Transforming Lessons and Those Who Write Them: Professional Development for Educational Content Writers to Integrate Technology Into Lessons Using the Tpack Framework

Rachael Patricia Santopietro

Follow this and additional works at: https://scholarcommons.sc.edu/etd

Part of the Educational Technology Commons

Recommended Citation

This Open Access Dissertation is brought to you by Scholar Commons. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of Scholar Commons. For more information, please contact digres@mailbox.sc.edu.
TRANSFORMING LESSONS AND THOSE WHO WRITE THEM: PROFESSIONAL DEVELOPMENT FOR EDUCATIONAL CONTENT WRITERS TO INTEGRATE TECHNOLOGY INTO LESSON DESIGNS USING THE TPACK FRAMEWORK

By

Rachael Patricia Santopietro

Bachelor of Science
Bob Jones University, 2000

Master of Education
Bob Jones University, 2017

Submitted in Partial Fulfillment of the Requirements
For the Degree of Doctor of Education in
Learning Design and Technologies
College of Education
University of South Carolina
2023

Accepted by:
William Morris, Major Professor
Anna Clifford, Committee Member
Hengtao Tang, Committee Member
Lucas Vasconcelos, Committee Member
Ann Vail, Dean of the Graduate School
DEDICATION

To my husband, for supporting this venture with his editorial skills, his many cups of hot tea, and his encouraging words
ACKNOWLEDGEMENTS

I extend a heartfelt thanks to Dr. Morris and to my colleagues and friends at my publishing company for their participation, ideas, support, and inspiration—especially my manager, Jeff, and my collaborator, Milton.
ABSTRACT

Efforts to improve technology integration for K–12 teaching and learning focus on professional development for teachers. This research study, however, implemented a professional development course in technology integration for Educational Content Writers at a publisher in the Southeastern United States. This research is strategic because most writers surveyed do not integrate technology to align with pedagogy and content, because developing 21st century learning is important, and because educational resources should meet national standards for integrating technology.

This action research involved designing and implementing a professional development course that instructed Content Writers \( n = 6 \) in technology integration using the TPACK framework in combination with transformative learning theory in a descriptive, predominantly qualitative mixed methods approach. Professional development employed an asynchronous, interactive course accessed through the Canvas learning management system. This course included instruction for participants through readings, video, discussion posts, journal entries, collaborative meetings, and assessments. Data collection methods included the TPACK survey and the Technology Integration Assessment Rubric to evaluate the knowledge and lesson designs of six Educational Content Writers both before and after the intervention. Discussion posts, a focus group, and individual interviews collected data on writer experiences and changes in perceptions of technology integration.
Participants expressed the perception that though they had struggled in the past to integrate technology, they were motivated and confident to integrate technology into lesson designs. Professional development for Educational Content Writers in technology integration can effectively employ the same strategies and frameworks as professional development for teachers with the added benefit of a greater impact on student learning experiences through educational materials that align content, pedagogy, and technology.
TABLE OF CONTENTS

Dedication ................................................................................................................................................... iii

Acknowledgements ....................................................................................................................................... iv

Abstract ....................................................................................................................................................... v

List of Tables ................................................................................................................................................ x

List of Figures ............................................................................................................................................... xii

Chapter 1: Introduction ................................................................................................................................. 1
  National Context .......................................................................................................................................... 1
  Local Context .............................................................................................................................................. 4

Statement of the Problem ............................................................................................................................. 6

Statement of Researcher Subjectivity and Positionality ............................................................................. 7

Definition of Terms ...................................................................................................................................... 10

Chapter 2: Literature Review ....................................................................................................................... 12
  Introduction ................................................................................................................................................. 12

Setting Context for Technology Integration ............................................................................................. 14

TPACK Conceptual Framework of Professional Development in Technology Integration

Integration ....................................................................................................................................................... 26

Strategic Professional Development in Technology Integration .............................................................. 33

Assessment of Professional Development in Technology Integration ..................................................... 39

Chapter Summary and Discussion .............................................................................................................. 42
Chapter 3: Method ............................................................................................................. 44
  Research Design ........................................................................................................... 45
  Setting ......................................................................................................................... 47
  Participants .................................................................................................................. 48
  Intervention .................................................................................................................. 50
  Data Collection Methods .............................................................................................. 58
  Data Analysis ............................................................................................................... 66
  Rigor and Trustworthiness ............................................................................................ 70
  Plan for Sharing and Communicating Findings .......................................................... 78

Chapter 4: Analysis and Findings ...................................................................................... 80
  Quantitative Data and Findings .................................................................................... 80
  Qualitative Findings and Interpretation ........................................................................ 85
  Chapter Summary ........................................................................................................ 159

Chapter 5: Discussion, Implications, and Limitations ..................................................... 161
  Discussion ................................................................................................................... 162
  Implications .................................................................................................................. 197
  Limitations ................................................................................................................... 206
  Closing Thoughts ......................................................................................................... 209

References ...................................................................................................................... 210

Appendix A: TPACK Self-Assessment Survey (Schmidt et al., 2009) ................................ 234
Appendix B: Technology Integration Assessment Rubric (Harris et al., 2010) ................. 243
Appendix C: Focus Group Protocol ............................................................................... 245
LIST OF TABLES

Table 2.1 Connecting Literature on Professional Development to Populations .......... 205

Table 3.1 Demographics of Volunteers................................................................................................................. 49

Table 3.2 Alignment of Research Questions to Professional Development Use of the TPACK Framework...................................................................................................................................... 49

Table 3.3 Alignment of Professional Development with Transformative Learning Theory .................................................................................................................................................. 56

Table 3.4 Research Questions and TPACK and Data Collection Sources Alignment .... 59

Table 3.5 Research Questions and TPACK Domains.............................................................................................. 60

Table 3.6 TPACK Survey Reliability Scores, Version 1.1 (Schmidt et al., 2009) ................. 61

Table 3.7 Alignment of Discussion Post Prompts with Transformative Learning Theory 62

Table 3.8 Sample Focus Group Protocol Prompts ................................................................................................. 64

Table 3.9 Sample Interview Protocol Prompts ................................................................................................. 65

Table 3.10 Research Questions and Data Analysis Alignment ................................................................................. 67

Table 3.11 Summary of Procedure and Timeline ................................................................................................. 74

Table 4.1 Subscale Composite Scores for the TPACK Survey.......................................................... 82

Table 4.2 Lesson Analysis Using the Technology Integration Assessment Rubric.............. 84

Table 4.3 Qualitative Data Sources and Codes ......................................................................................... 86

Table 4.4 Classifications of Round 3 and Round 4 Codes of First Cycle Coding ................. 93

Table 4.5 Comparison of the Categories in Rounds of Second Cycle Coding ..................... 97

Table 4.6 Comparing Round 1 and Round 2 Themes During Third Cycle Coding............ 103
<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7</td>
<td>Themes, Related Categories, and Assertions</td>
<td>105</td>
</tr>
<tr>
<td>5.1</td>
<td>Writers Grouped by Characteristics (Presky, 2001)</td>
<td>183</td>
</tr>
<tr>
<td>A.1</td>
<td>TPACK Self-Assessment Survey (Schmidt et al., 2009)</td>
<td>234</td>
</tr>
<tr>
<td>A.2</td>
<td>Revised Questions on TPACK Self-Assessment Survey</td>
<td>241</td>
</tr>
<tr>
<td>B.1</td>
<td>Technology Integration Assessment Rubric (Harris et al., 2010)</td>
<td>243</td>
</tr>
<tr>
<td>C.1</td>
<td>Research Questions and Focus Group Questions Alignment</td>
<td>246</td>
</tr>
<tr>
<td>D.1</td>
<td>Research Questions and Interview Questions Alignment</td>
<td>249</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure 1.1 Framework for 21st Century Learning ......................................................... 2

Figure 2.1 The TPACK Framework of Professional Development ................................. 28

Figure 2.2 Transformative Learning Theory (Mezirow, 1995) ........................................ 31

Figure 3.1 Syllabus in Professional Development Course ............................................. 52

Figure 3.2 Example of a Module in the Professional Development Course .................. 53

Figure 3.3 Sample Module Overview ........................................................................... 53

Figure 3.4 Sample Module Instruction .......................................................................... 53

Figure 3.5 Sample Module Self Quiz ........................................................................... 54

Figure 4.1 Sample of First Round Coding in Microsoft Word in First Cycle Coding .... 89

Figure 4.2 Second Round Coding in Delve in First Cycle Coding ............................... 91

