related to the learner's job description.

PK2: I can use a variety of teaching strategies to relate various concepts to learners.

PK3: I can support learner's reflective and critical thinking.

PK4: I can guide learners in planning their own learning.

PK5: I can guide learners to make use of each other's thoughts and ideas during group work (2-8 learners).

PK6: Supporting learners' task related problem-solving skills.

Technological Knowledge (TK)

Next, consider your own relationship with information and communications technology (ICT), teaching technologies (WebEx, learning management systems, and social media), and control room software such as the Outage Response Management System or control system software. How do you perceive your knowledge and your skills?

Evaluate your knowledge and skills in the given topics:

TK1: I can solve ICT and related problems.

TK2: I am familiar with technologies for teaching and their features.

TK3: I can use new teaching technologies.

TK4: I know several websites about new teaching technology.

TK5: I know how control room technologies work.

TK6: I can use control room technologies.

Content Knowledge (CK)

Next think about your content expertise in power system operations, outage planning, and control room work processes. Please consider how well you believe you know the subject contents and in which areas you feel you need additional information or in which areas you feel your knowledge is sufficient or strong.

Evaluate your knowledge in the given topics:

CK1: I have sufficient knowledge to develop content for power system operations.

CK2: I can plan the sequence of concepts taught within my class.

CK3: I know the history and development of important theories and practices in power system operations.

CK4: I am familiar with recent research in power system operations.

CK5: I am familiar with power system outage planning.

CK6: I am familiar with control room work processes.

Interaction Between Pedagogical and Content Knowledge (PCK)

Now consider your pedagogical knowledge and content knowledge in power system operations together. Please consider in which areas you feel you need additional information or in which areas you feel your knowledge is sufficient or strong.

Evaluate your knowledge about the given topics:

PCK1: In power system operations, I know how to guide learners' content-related problem solving in groups (2-8 learners).

PCK2: In power system operations, I know how to assist learners in noticing connections between various concepts in a curriculum.

PCK3: In power system operations, I know how to guide learners to make use of each other's thoughts and ideas in group work (2-8 learners).

PCK4: In power system operations, I know how to to anticipate learner's misconceptions within a particular topic.

PCK5: In power system operations, I know how to guide learners in planning their own learning.

PCK6: In power system operations, I know how to guide learners' problem-solving skills.

Interaction Between Technological and Pedagogical Knowledge (TPK)

Next, we consider the possibilities of using information and communications technology (ICT), teaching technologies (WebEx, learning management systems, and social media), and control room software in teaching. First think on a general level about how familiar you are with using technology to realise your pedagogical goals. Please consider in which areas you feel you need additional information or in which areas you feel your knowledge is sufficient or strong.

Evaluate your knowledge about the given topics:

TPK1: I know how to create an online environment which allows learners to build new knowledge and skills.

TPK2: I know how to use ICT in teaching as a tool for learners to plan their own learning.

TPK3: I know how to use ICT in teaching as a tool for sharing ideas and thinking together.

TPK4: I know how to implement different methods of teaching online.

TPK5: I know how to use ICT in teaching as a tool for learners' problem solving in groups (2-8 students).

TPK6: I know how to use ICT in teaching as a tool for learners' critical and reflective thinking.

Interaction Between Content and Technological Knowledge (TCK)

Please consider now, how well you know the technologies that are used in professions related to power system operations.

Evaluate your knowledge about the given topics:

TCK1: I know websites with online materials for studying power system operations.

TCK2: I know ICT-applications which are used by instructional staff in power system operations.

TCK3: I know ICT-applications which I can use to better understand the topics of power system operations.

TCK4: I know technologies which I can use to illustrate difficult concepts in power system operations.

TCK5: I know how to use technological representations (i.e., multimedia, visual demonstrations, etc.) to demonstrate specific concepts in power system operations.

TCK6: I can implement job and task related curriculum in an online or blended learning environment.

Interaction Between Pedagogical, Technological, and Content Knowledge (TPACK)

Now we add all the segments together. Please consider your pedagogical, technological, and content knowledge in power system operations training together. Please consider in which areas you feel you need additional information or in which areas you feel your knowledge is sufficient or strong.

Evaluate your knowledge about the given topics:

TPACK1: In teaching power system operations, I know how to use technology as a tool for encouraging online interactivity among learners.

TPACK2: In teaching power system operations, I know how to use learner assessment technology to modify online instruction.

TPACK3: In teaching power system operations, I know how to use technology through online learner feedback to modify instruction.

TPACK4: In teaching power system operations, I know how to use technology to predict learners' skill/understanding of a particular topic.