Figure 4.3 Codebook Begun During the Second Round Coding in Delve in First Cycle Coding ................................................................. 92

Figure 4.4 First Round Coding in Microsoft Word in Second Cycle Coding ............... 94

Figure 4.5 Third Round Coding in Delve in Second Cycle Coding ............................. 96

Figure 4.6 Preliminary Concept Mapping to Determine Initial Themes from Categories and Codes in Round 1 of Third Cycle Coding .................. 100

Figure 4.7 Concept Mapping to Determine Themes from Categories and Codes in Round 2 of Third Cycle Coding ........................................ 102

Figure 4.8 Final Organization of Codes, Categories, and Themes in Delve at the end of Third Cycle Coding .................................................. 102
Figure 4.9 Theme 1 Categories and Selected Codes Concept Map ................................ 108

Figure 4.10 Theme 2 Categories and Selected Codes Concept Map ............................. 124

Figure 4.11 Theme 3 Categories and Selected Codes Concept Map ............................. 143

Figure 5.1 Course Module 5 Web 2.0 Tools Showcase ................................................ 165

Figure 5.2 Course Module 4 Models of Technology Use
   Within Specific Content Areas ........................................................................... 168

Figure 5.3 Course Module 1 Activating Event ............................................................. 173

Figure 5.4 Discussion Blog in Module 2 .................................................................... 174

Figure 5.5 Video Lesson Models of TPACK in Module 4 ........................................... 176
CHAPTER 1: INTRODUCTION

National Context

One significant way educators invest in families, communities, and the nation is by preparing students for their future jobs. Some of these jobs do not yet exist (Kruger, 2019). Jobs related to science, technology, engineering, and mathematics (STEM fields) represented 6.2% of U.S. jobs in 2015 (Business Roundtable, 2013; Fayer et al., 2017; Vilorio, 2014), with this statistic remaining steady in 2023 (Deville, n.d.). Jobs in STEM fields are projected to rise by 10.5% in the next decade (U.S. Bureau of Labor Statistics, 2022). In addition to this, all jobs are predicted to change with the emergence of new technologies (Business Roundtable, 2013).

Businesses are concerned that education has not kept up with a continually changing workforce. Business leaders observe that students are not well prepared to enter the workforce for two reasons. First, the current educational system demonstrates a continued focus on the development of knowledge and skills that may be automated in the jobs of the future (Business Roundtable, 2013; Dintersmith, 2019). Second, students are not developing the skills needed to thrive in the modern workforce, such as creativity, collaboration, communication, and problem-solving skills (Business Roundtable, 2013; Dintersmith, 2019).

Instead, K–12 education should prepare students for jobs of the future by focusing on closing gaps in 21st century skills, including critical thinking, creativity,
collaboration, digital literacy, and problem-solving in authentic contexts (Dintersmith, 2019; Johnson, 2009; Sixt, 2020). According to the Framework for 21st Century Learning, the four support systems for developing 21st century skills are (1) standards and assessments, (2) curriculum and instruction, (3) professional development, and (4) learning environments (Partnership for 21st Century Learning, 2019). See Figure 1.1 for a diagram of the Framework for 21st Century Learning.

![Figure 1.1](image)

**Figure 1.1**

**Framework for 21st Century Learning**

(Note: Creative Commons)

The importance of technology integration for 21st century learning is highlighted by the establishment of technology standards for teachers (ISTE, 2018) and students (ISTE, 2018). Curriculum and instruction should integrate technology to promote critical
thinking and give practice in solving authentic problems (Coskun et al., 2017; M. Miller, 2017; Tarling & Ng’ambi, 2016).

Professional development is also essential for educators to effectively integrate technology into instructional materials in strategic ways (Aprinaldi et al., 2018; Coskun et al., 2017; Selwyn et al., 2017). Researchers have demonstrated that frameworks of technology integration can provide structure to assist educators in designing instruction that integrates technology (Koehler & Mishra, 2006). Professional development can build teacher confidence and shape their core dispositions toward technology integration for sustained change (Günes & Bahçivan, 2016; Tarling & Ng’ambi, 2016; Tondeur et al., 2020).

Technology can be integrated in ways that profoundly influence learning environments. Instructional materials that are interactive (Gay et al., 2020; Ilovan et al., 2018) and employ simulations (Arista & Kuswanto, 2018; Cayvaz et al., 2020), digital storytelling (Girmen & Kaya, 2019), animations (Ilovan et al., 2018), adaptive learning (Farmer et al., 2020), cloud computing (Lee et al., 2013), augmented reality (Öngöz & Mollamehmetoglu, 2017), game-based learning (Thomas, 2017), virtual reality (Peterson & Stone, 2019), podcasts (Selwood et al., 2016), and multimedia (Lin, 2019; Öngöz & Mollamehmetoglu, 2017) have the potential to provide students with meaningful educational experiences in the hands of a competent teacher.

Textbook publishers are one of the most common providers of standards-based instructional materials. These materials have great potential to influence learning environments. However, there is evidence that the traditional textbook is in decline and
digital educational resources are on the rise, with a decline in the sales of basal curriculum of 3.6% and an increase in courseware sales of 2.5% (Simba Information, 2019). According to McKenzie (2018), more textbook revisions are being completed with fewer authors, and large textbook publishers such as Pearson, Macmillan, and Cengage are changing the way they develop products so that they are more efficient, nimble, and prepared to offer content in a digital format along with adaptive assessments and more interactive multimedia features. In a large survey of K–12 educational publishing material by Simba Information (2019) for the 2019–2020 school year, researchers identified open education resources as offering competition to textbook publishers and indicated that artificial intelligence, videos, and courseware are needs in the market, highlighting the need in the textbook publishing industry for instructional materials that integrate technology in strategic ways.

Local Context

The local context of this research is a pre-K–12 educational publisher in the Southeastern United States. The Academic Integrity division consists of content creators for educational products, including writers and Instructional Designers. Writers are responsible for writing educational content in the form of lessons, activities, and features for printed and digital instructional materials. They work to align subject content with pedagogy. A qualification for writers is that they have previous teaching experience, preferably in the content in which they are writing.

The technology offerings for this publisher, including a digital resource library, are created by an entirely different group of employees. Based on a research study
including interviews, focus groups, and survey data of users and nonusers, participants valued the time-saving quality of the technology resources in this library, though users requested professional development and recommended ways to improve the user interface and visual appeal (Anonymous, 2019). Though collaboration is increasing among departments at this pre-K–12 educational publisher, there is room for growth in collaboration and in the production of technology tools.

In July of 2020, this publisher created the Educational Technology department and hired a senior manager. The role of this department is to research developments in educational technology, recommend innovations in educational technology, and collaborate with other departments to develop and promote educational technology (Anonymous, 2022). This department has grown, hiring its first employees and working to roll out new technology products. These new products include a customizable e-textbook with an interactive layer in which a teacher can embed hyperlinks, assessments, and video content.

As the manager of Instructional Design, my interaction with this new department is to lead Instructional Designer in my department to collaborate with both Educational Technology Specialists and writers to develop and integrate educational technology into instruction (Anonymous, 2022). My department works most closely with the Educational Technology Specialists. This has involved brainstorming for ideas with writers and Educational Technology Specialists for technology to integrate into educational products to facilitate and enhance learning (Januszewski & Molenda, 2008).
Statement of the Problem

Based on a survey of the Educational Content Writers with a 65% response rate, 85% of respondents do not integrate technology into educational products (Santopietro, 2020). The two most common reasons cited for not doing so are lack of knowledge and a lack of ideas for technology integration (Santopietro, 2020). When respondents do try to integrate technology, they are not confident that it is meeting standards. This lack of confidence does not indicate reluctance, however, because almost all respondents indicated a neutral to strong need for professional development, a need whose value and effectiveness is supported by research (Kimmons & Hall, 2019; Kuo, 2015; Shafie et al., 2019). Writers also viewed technology integration as vital to remaining competitive as a supplier of educational content. The need for publishers to integrate technology is also supported by research (McKenzie, 2018; Shelley et al., 2018; Simba Information, 2019).

A conceptual framework of technology integration provides structure to enable educators such as Educational Content Writers to reach learning goals, assure that technology integration is strategic, and confirm that instruction is pedagogically sound (Kimmons & Hall, 2017; J.-J. Tseng, 2019).

Purpose Statement

The purpose of this action research was to implement a professional development program for Educational Content Writers in technology integration using the TPACK framework to affect the design of educational resources.
Research Questions

The grand tour research question for this study was as follows: How does professional development in the TPACK framework affect the design of educational resources produced by Content Writers?