TPACK5: In teaching power system operations, I know how to use technology to create effective representations of content that depart from theoretical knowledge.

TPACK6: In teaching power system operations, I know how to meet the overall demands of online teaching.

Part 3 – Self-Efficacy Questionnaire

Note: The questions in this part of the questionnaire are drawn from Tschannen-Moran & Hoy (2001) who permit the use of the Ohio State Teacher Efficacy Scale (OSTES) instrument without

copyright restrictions on the instrument for use in scholarly research and for non-profit educational purposes. The questions have replaced "student" with "learner" and "classroom" with "blended teaching". "Coursework" was replaced with the word "learning", and "families" was replaced with "manager" to respect the workplace application of this study.

This part of the questionnaire is designed to help me gain a better understanding of the kinds of things that create challenges for workplace instructors. Please indicate your opinion about each of the questions below by marking any one of the nine responses ranging from (1) "None at all" to (9) "A Great Deal" as each represents a degree on the continuum. Please respond to each of the questions by considering the combination of your current ability, resources, and opportunity to do each of the following in your present position. Note that blended learning includes standard classroom instruction as well as learning online.

Instructional Strategies

1. To what extent can you use a variety of assessment strategies?
2. To what extent can you provide an alternative explanation or example when learners are confused?
3. To what extent can you craft good questions for your learners?
4. How well can you implement alternative strategies in your blended teaching?
5. How well can you respond to difficult questions from your learners?
6. How much can you do to adjust your lessons to the proper level for individual learners?
7. To what extent can you gauge learner comprehension of what you have taught?
8. How well can you provide appropriate challenges for very capable learners?

Blended Learning Management

9. How much can you do to control disruptive behavior in blended teaching?

10. How much can you do to get learner to follow blended teaching rules?
11. How much can you do to calm a learner who is disruptive or noisy?
12. How well can you establish a course management system with each group of learners?
13. How well can you keep a few problem learners from ruining an entire lesson?
14. How well can you respond to defiant learners?
15. To what extent can you make your expectation clear about learner behavior?
16. How well can you establish routines to keep activities running smoothly?

Student Engagement

17. How much can you do to get students to believe they can do well in their learning?
18. How much can you do to help your learners value the process of learning?
19. How much can you do to motivate learners who show low interest in their learning?
20. How much can you assist managers in helping their workers do well in blended learning?
21. How much can you do to improve the understanding of a learner who is failing?
22. How much can you do to help your students think critically?
23. How much can you do to foster learner creativity?
24. How much can you do to get through to the most difficult learners?

Part 4 – Open-Ended Questions

Two open-ended questions will be posed to the participants to provide richer data to the study via free-form text responses.

Q1. Based on your experience as a training team member, what teaching technologies are you intending or planning to use as we move to a blended teaching model?

Q2. Given your answer about teaching technologies, what barriers to adoption do you anticipate that might affect your use of those technologies?

Thank you for your participation in this research! Your individual responses will be analyzed and shared with you soon. The data from your responses will be used to invite you to participate in a focus group discussion on a topic related to TPACK and technology adoption.

Appendix C – Semi-Structured Focus Group Questions

Note: Appendix C gathers data associated with research SQ3 and SQ4.

Thank you for agreeing to participate in this focus group. This group is formed from participants with the common developmental area of _____ (Technology, Pedagogy, or Content Knowledge). This meeting is scheduled for approximately 60 minutes, and you can withdraw at any time without fear of penalty. I am requesting your permission to record today's discussion to assist with accurate data gathering. Be assured that I will safeguard your responses by using pseudonyms if your responses are used in the final report. A copy of your transcript will be provided to you so you can check your text for accuracy. Do I have your agreement to proceed?

Let us begin.

1. What was your initial thoughts or feelings when you received your TPACK and self-efficacy questionnaire results?
2. What ideas did you generate about specific training you might take to improve your abilities as a trainer through professional development?
3. What approaches to blended teaching or technologies are you considering exploring?
4. The people in this interview all have the same area of development. How do you feel about learning together?
5. What timeline, number of courses, and whether campus or online delivery, are you thinking about for your personal development action plan?

Closing the focus group meeting

Thank you for participating in this discussion which is now closed. I will return to you a transcript of your specific responses for you to check, confirm, and clarify any point you made.

Please return your transcript to me by _____ so I can start the data analysis. Any responses included in the final report will use an alias to ensure your anonymity.

I will also be sending you a short questionnaire to gather information about your current state of self-efficacy now that your personal professional development plan may be clearer. Please complete this questionnaire by _____.

Appendix D – Study Location Access Request

From:

Sent: Tuesday, May 18, 2021, 3:16 PM

To: Tracz, Warren <wtracz1@athabasca.edu>

Subject: RE: Access request - Teaching Self-efficacy research study

Warren you have my approval.

All the best.

Director

Date

Name

Director – Utility

Street address

City, Province, Postal Code

Dear (Name),

As required by Athabasca University Research Ethics Board, this letter is sent to you requesting your approval for me to conduct a survey of, and focus group meetings with, Training and Development department employees as part of my Doctor of Education program at Athabasca University. The survey questionnaire will take approximately 45 minutes to complete though an online survey website. The focus group interviews will take approximately 60 minutes to complete and may be conducted in person or by web conferencing software. Invitations for

these activities will be distributed by email and will include informed consent information. Study participants may elect to opt out without penalty until the data collection process is completed.

The survey questionnaire seeks to determine participant demographic information as well to gather their technology, pedagogy, and content knowledge (TPACK) scores. Teaching self-efficacy data will also be gathered in the areas of instructional strategies, blended learning management, and learner engagement. Individual questionnaire data will be shared with the employees and be used to invite them to focus group interviews which focus on creating personal professional development plans for blended teaching. Focus group interviews will be recorded and transcribed, then information will be shared with the participants for them to confirm their statements have been accurately documented.

I look forward to your approval of this request at your earliest convenience such that I may continue with the Research Ethics Board application procedure. Should you have any questions, please contact me at wtracz1@athabasca.edu.

Sincerely,

Warren Tracz

EDDE Program Student

Athabasca University

Appendix E – Focus Group Invitation

From: TRACZ Warren

Sent: December 8, 2021, 10:30 AM

To:

Subject: Research Project (Pedagogy, Technology or Content Knowledge) focus group

When: December 17, 2021, 9:00 AM-11:00 AM (UTC-05:00) Eastern Time (US & Canada).

Where: CONF RM: ___ VIDEO

All,

Thanks for your participation in this research by completing the TPACK questionnaire. This focus group will focus on content knowledge professional development and will be approximately one hour in duration.

I have attached a participant consent form for you to consider prior to the meeting. This form is required as I will be recording the audio discussion in the meeting to aid in the preparation of a transcript which you will be asked to verify once prepared.

Let me know if you have any questions, I'd be happy to answer them.

Warren Tracz

EDDE Program Student

Athabasca University

Webex Personal Room meeting Invitation (link) and dial-in instructions

Appendix F – Focus Group Informed Consent Form

Date:

Study Name: Assessing and promoting corporate instructor blended teaching self-efficacy via the TPACK model

Researcher: Warren Tracz

Purpose of the Research: To determine if TPACK data, informed by focus groups, assists instructors with defining professional development plans.

What You Will Be Asked to Do in the Research: In a focus group of approximately 60 minutes duration, you will be asked to reflect on your TPACK and self-efficacy scores gathered through a questionnaire. You will be asked five questions that you will discuss with peers to determine what, if any, professional development you would like to complete.

Risks and Discomforts: We do not foresee any risks or discomfort from your participation in the research.

Benefits of the Research and Benefits to You: Include a statement regarding any benefits of the research as well as benefits to the research participants.

Voluntary Participation and Withdrawal: Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer, to stop participating, or to refuse to answer questions will not influence the nature of the ongoing relationship you may have with the researcher, with [name of utility], or Athabasca University either now, or in the future. In the event you withdraw from the focus group portion of this study, all associated data collected will be immediately destroyed up to the point where the transcript has been verified by you.

Confidentiality: The recording of the participant will not be associated with identifying information. An alias will be used in place of names. All information you supply during the research will be held in confidence and your name will not appear in any report or publication of the research. Audio data will be collected on a digital recording device and converted to a text transcript. Your data will be safely stored in a locked facility on an encrypted and password protected USB and only researcher will have access to this information. The audio data will be stored only until your audio transcript has been verified by you. Once verified, the audio file will be deleted. This process is anticipated to take up to three months. Once deleted, the Transcript data will be retained for five years and then destroyed by deleting digital files and secure shredding of any notes. Confidentiality will be provided to the fullest extent possible by law. The data collected in this research project may be used – in an anonymized form – by the researcher in subsequent research investigations exploring similar lines of inquiry. Such projects will still undergo ethics review by our institutional REB. Any secondary use of anonymized data by the research team will be treated with the same degree of confidentiality and anonymity as in the original research project.

Questions About the Research? If you have any questions about this study or would like additional information to assist you in reaching a decision about participating, please feel free to contact me via email at wtracz1@athabasca.edu, or Dr. Mohamed Ally at 1-866-916-8650, or by email to mohameda@athabascau.ca. In addition, this study has been reviewed by the Athabasca University Research Ethics Board (Ethics File No. 6578). Should you have any comments or concerns regarding your treatment as a participant in this study, please contact the Office of Research Ethics at 780-213-2033 or by e-mail to gleicht@athabascau.ca.