- Research Question 1: How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals?
- Research Question 2: How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies?
- Research Question 3: How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?

Statement of Researcher Subjectivity and Positionality

In my work for the past twenty years, I have been involved in my company’s efforts to develop and expand our educational technology offerings. In my current position as an instructional designer, I am responsible for inspecting the quality of the educational materials that writers produce as it relates to educational standards and best practices. I make recommendations to improve this quality. These standards and best practices involve instruction in 21st century skills. My work in elevating the quality of educational materials is meaningful for me because I believe that teaching and learning are facilitated and improved by technology integration (Januszewski &
Molenda, 2008). Writers need support to explore emerging technologies to integrate
into lesson designs (Shafie et al., 2019).

My research investigated the effects of professional development using a
contceptual framework to support technology integration in educational materials. I
employed a pragmatic paradigm in my research, using eclectic research methods to
create workable solutions to problems in my local context (Creswell, 2014; Longstreet,
1980).

Because I conducted research with coworkers with similar experience and
expertise and with whom I am well acquainted, my positionality was that of an insider in
collaboration with insiders (Herr & Anderson, 2005). The mode of participation was one
of cooperation (Herr & Anderson, 2005). This positionality enabled me to impact my
cultural context and result in a more democratic approach to research. Participants
operated as fellow researchers. A possible conflict of interest existed because my
company was financially invested in my research pursuits, making the negotiation of my
positionality more sensitive. There was potential for my participants to feel pressure to
participate. Because of this sensitivity, safeguards were added to the recruitment
process, and participants were reassured that participation is voluntary and not a
condition of employment. Member checking by participants and stakeholders as well as
expert consultation on developing professional development was vital for improving
validity, reliability, and objectivity. Accountability to both participants and stakeholders
levered out power differentials and promoted my positionality as an insider in
collaboration with insiders. Journaling during the research process also stimulated constant reflexivity (Creswell, 2014).

Because I am an insider in collaboration with insiders, I began with a thorough knowledge of my participants that led to more accurate research conclusions. Because of my experience and relationship with participants as well as the carefully planned interactions, I have had prolonged exposure to the research site (Mertler, 2020). However, I had already formed postures toward many of my participants and stakeholders, including biases. One of these biases is toward innovation. Because I used volunteer writers for this study, participants may have naturally included more innovative writers that value research for productive change.

As an insider in collaboration with insiders, I was also a participant in the action research (Herr & Anderson, 2005). In my position as the manager of Instructional Design, I am responsible for advising, preparing, and developing writers in the production of educational materials. I empathize with Content Writers throughout this process because of my background as a writer for fifteen years prior to my current position as an instructional designer.

My aim was to realize research goals shared by participants in my professional community, with emphasis on contributing to this community with compassion and integrity.
Definition of Terms

Educational technology is “the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources” (Januszewski & Molenda, 2008, p. 1).

Technology integration is the student and teacher use of technology to improve learning (Inan & Lowther, 2010; Januszewski & Molenda, 2008).

Professional development is training to improve instructional methods (Earle, 2002; Tondeur et al., 2020).

A participant is a volunteer who produced data for this action research and benefits from it (Creswell, 2014).

A facilitator is a volunteer who aided in but did not produce data for this action research (Avgitidou, 2009).

Educational Content Writers create text for educational materials and were participants in this research (Anonymous, 2022).

Educational Technology Specialists advise writers on technology integration in the educational materials they write and were facilitators in this research (Anonymous, 2022).

Biblical Worldview Specialists are theologians who provide philosophical vision and support for Educational Content Writers and were facilitators in this research (Anonymous, 2022).
Instructional Designers are educators who provide academic vision and support for Educational Content Writers and were facilitators in this research (Anonymous, 2022).

A lesson design is a plan for instruction using instructional goals, strategies, and educational technology (Harris et al., 2010; Koh et al., 2015; Tarling & Ng‘ambi, 2016).

Instructional goals are targeted learning outcomes for an instructional experience (Harris et al., 2010; Pareto & Willermark, 2019; Whitfield, 2019).

Instructional strategies are methods of instruction to improve learning (Aldosemani, 2019; Harris et al., 2010).

Educator perceptions are conscious or unconscious attitudes, habits, points of view, and postures which motivate (Anderson, 2016, Tarling & Ng‘ambi, 2016; Tondeur et al., 2020).
CHAPTER 2: LITERATURE REVIEW

Introduction

The purpose of this action research was to implement a professional development program for Educational Content Writers in technology integration using the TPACK framework to affect the design of educational resources. The grand tour research question for this study is as follows: How does professional development in the TPACK framework affect the design of educational resources produced by Content Writers? Supporting research questions are (1) How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals? (2) How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies? (3) How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?

A variety of keyword searches located peer-reviewed articles published between 2013 and 2022. Keywords used to search for articles include the following: technology integration, ICT integration, action research, professional development, digital textbooks, teacher efficacy, and student attitudes. Of the keywords searched, almost all included the addition of the keyword “technology.” Of the other keywords used the four most productive searches involved “professional development” with 42 articles of
interest, “technology integration” with 30 articles, “TPACK” with 28 articles, “action research” with 14 articles, “transformative learning” with nine articles, and “TPACK-in-Action” with 2 articles of interest. Almost all articles were from Eric EBSCO, although a few articles were obtained from searching other databases such as Eric ProQuest, Google Scholar, Springer, and PsychINFO. Other articles were mined from these or recommended by professors, colleagues, and the citation manager Mendeley used to organize literature. A few classic and historical research articles were mined from these articles and included in the literature review.

There is a large body of literature on professional development in technology integration. Many articles on the subject have risen out of shifts in education due to emerging technology and the COVID pandemic. Of the literature reviewed, no research probed my population of study, Educational Content Writers. The lack of research studies on Educational Content Writers is most likely due to the availability of participants from such a population for study and represents a gap in the literature. Table 2.1 is a truth table that explores the transfer of the literature on professional development in technology integration from a population of pre-service and in-service teachers to my population of study of Educational Content Writers through induction (Barnes, et al., 2005; Eldredge et al., 2014). This table reveals that the Educational Content Writers share all criteria examined with pre-service teachers, a population that is often studied in the context of professional development in technology integration (Arya et al., 2020; Günes & Bahçivan, 2016; Schmidt et al., 2009). They also share most criteria with in-service teachers. This inductive analysis concluded that professional
development was likely to produce similar results in my population of study to the
results of pre-service and in-service teachers.

Table 2.1

**Transferring Literature in Professional Development to Population Under Study**

<table>
<thead>
<tr>
<th>Criteria for Analysis</th>
<th>Pre-service Teachers</th>
<th>In-service Teachers</th>
<th>Educational Content Writers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching in a classroom</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Writing lessons</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Setting instructional goals</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Using instructional strategies</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Possessing perceptions of technology</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Possessing content knowledge</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Possessing pedagogical knowledge</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Possessing technological knowledge</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Participating in professional development in technology integration</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

This literature review considers four different components of professional
development in technology integration for the purpose of identifying the most effective
process, strategies, and assessments. I will discuss the (1) context, (2) theoretical
framework, (3) strategies, and (4) assessments of professional development in
technology integration.

**Setting Context for Technology Integration**

When considering the context of professional development in technology
integration, questions to answer are, (1) What is educational technology? and (2) What
prevents technology integration? With those answers, the importance of the integration
of educational technology will be considered.
Defining Educational Technology

The term *technology* is used in different contexts to denote different objects, processes, and resources. First, consider a definition for educational technology to specify the context of the technology under discussion.

Januszewski and Molenda (2008) revised the Association for Educational Communications and Technology (AECT) definition of educational technology to define it as “the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources” (p. 1). Facilitating learning implies meeting learning goals, and improving performance implies using instructional strategies. Januszewski and Molenda acknowledged that educational technology has a history of both study and practice and is governed by a code of ethics. They also noted that educational technology is a tool to make learning easier, though it does not necessarily guarantee or direct learning. The term *learning* does not necessarily mean the accumulation of knowledge; rather, it is the real-world application of knowledge and skills in a way that changes learner dispositions and is best assessed through action (Januszewski & Molenda, 2008). Januszewski and Molenda framed the assessment of learning as “creating, using and managing” technology (p. 1). This technology must be appropriate, as determined by the ethics of technology use (Januszewski & Molenda, 2008).