Legal Rights and Signatures:

I _____, consent to participate in the study Assessing and promoting corporate instructor blended teaching self-efficacy via the TPACK model conducted by Warren Tracz. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Signature Date

Participant

Signature Date

Principal Investigator

Additional consent

I give my additional consent by including check boxes or requesting additional signatures for the following:

1. Audio recording

___ I consent to the audio-recording of my focus group.

Signature Date

Participant Name:

Appendix G – Focus Group Transcript Member Check Request

From: TRACZ Warren

Sent: Tuesday, January 4, 2022, 8:27 AM

Subject: Content Knowledge focus group transcript

Attached is the transcript of the content knowledge focus group we had on December __, 2021. Please review the transcript and make any additions to your remarks in the transcript using tracked changes that you feel makes you answers to the questions more complete. If you have no changes, let me know.

I will accept changes transcript until 4 pm, January 14, 2022. If none returned by then I'll consider the transcript to be accurate and complete.

Thanks again for your participation in this research.

Warren Tracz

EdD candidate

Athabasca University

Appendix H – Post Focus Group Self-Efficacy Questionnaire Request

The following message was sent to focus group participant inviting them to complete the self-efficacy questionnaire a second time. This would assist in determining if there was any change in the participant's self-efficacy as a result of engaging in a focus group.

From: TRACZ Warren

Sent: December 10, 2021, 3:27 PM

To:

Subject: Post Focus Group Questionnaire

Thanks again for participating in the focus group today. As I mentioned, there is one last survey to complete as part of this research.

You can access the questionnaire at (link)

It should only take you 10 minutes to complete.

Thanks again and I look forward to reviewing your responses.

Warren Tracz

EdD candidate

Athabasca University

Appendix I – Research Ethics Board Approval

Athabasca University
RESEARCH CENTRE

CERTIFICATION OF ETHICAL APPROVAL

The Athabasca University Research Ethics Board (REB) has reviewed and approved the research project noted below. The REB is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2) and Athabasca University Policy and Procedures.

Ethics File No.: **24472**

Principal Investigator:
Mr. Warren Tracz, Doctoral Student
Faculty of Humanities & Social Sciences\Doctor of Education (EdD) in Distance Education

Supervisor:
Dr. Mohamed Ally (Supervisor)

Project Title:
PROMOTING CORPORATE INSTRUCTOR BLENDED TEACHING SELF-EFFICACY VIA THE TPACK MODEL

Effective Date: October 20, 2021 **Expiry Date**: October 19, 2022

Restrictions:

Any modification or amendment to the approved research must be submitted to the AUREB for approval.

Ethical approval is valid *for a period of one year*. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.

A Project Completion (Final) Report must be submitted when the research is complete *(i.e. all participant contact and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable))* or the research is terminated.

Approved by: **Date: October 20, 2021**

Michael Lithgow, Chair
Faculty of Humanities & Social Sciences, Departmental Ethics Review Committee

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Athabasca University Research Ethics Board
University Research Services, Research Centre
1 University Drive, Athabasca AB Canada T9S 3A3
E-mail rebsec@athabascau.ca
Telephone: 780.213.2033

Appendix J – Research Ethics Board Renewal

Athabasca University
RESEARCH CENTRE

CERTIFICATION OF ETHICAL APPROVAL - RENEWAL

The Athabasca University Research Ethics Board (REB) has reviewed and approved the research project noted below. The REB is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2) and Athabasca University Policy and Procedures.

Ethics File No.: 24472

Principal Investigator:
Mr. Warren Tracz, Doctoral Student
Faculty of Humanities & Social Sciences\Doctor of Education (EdD) in Distance Education

Supervisor/Project Team:
Dr. Mohamed Ally (Supervisor)

Project Title:
PROMOTING CORPORATE INSTRUCTOR BLENDED TEACHING SELF-EFFICACY VIA THE TPACK MODEL

Effective Date: July 4, 2022 **Expiry Date**: July 03, 2023

Restrictions:

Any modification/amendment to the approved research must be submitted to the AUREB for approval prior to proceeding.

Any adverse event or incidental findings must be reported to the AUREB as soon as possible, for review.

Ethical approval is valid *for a period of one year*. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.

An Ethics Final Report must be submitted when the research is complete *(i.e. all participant contact and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable))* or the research is terminated.

Approved by: **Date: July 04, 2022**

Paul Jerry, Chair
Athabasca University Research Ethics Board

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