The definition for educational technology created by Januszewski and Molenda (2008) offers clarity for the goals for technology integration and implies that there are barriers to be overcome.
Describing the Barriers to Technology Integration

Educational technology must be integrated into instruction in strategic ways for it to accomplish the purpose of “facilitating learning and improving performance” (Januszewski & Molenda, 2008, p. 1). There are first- and second-order barriers to technology integration.

The Current State of Technology Integration in K–12 Education

Inan and Lowther (2010) observed that educational technology is used in three different ways: for preparing instruction, for delivering instruction, and for learning. They noted that the use of technology for preparing instruction is teacher-led, using it for delivering instruction may be teacher-led or student-led, and using it as a learning tool is student-led.

The U.S. National Center for Education Statistics (NCES) conducted a survey of public schools from all 50 states on the pre-pandemic use of technology for the 2019–2020 school year (Gray & Lewis, 2021). The survey revealed that 45% of public schools had a one-to-one program, with each student having a computer (Gray & Lewis, 2021). Of the schools surveyed, 80% of schools reported that technology integration is strategic for teaching and learning (Gray & Lewis, 2021). About half of the schools surveyed indicated that teachers receive professional development, and half also indicated that they use technology for educational tasks that are not able to be accomplished any other way (Gray & Lewis, 2021). However, only about half of the schools indicated that teachers want to use technology for educational purposes (Gray & Lewis, 2021). When asked about barriers to education, 26% of schools indicated that support in using
technology resources was a moderate barrier to technology integration (Gray & Lewis, 2021).

In the K–12 context, technology integration is largely nonstrategic, teacher-led, and mundane (An & Reigeluth, 2011; Ertmer, 2011; Selwyn et al., 2017). When studying three Australian schools implementing one-to-one and bring-your-own-device programs with 500 hours of observation, Selwin et al. (2017) observed that devices are often used in inappropriate and mediocre ways for teacher-led learning, reducing the effectiveness of technology integration for student problem-solving. Heintink et al. (2016) observed that half of the 157 teachers studied in videoed case studies misaligned their pedagogical reasoning and use of technology, though those that integrated technology at high levels expressed reasoning that aligned technology use with student-led strategies. Teachers predominantly use technology in teacher-led ways because of their pedagogical beliefs shaped by their experiences as a student (Ertmer, 2011). This indicates a lack of technology use in student-led instructional strategies. Without a well-thought-out technology integration program rollout, Selwyn et al. (2017) observed that students experienced time off-task and misused devices or did not have a device at all, and typical lessons involving technology were not considered memorable. Technology has failed to transform education (An & Reigeluth, 2011; Reich, 2020). There is a need to shift teacher practices in technology integration from teacher-led uses to student-led uses through technology-enabled instructional strategies.
First-Order Barriers to Technology Integration

Why do teachers largely fail to integrate educational technology for “facilitating learning and improving performance” (Januszewski & Molenda, 2008, p. 1)? There are first-order barriers to technology integration, barriers that are external to the teacher (An & Reigeluth, 2011; Ertmer, 1999; Günes & Bahçivan, 2016; Young et al., 2019). One of the most significant is acquiring needed hardware and software for technology integration (Günes & Bahçivan, 2016; Young et al., 2019). Young et al. (2019) observed in a pretest-intervention-posttest design of in-service teachers from four urban schools that the growth of teachers’ technology integration was limited by lack of technology resources and poor support from school leadership. Though the availability of needed hardware and software for technology integration cannot be overcome with professional development alone, it is a challenge that must be met in order for professional development to be effective.

A second first-order barrier is the time needed for technology integration (An & Reigeluth, 2011; Claesgens et al., 2013; Ertmer, 1999, S. Tseng & Yeh, 2019; vanOostveen, 2017). Teachers need collaboration time with other teachers (vanOostveen, 2017), practice time in professional development (Claesgens et al., 2013; S. Tseng & Yeh, 2019), planning time (Ertmer, 1999), and instructional time with students (An & Reigeluth, 2011, Ertmer 1999).

Leadership support is a third first-order barrier for technology integration (An & Reigeluth, 2011; Ertmer, 1999). Educational leadership support for technology integration may be related to the quality of technology integration (Raman et al., 2019;
Young et al.; 2019). Young et al. (2019) cited a lack of leadership support in the four Midwest urban schools studied as being one of the limitations to the development of teacher technological knowledge, which has a logical effect on the availability of professional development to teachers. However, Raman et al. (2019) gathered data using questionnaires from 47 principals and 375 teachers from secondary schools in Malaysia to find no relationship between principals’ technology leadership and the technology integration of teachers at their schools or the adoption of ISTE standards. However, Raman et al. sent out the call for more research, specifically within the context of professional development.

The picture of the relationship of school leadership to technology integration becomes clearer with the addition of more current research on changes in technology integration as a result of the COVID-19 pandemic. Technology integration has become a vital part of education after the pandemic, despite teacher burn-out (Elçiçek, 2021; Phillips, 2021; Teo et al., 2021). Compulsory distance education during the pandemic had a profound effect on technology integration (Elçiçek, 2021). Phillips (2021) connected teacher burnout during and after the COVID-19 pandemic to a failure of school leadership to change expectations for teachers with an increased workload. Phillips predicted that good teachers will leave the profession and students will suffer decreased instructional quality unless school leaders give teachers renewed support to stay connected and build relationships with both students and peers. After performing three case studies to analyze themes for a response to the COVID-19 pandemic in Singapore for a three-year period, Teo et al. (2021) echoed this theme of renewed
support and called for cross-school, knowledge-building communities of teachers and the use of technology integration that aligned technology and classroom practices.

A final first-order barrier to technology integration is the availability of professional development. A chorus of research concludes that teachers must have professional development to integrate technology in strategic ways (M. Miller, 2017; Tarling & Ng’ambi, 2016). M. Miller (2017) observed that slow faculty buy-in has reduced the potential of technologies such as massive open online courses, digital textbooks, mobile apps, and multimedia. He sent out a plea for leadership and collaboration as well as alignment with learning science to propel the educational technology revolution forward. Tarling and Ng’ambi (2016) evaluated shifts in pedagogical practices in 325 teachers from diverse schools in South Africa towards transformational pedagogies using the Teaching Change Frame and Blooms Taxonomy. They pinpointed the necessary ingredients for sustained change in teachers’ technology integration, including equipping teachers who are leaders in technology integration to mentor others in ways that result in a permanent shift of pedagogy. Teacher mentoring and professional development are essential for strategic technology integration to become commonplace in education.

**Second-Order Barriers to Technology Integration**

There are second-order barriers to technology integration that are internal to the teacher (An & Reigeluth, 2011; Ertmer, 1999; Günes & Bahçivan, 2016). Inan and Lowther (2010) gathered data from 1,382 public school teachers in Tennessee to conclude that age and years of teaching experience does not seem to be the leading
factor in predicting teachers’ technology integration. Instead, teacher perceptions and motivation are some of the most significant barriers to technology integration (Günes & Bahçivan, 2016; Heintink et al., 2016; Rosenberg & An, 2019; Young et al., 2019). Related to this is teacher readiness for technology integration (Inan & Lowther, 2010). Günes and Bahçivan (2016) judged teacher motivation to be the greatest one when analyzing case studies of the technology integration practices of 55 pre-service teachers from a purposive sample in Turkey. Young et al. (2019) also noted that teacher personalities and perceptions toward technology can limit growth in technology integration. Teachers choose technology to integrate for the purpose of implementing best teaching practices and/or strengthening content in a way that connects with a teacher’s educational beliefs (Heintink et al., 2016). For teachers to successfully integrate technology, their educational beliefs and practices must shift toward student-led learning strategies through professional development (An & Reigeluth, 2011; Rosenberg & An, 2019). Professional development in technology integration is the most effective method to shift perceptions and practices towards more strategic technology integration.

With a definition of educational technology in place and first- and second-barriers to technology integration identified, it is strategic to consider the importance of technology integration.
Establishing the Importance of Technology Integration

Technology integration is important because it develops 21st century skills in both teachers and students. The integration of emerging technology is also strategic for motivating and engaging students.

Developing 21st Century Skills in Teachers

Teachers model 21st century skills for students when they integrate technology, including the skills of creativity, critical thinking, collaboration, problem-solving, and digital literacy (Açıkgül & Aslaner, 2020; Baysan & Çetin, 2021; Hursen, 2021; Yamaç & Öztürk, 2019). When surveying a simple random sample of 745 public school teachers in Turkey, Baysan, and Cetin (2021) observed that teachers are generally knowledgeable about the ethical use of technology for instruction as measured by the Scale of Ethical Use of Information Technologies in Education. Teachers’ ethical use of technology can offer a model of digital literacy for students. Açıkgül and Aslaner (2020) found that 88 elementary teachers from Turkey enrolled in a professional development course in technology integration demonstrated the capacity to interact and collaborate with other teachers to improve technology integration using micro teaching, a game, and software applications. Using Web 2.0 tools—technology tools that facilitate online collaboration and contribution—can improve teachers’ ability to solve problems and think critically (Hursen, 2021). Yamaç and Öztürk (2019) interviewed nine pre-service teachers in Turkey after completing research and comprehension tasks using educational technology to discover that the integration of technology can be used to help develop 21st century skills in pre-service teachers. The ability of teachers to exercise digital
citizenship, collaboration, problem-solving skills, and critical thinking demonstrates a correlation between technology integration and 21st century skills in teachers. Educational Content Writers can exercise these same 21st century skills in lesson development and support teachers as they exercise these skills.

**Developing 21st Century Skills in Students**

Teachers can also integrate technology to develop 21st century skills in students (Almerich et al., 2020; Aprinaldi et al., 2018; Law et al., 2016). Almerich et al. (2020) correlated 21st century competencies such as collaboration, problem-solving, and critical thinking skills to technology integration in a correlational study of 983 university students. Aprinaldi et al. (2018) connected technology integration with both 21st century skills and critical thinking skills on Bloom’s taxonomy in a review of the literature. At the EDUsummIT 2015 Thematic Working Group 7, an international collaboration of educators concluded that high-quality technology integration was essential to help students achieve learning outcomes and develop life skills (Law, at al., 2016). When teachers exhibit 21st century skills, they have the ability to integrate technologies to help students develop these same skills. Educational Content Writers can give students opportunities to exercise 21st century skills through teacher support and lesson development.

**Developing Digital Literacy in Emerging Technologies**

Technology integration can employ a variety of Web 2.0 tools to develop digital literacy in emerging technologies and leverage the power of the Internet (Adiguzel et al., 2020; Railean, 2014; Selwood et al., 2016; Uçak, 2019; Wright & Akgunduz, 2018).
Wright and Akgunduz (2018) found a strong correlation between teacher confidence in technology integration and the use of Web 2.0 applications for instruction when surveying a sample of 344 pre-service volunteers from Turkey. Selwood et al. (2016) observed that the use of podcasts was as effective or more effective than traditional classroom learning with printed textbooks with the added benefit of improved listening skills in students from four different English language courses at a Japanese university. Uçak (2019) probed the use of QR code technology in science instruction with a case study of 38 pre-service teachers in Turkey to find multiple advantages. These advantages outweighed disadvantages of requiring Internet connectivity, with applications for facilitating independent instructional strategies through games, labs, assessments, blogs, and homework assignments (Uçak, 2019). Adiguzel et al. (2020) discovered through case studies of 179 engineering math and science students’ use of interactive e-textbooks and noted the benefits and challenges of integrating this technology. The sampling of research studies mentioned above on emerging technologies including interactive e-textbooks, podcasts, games, and QR codes gives evidence for the potential of emerging technologies for technology integration and the development of digital literacy as a 21st century skill. Educational Content Writers can give students opportunities to use Web 2.0 tools such as these by integrating them into lesson designs in educational products.

**Engaging and Motivating Students**

Technology integration can also be used to engage and motivate a variety of students (Adiguzel et al., 2020; Autio et al., 2019; Hediansah & Surjono, 2019; Hougham
et al., 2018; Kuo-Hung et al., 2016). Adiguzel et al. (2020) revealed that science and engineering students perceived instruction differently with the use of emerging technology. Students were comfortable using it, though engagement varied with the success of integration. Hediansah and Surjono (2019) observed that junior high student achievement experienced high increases with the use Android-based physics textbooks compared with that of the previous use of traditional textbooks. This enjoyment was accompanied by increases in student motivation as demonstrated by independent learning in a sample of 72 students. Hougham et al. (2018) discovered that students ranging in age from 7–14 from a sample of 183 students from Wisconsin improved in their knowledge of technology, their ability to use technology, and their attitudes toward technology in the use of technology to learn outdoors. Kuo-Hung et al. (2016) concluded that culinary students from a sample of 50 students in Taiwan who used augmented reality enjoyed the learning experience. These students were also more successful than those who used more traditional instructional tools. In a survey across Eastern Europe, Autio et al. (2019) connected engagement and motivation of the 864 students surveyed to their “technological will” to participate in instruction involving technology. A student’s “technological will” is guided by human emotions, motivation, values, and personal qualities that are shaped by the history of educational technology and the current pedagogy at work in the national curriculum. The sampling of research studies mentioned above on emerging technologies included mobile technology, e-textbooks, and augmented reality. The research above gives evidence for the potential of emerging technologies to engage and motivate students.
can motivate students by integrating emerging technology such as these into educational products.

The importance of technology integration for both teachers and students has been highlighted with a sampling from a large body of research. Teachers supported by educational products can develop 21st century skills that they can model for students with the integration of Web 2.0 tools and other emerging technologies. Students supported by educational products can in turn also develop 21st century skills and digital literacy. Students can experience heightened engagement and motivation with the integration of educational technology.

**Summary of the Context for Technology Integration**

In establishing the context of technology integration, I have investigated the definition of educational technology and first- and second-order barriers to technology integration, the greater of which is the second-order barrier of teacher readiness, motivation, and dispositions. The importance of technology integration for developing 21st century skills in teachers and students and engaging and motivating students was also highlighted. The importance of technology integration underscores the need for leadership support and professional development in technology integration.

**TPACK Conceptual Framework of Professional Development in Technology Integration**

One of the leading conceptual frameworks for professional development is the Technological Pedagogical Content Knowledge (TPACK) framework. This conceptual framework offers benefits for professional development when used correctly (Green,
The Significance of the TPACK Framework of Professional Development

First, the significance of TPACK for professional development in technology integration is notable in its effectiveness.

Koehler and Mishra (2006) formed the TPACK framework to classify educator knowledge based on three domains and their interactions: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). A teacher’s technological knowledge is his or her knowledge of the tools of educational technology and their application for learning (Koehler & Mishra, 2006). A teacher’s pedagogical knowledge is the “how” of teaching, his or her knowledge of teaching (Koehler & Mishra, 2006). A teacher’s content knowledge is the “what” of teaching, his or her knowledge of subject (Koehler & Mishra, 2006).

According to Kohler and Mishra (2006, 2009), these three domains of a teacher’s knowledge can intersect. Pedagogical content knowledge (PCK) is a teacher’s use of teaching strategies and theories to convey content (Koehler & Mishra, 2006, 2009). Technological content knowledge (TCK) is a teacher’s use of technology to access content or the students’ use of technology to access content (Koehler & Mishra, 2006, 2009). Technological pedagogical knowledge (TPK) is a teacher’s use of the tools of technology for instruction (Koehler & Mishra, 2006, 2009). Ultimately, a teacher should strive to develop technological pedagogical content knowledge (TPACK), a teacher’s
knowledge of how to use technology to teach content (Koehler & Mishra, 2009). See Figure 2.1 for an illustration of the TPACK framework.

![The TPACK Framework of Professional Development](image)

**Figure 2.1**

*The TPACK Framework of Professional Development*

*(Note: Creative Commons)*

The TPACK framework has a strong presence in academic literature and is widely used for teacher professional development (Green, 2014; Hilton, 2015; Kimmons & Hall, 2019; Kuo, 2015). Professional development with the TPACK framework should involve learning activities that are authentic and content-specific with appropriate assessment for developing teachers’ TPACK competence (Harris et al., 2009). Professional development within the real-world context of teaching has been demonstrated to be successful in building TPACK knowledge (Açıkgül & Aslaner, 2020; S. Tseng & Yeh, 2019).
The structure of the TPACK framework has been explained and its widespread use as a professional development tool has also been discussed.

**Uses of the TPACK Framework in Professional Development**

The TPACK framework is useful for both practice and for professional development in technology integration.

TPACK is used in professional development to help teachers focus on how technology is used rather than focusing on specific technology tools (Green, 2014; Hilton, 2016; L. Miller et al., 2019). L. Miller et al. (2019) discovered that the use of the TPACK framework in professional development helps teachers connect their beliefs and practices in education to their decision-making regarding technology use to meet instructional goals. Hilton (2016) studied teachers involved in case studies from two schools in Pennsylvania who were trained using the TPACK framework. Hilton found that teachers trained in the TPACK framework thought more holistically about using iPads for social studies instruction than teachers from the sample who trained using a different framework of technology integration. Using the TPACK framework helps teachers focus on technology-enabled learning rather than just technology integration (Green, 2014).

The TPACK framework brings together all of the domains of a teacher’s knowledge to intentionally integrate technology.

Teacher professional development using the TPACK framework has been shown to be effective at improving technology integration (Kuo, 2015; Voithofer et al., 2019; Wright & Akgunduz, 2018). Kuo (2015) employed action research using the TPACK framework to engage 32 pre-service teachers in the use of available technology tools.
with positive results in effectiveness and motivation. Voithofer et al. (2019) found a relationship between TPACK adoption and the adoption of ISTE standards among 541 educational institutions across all 50 United States when interviewing 842 K–12 in-service teachers. When surveying a sample of 344 volunteer pre-service science teachers from six universities in Turkey, Wright and Akgunduz (2018) found a strong correlation between confidence in TPACK competencies and the integration of Web 2.0 tools. Professional development using the TPACK framework produces technology integration that is effective, strategic, and tactical in the use of emerging technologies.

The TPACK framework has been explained and its significance for creating change in teacher competence in technology integration has been discussed.

**TPACK-in-Action as Transformative Learning Theory in Professional Development**

The transformative learning theory offers a process of adult professional development for TPACK-in-Action.

Transformative learning theory is a theoretical framework for adult professional development developed by Mezirow (1978). Transformative learning theory posits that people can transform beliefs when they learn new information by elaborating, transforming, and reflecting on one’s perspectives of knowledge (Mezirow, 1994). This theory is applied especially to adult education, because adults bring prior knowledge, experiences, and perspectives with them to a new learning experience (Mezirow, 1991).

Transformative learning theory follows a multistep process that is not linear but spiral (Mezirow, 1995). Mezirow’s original theory included a 10-step process, though others have adjusted these steps (Cranton, 2002). Other researchers criticized
transformation learning for overemphasizing rationality and analysis over emotion, creativity, and intuition and worked to further develop the theory (Dirkx, 1997; Grabove, 1997; Taylor, 1998). See Figure 2.2 below for a diagram of Mezirow’s transformative learning theory.

Figure 2.2

**Transformative Learning Theory (Mezirow, 1995)**

TPACK can be used in professional development in combination with transformative learning theory in a process known as TPACK-in-Action (Harris & Hofer, 2009; Mouza, 2011; Paneru, 2018; Izmirli & Yurdakul, 2014). TPACK-in-Action is the process of transforming teacher points of view and habits of mind in technology integration through discourse and reflection (Harris & Hofer, 2009; Illeris, 2018). Sahin
Izmirli and Kabakçi Yurdakul (2014) monitored 54 prospective teachers’ technology integration transformation through surveys, interviews, and focus groups to find that TPACK-in-Action was effective in transforming the technology integration of a third of the participants. However, Mouza (2011) found that progress in integrating technology for eight teachers from urban schools was hampered by previously held beliefs about teaching and the availability of technology resources. When contrasting two groups of elementary teachers trained with TPACK-in-Action versus more traditional professional development, Paneru (2018) found that teachers using professional development structured around TPACK-in-Action were more creative in their technology integration. When studying the development of secondary social studies teachers’ development of TPACK-in-action, Harris & Hoffer (2009) found that teachers’ lesson designs can become more strategic, their planned instructional strategies can become more student oriented, and the quality of technology integration can improve.

TPACK-in-Action has been investigated as a combination of both the TPACK framework and transformative learning theory.

**Summary of the TPACK Conceptual Framework**

A conceptual framework for this action research has been discussed in this section of the literature review. The structure of the TPACK framework has been explained. The framework’s application as an effective tool for professional development has also been discussed for creating change in teacher competence in technology integration. TPACK-in-Action has been investigated as a combination of both the TPACK framework and transformative learning theory.
Strategic Professional Development in Technology Integration

Specific strategies associated with the TPACK framework and transformative learning theory can aid in overcoming barriers to technology integration.

Overcoming Barriers to Technology Integration

Professional development in technology integration is strategic when it is focused on overcoming barriers with specific research-based remedies. Ertmer (2011) called for a 21st century vision for technology integration as the driver for change in technology integration.

There is a relationship between teacher efficacy in technology integration and growth in TPACK capabilities (Foulger et al., 2013; Tondeur et al., 2020). Foulger et al. (2013) discovered that a sample of 110 pre-service teachers had a statistically significant increase in confidence and TPACK scores in a standalone course as assessed through surveys. Tondeur et al. (2020) found in a study of 688 pre-service teachers that they not only benefited from growth in TPACK competency with professional development in TPACK; they also improved attitudes toward technology integration. The benefits of professional development in TPACK are evidenced in increased TPACK competencies, increased efficacy, and improved perceptions toward technology integration to overcome one of the most significant barriers to technology integration.

There is a relationship between professional development and the use of Web 2.0 tools for instructional strategies (Sahin-Topalcengiz & Yildirim, 2020; Tarling & Ng’ambi, 2016; Wright & Akgunduz, 2018). Teachers use emerging technologies more strategically when they are instructed in these technologies in unregulated, dispersed
formats and given the autonomy to choose the best technology for the teaching goal rather than through delivery-based pedagogies that they were instructed use (Tarling & Ng’ambi, 2016; see also Grabove, 1997). Wright and Akgunduz (2018) found a strong correlation between confidence in TPACK competency and the use of Web 2.0 applications by pre-service science teachers as measured by a survey. Sahin-Topalcengiz and Yildirim (2020) gathered data on teacher opinions on professional development in technology integration carried out through distance learning in comparison with in-person learning. Sahin-Topalcengiz and Yildirim determined that distance learning professional development was effective for improving the integration of Web 2.0 tools with the benefits of greater accessibility and lower costs. Professional development in technology integration, even if not conducted in an in-person class environment, improves teacher use of Web 2.0 tools for instruction. This opens up opportunities for blended instruction as well as distance education in professional development in technology integration. In a study of professional development delivery formats, Niess and Roschelle (2018) implemented four professional development courses in technology integration for in-service mathematics teachers using the TPACK framework, with three being online formats and one being a blended learning format. All four courses were successful in transforming teacher practices in technology integration.

Strategies for professional development for TPACK-in-Action to overcome barriers to technology integration include improving teacher attitudes and efficacy and using Web 2.0 tools in professional development. Effective formats for professional development include both for in-person and at-distance instruction.
Transformation Strategies for Professional Development in Technology Integration

The use of TPACK in professional development in technology integration can be effective for transforming teacher points of view and habits of technology integration. Transformational strategies are (1) creating an authentic, social context, (2) giving sufficient time for learning, (3) providing a knowledgeable mentor, (4) leveraging participant-led strategies, and (5) creating opportunities for active practice.

Creating an Authentic, Social Context

Professional development in technology integration happens in a social context implementing discourse and reflection (Goodnough & Murphy, 2017; Gow et al., 2018; Heintink et al., 2016; Tondeur et al., 2020; Voogt et al., 2016). A social context for professional development can be in-person or could involve collaboration in an online forum (Tondeur et al., 2020). Teachers engage well in groups participating in similar activities both in-person and online while navigating challenges and solving problems (Gow et al., 2018; Voogt et al., 2016). When studying the experiences of four sixth-grade teachers implementing a flipped classroom approach over a period of two years, Goodnough and Murphy (2017) found that the development of a social context through discourse and reflection and the practiced use of tools in this context was helpful in the teachers’ integration of technology. Discourse in this social context can involve expressing reasoning about why teachers chose technology for the purpose of implementing best instructional strategies and/or strengthening content in a way that connects with a teacher’s educational beliefs (Ertmer, 1999; Heintink et al., 2016). A social context for professional development in technology integration connects with
Mezirow’s fourth step in the transformative learning process (1995) in which fellow learners recognize their shared experience of transformation (see Figure 2.2).

**Giving Sufficient Time**

Professional development should be given sufficient time for effectiveness (Claesgens, et al., 2013; Ertmer, 1999; Young et al., 2019). Claesgens et al. (2013) discovered when exploring delivery formats of teacher professional development with 238 prospective teachers that technology integration courses for pre-service teachers occurring over the course of a semester did not have significantly different outcomes than summer institute courses. However, Claesgens found that more authentic learning projects were produced by teachers in the semester course. Young et al. (2019) observed teachers grow in TPACK capabilities after a three-week professional development course. Teachers need time to share their plans for technology integration (Ertmer, 1999). Sufficient time for professional development is necessary for active practice, discourse, and reflection.

**Providing a Knowledgeable Mentor**

Professional development in technology integration should involve a knowledgeable facilitator and mentor (Tondeur et al., 2020; vanOostveen, 2017; Voogt et al., 2016). When implementing professional development for four elementary science teachers in an action research project, vanOostveen (2017) found that teachers benefitted from opportunities to collaborate with other teachers, all guided by a knowledgeable facilitator (vanOostveen, 2017). Facilitators can model best practices in technology integration (An & Reigeluth, 2011; Ertmer, 1999; Tondeur et al, 2020).
Within Mezirow’s ten steps of transformative learning (1978), a facilitator is crucial to introduce a disruptive dilemma, create the social context, fuel discourse, and prompt and guide transformative learning.

**Leveraging Participant-Led Strategies**

Professional development in technology integration should leverage participant-led teaching strategies for transformative learning (Açıkgül & Aslaner, 2020; An & Reigeluth, 2011; Cranton, 2002; Dirkx, 1997). Within the context of adult education, teaching strategies can be utilized to nurture the soul and promote transformation (Dirkx, 1997). Transformation begins with an activating event, which could involve the use of video (Açıkgül & Aslaner, 2020; Cranton, 2002). Articulating assumptions and self-reflection occur naturally through journaling (Cranton, 2002). Learners become more open to other perspectives through role play, debate, or peer observations (Açıkgül & Aslaner, 2020; Cranton, 2002; Heintink et al., 2016). These strategies may also be used in an online environment (Gow et al., 2018; Pareto & Willermark, 2019, Tondeur, 2020; Zhou et al., 2007). The purposeful use of participant-led strategies to transform teachers’ educational beliefs for technology integration can produce new habits of mind that result in changes in practice.

**Creating Opportunities for Active Practice**

Professional development in technology integration gains traction through active practice (Açıkgül & Aslaner, 2020; Harris et al., 2009; Irdalisa et al., 2020; J.-J. Tseng, 2019; S. Tseng & Yeh, 2019; Voogt et al., 2016). Professional development in TPACK should involve learning activities that are content-specific for developing teachers’
TPACK competence (An & Reigeluth, 2011; Harris et al., 2009). Active practice could involve project-based learning (S. Tseng & Yeh, 2019), guided inquiry (Irdalisa et al., 2020); lesson design (Koh et al., 2015; Pareto & Willermark, 2019) and teaching prepared lessons (Açıkgül & Aslaner, 2020; J.-J. Tseng, 2019). Active practice helps teachers develop mastery in taking principles of technology integration and applying them within the practical limits of teaching and can highlight gaps between teachers’ espoused TPACK and their TPACK in use (Voogt et al., 2016). Active practice is essential for TPACK-in-Action to give participants opportunities to explore options for new behaviors, plan a course of action, try new roles, and act on new perspectives (Mezirow & Taylor, 2009).

Participant-led strategies for professional development can be used by a knowledgeable facilitator to encourage discourse, active practice, self-reflection, and assessment in authentic, social contexts given sufficient time in ways that transform teachers’ points of view and habits of mind.

Summary of Strategies for Professional Development in Technology Integration

Strategies for professional development in technology integration have been identified to overcome teacher barriers, the greatest of which is teacher attitudes toward technology integration. These strategies have been identified as using two key frameworks for professional development: (1) the TPACK framework, and (2) the transformative learning theory. These frameworks are used in combination for maximum effectiveness in changing teacher points of view and habits of mind in technology integration in TPACK-in-Action.
Assessment of Professional Development in Technology Integration

The context, conceptual frameworks, and strategies for professional development in technology integration have been explored. The final aspect to investigate is that of assessment of the effectiveness of professional development in technology integration. There is a good foundation of research in assessing professional development in technology integration using a TPACK survey, the evaluation of designed lessons, and the assessment of changes in teacher dispositions.

Pretest-Posttest Application of a TPACK Survey

The most common assessment that researchers have employed to measure the effectiveness of professional development in technology integration is a pretest-posttest application of a survey measuring self-reported TPACK competencies (Craciun, 2019; Koh et al., 2015; Rolando et al., 2021; Schmidt et al., 2009; Torun, 2020).

Researchers have used a variety of TPACK surveys for the pretest-posttest application of a TPACK survey, including the seminal TPACK survey (Schmidt et al., 2009), the Sahin (2011) TPACK survey (Craciun, 2019), the TPACK for Meaningful Learning Survey (Rolando et al., 2021), TPACK Self-Confidence Scale (Torun, 2020), and the TPACK Lesson Design survey (Koh et al., 2015). All of the TPACK surveys mentioned above assess teacher perceptions of their TPACK competencies.

A variety of TPACK surveys have been used to assess the effects of professional development in TPACK competencies, but these surveys have relied largely on self-reporting.
Lesson Designs in Combination with a TPACK Survey

Researchers have recognized that using solely a TPACK survey can give an inaccurate assessment of teachers’ ability to connect theory with practice in technology integration. Researchers have met this challenge by combining the use of surveys with direct assessment of lesson designs.

Koh et al. (2015) assessed lesson design dispositions from 201 Singaporean pre-service and in-service teachers in connection to the TPACK framework using a survey to ensure that teachers are connecting theory with practice to produce technology integration. Heintink et al. (2016) conducted case studies inspecting the relationship between teacher reasoning and justification for the integration of specific technology in instruction. However, an even more effective assessment of professional development in technology than simply surveying teachers about lesson design is the assessment of lessons developed by teachers during professional development. Lessons can be analyzed for the use of technology to meet instructional goals and support instructional standards (Schmidt et al., 2009).

Assessment of professional development in technology integration is insightful to actual practice if it involves evaluating teacher-created lesson materials integrating technology in combination with the use of the TPACK survey (Craciun, 2019; Günes & Bahçivan, 2016; Torun, 2020). Torun (2020) combined the TPACK survey with a teacher reflection and self-assessment of lesson designs in a mixed methods approach. Günes and Bahçivan (2016) assessed TPACK competency with the TPACK survey with the addition of the observations of teacher practices and artifacts in the form of lesson
designs. Craciun (2019) combined the examination of technology tools used in teacher-designed lessons, including the use of emerging technology, with the TPACK framework. Harris et al. (2010) developed and validated a rubric for lesson analysis that is explicitly connected to the TPACK framework (See Appendix B). Assessing both reasoning and practice through a combination of the TPACK survey and the evaluation of teacher-designed lessons gives researchers a more complete picture of the effectiveness of professional development in technology integration.

Assessments of lesson design in implementing TPACK competencies have been discussed both in surveys and in the evaluation of teacher-designed lessons. The later has been identified as being more insightful to evaluate the effectiveness of professional development.

**Assessment of Changes in Teacher Perception**

A key component of assessing the effectiveness of professional development in technology integration is assessing changes in teacher perceptions of technology integration (Günes & Bahçivan, 2016; Koh et al.; 2015; Torun, 2020).

Koh et al. (2015) included survey items on design dispositions as part of a broader survey on integrating technology into lesson design using TPACK competencies. Torun (2020) utilized the TPACK Self-Confidence survey to assess changes in teacher confidence for technology integration, resulting in statistically significant improvement in teacher confidence levels as correlated to professional development. Assessment for professional development for technology integration using the TPACK framework should
incorporate the creation of lessons as well as a self-assessment survey monitoring TPACK competence and confidence.

It is especially strategic to evaluate changes in teacher perceptions in the context of professional development in technology integration, especially when considering that the greatest barrier to technology integration is teacher dispositions (Günes & Bahçivan, 2016).

**Summary of Assessments of Professional Development in Technology Integration**

The assessment of professional development in technology integration used by researchers discussed included using a TPACK survey, evaluating designed lessons, and measuring changes in teacher dispositions.

**Chapter Summary and Discussion**

This literature review has considered four different components of professional development in technology integration for the purpose of identifying the most effective methods. These components are the (1) context, (2) theoretical frameworks, (3) strategies, and (4) assessments of professional development in technology integration. When establishing the context of technology integration, the definition of educational technology, the barriers to technology integration, and importance of technology integration were examined. Frameworks of technology integration used for professional development included the TPACK framework and transformative learning theory. Strategies used for professional development in technology integration to overcome barriers included the use of transformative learning in combination with the TPACK conceptual framework. Finally, assessments discussed to examine the efficacy of
professional development are the TPACK survey, evaluation of lesson designs, and the assessment of teacher perception of technology integration.

This literature review offers implications for action research in professional development for technology integration, including the process of and strategies for professional development and assessment in technology integration. The purpose of this action research was to implement a professional development program for Educational Content Writers in technology integration using the TPACK framework to affect the design of educational resources. This evaluation involved the use of a TPACK survey to evaluate transformation in points of view and habits of mind and the assessment of perceptions and lesson designs to evaluate the hallmarks of action on new perspectives in technology integration.
CHAPTER 3: METHOD

The purpose of this action research was to implement a professional development program for Educational Content Writers in technology integration using the TPACK framework to affect the design of educational resources. This chapter will first set the stage by explaining the research design, setting, participants, and the intervention. The data collection methods, the data analysis, and the procedure and timeline will also be described. Methods to assure rigor and trustworthiness and the plan for sharing findings will also be discussed to demonstrate best practices in research.

To answer the question, “How does professional development in the TPACK framework affect the design of educational resources produced by Content Writers?” the following research questions were investigated.

- Research Question 1: How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals?
- Research Question 2: How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies?
Research Question 3: How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?

Research Design

This study used action research and a predominantly qualitative mixed methods design to implement a professional development program in technology integration to affect the design of educational resources produced by Content Writers. There is a rich history in the use of action research to improve technology integration in educational contexts (Girmen & Kaya, 2019; Kuo, 2015; vanOostveen, 2017), and the literature has been inductively analyzed to transfer this research to the population under study (see Table 2.1).

Action research is the most appropriate approach for this research study because of the emphasis on a practical, local context. Traditional research is essentially theoretical; in contrast, action research is essentially practical (Mertler, 2020). When comparing traditional and action research, action research shares some characteristics with traditional research in that it uses systematic inquiry (Henderson et al., 2012). However, action research differs from traditional research in that it is usually conducted by a practitioner with a purposive sample in a nongeneralizable context for the purpose of solving a localized problem (O’Gorman & MacIntosh, 2014). Participants in action research are viewed as collaborators by contributing to the data and even the design to bring about positive change (Herr & Anderson, 2005; Mertler, 2020; Tracy, 2020).

Stringer (2014) summarizes action research as a pattern of thinking, observing, and
acting. The context, role of participants, and pattern of inquiry of action research matches the research plan for this research study.

Action research is the most appropriate approach for this research study because of the tools and data collection methods that it will employ. Action research, though somewhat different from traditional research, can employ the tools of both qualitative and quantitative research designs to provide the best understanding of the research problem (Mertler, 2020). A mixed methods research design maximizes the strengths of quantitative and qualitative designs and minimizes their limitations because it diversifies the data collected. Action research lends greater flexibility to how data can be cross-referenced and analyzed to fulfill research purposes, giving the researcher assurance that conclusions are valid. This research study leveraged the flexibility and structural integrity of action research to utilize both qualitative and quantitative tools, data collection, and data analysis techniques to increase rigor and trustworthiness in harmony with my pragmatic research paradigm (Frels & Onwuegbuzie, 2013).

This research study used a predominantly qualitative mixed methods approach (Creswell, 2014). This research design is mixed methods because quantitative and qualitative data were compared and related to answer research questions (Creswell, 2014; Halcomb & Hickman, 2015). Both quantitative and qualitative data were collected in tandem but analyzed independently (Creswell, 2014; Halcomb & Hickman, 2015). The quantitative and qualitative data were mixed during the interpretation stage of research (Halcomb & Hickman, 2015). Since quantitative and qualitative data were collected,
compared, and interpreted for each research question, there is rigor in this method because of the triangulation of data (Mertler, 2020).

Setting

This action research was conducted in the offices of a preK–12 educational publisher in the Southeastern United States.

The writers are located in the offices of Educational Content and Creative Development alongside other departments, including designers, editors, artists, project coordinators, and various specialists. Each department occupies a distinct space, though departments share a set of conference rooms.

Because the professional development was a combination of online and in-person coursework, the settings of this action research are the cubicles in which Educational Content Writers do their work, private areas in which they work remotely, conference rooms in which team meetings are typically held, and a digital environment of the learning management system Canvas and Microsoft Office applications.

Cubicles are arranged so that teams of 2–4 writers may easily confer. Conference rooms and cubicles are settings that are natural (Creswell, 2014; Flick, 2009), as they are the settings in which Content Writers encounter the challenges of integrating technology into instruction during the preparation of educational materials. These settings also facilitate the transfer of learning (Singley & Anderson, 1989). Each cubicle or private workstation has an identical Dell laptop 11th Gen Intel(R) Core equipped with a webcam, mouse, microphone, Microsoft Office, and multiple screens to navigate programs. Company conference rooms are equipped with data projectors or televisions,
and one has a laptop. Conference rooms seat between 10 and 30 attendees, with chairs arranged so that participants face each other. Bluetooth speakers, external webcams, and laptops are available to facilitate meetings in which some attendees were remote and some were in person.

The digital environments of Canvas and Microsoft Office are technical environments rather than natural ones with a potential to influence participant interactions (Flick, 2009). In this case, participants had formed relationships in a natural environment and translated those relationships to the digital environment (Flick, 2009).

The Educational Technology Specialists, a group of six educational technology experts, served as facilitators during the professional development process. Two of the Educational Technology Specialists are female and four are male, ranging in age from 30–65. Two of the Educational Technology Specialists work remotely.

A group of four Instructional Designers served as facilitators during the professional development process. Two of the Instructional Designers are female and two are male, ranging in age from 40–55. One of the Instructional Designers works remotely.

Biblical Worldview Specialists, a group of four theologians, also served as facilitators during the professional development process. All four are male, ranging in age from 30–60. None work remotely.

Participants

The study participants were seven volunteers, two male and five female, though one male withdrew from the action research because of health and schedule. Of the
seven, six were white and one was Hispanic. Participants ranged in age from 20s to 60s.

All participants had previous teaching experience, with three of the seven volunteers currently teaching on the college level. Table 3.1 describes groups of participants.

**Table 3.1**

*Demographics of Volunteers*

<table>
<thead>
<tr>
<th>Writer Type</th>
<th>Number</th>
<th>Age Range</th>
<th>Gender</th>
<th>Race</th>
<th>Teaching Experience</th>
<th>Currently Teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>3</td>
<td>20s–60s</td>
<td>2 female, 1 male</td>
<td>White</td>
<td>6–30 years</td>
<td>1 yes</td>
</tr>
<tr>
<td>History</td>
<td>2</td>
<td>40s–50s</td>
<td>2 females</td>
<td>White</td>
<td>20 years</td>
<td>1 yes</td>
</tr>
<tr>
<td>Math</td>
<td>1</td>
<td>20s–30s</td>
<td>1 female</td>
<td>White</td>
<td>8 years</td>
<td>no</td>
</tr>
<tr>
<td>Spanish (withdrew)</td>
<td>1</td>
<td>50s–60s</td>
<td>1 male</td>
<td>Hispanic</td>
<td>Yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

Participants were volunteers from a population of 50 Content Writers which make up 16 writing teams from eight disciplines spanning preschool to 12th grade.

Content Writers have an average of 10 years of teaching experience and an average of 2–4 years of writing experience (Santopietro, 2020). Gender is evenly distributed in writing groups, with groups being predominantly White with some Hispanic participants (Santopietro, 2020). Writers have varying prior knowledge of educational technology and are actively integrating technology into educational materials at varied levels. A few of the writers work remotely, and several more work on a hybrid remote basis. All writers were offered the opportunity to participate in this action research. A choice of a 64GB 10th generation iPad, an iPad mini, or a series 8 Apple watch was awarded to participating writers.
**Intervention**

The context of the intervention for this action research includes an orienting context, an instructional context, and a transfer context. The implementation of the intervention, including the conceptual framework, structure, and assessments, will also be discussed.

**Orienting Context**

Based on the results of an initial survey of writers, there may be different orienting contexts for newer writers and more experienced writers (Santopietro, 2020). The survey indicated a divide between these two groups of writers. Both bring pedagogical and content knowledge and skills to their context. However, more experienced writers have additional skill in writing. Newer writers have more recent teaching experience and are more open to innovation. Seasoned writers have less recent teaching experience and may be more hesitant to innovate (Santopietro, 2020).

Both groups of writers have indicated that most writers view training as somewhat to very helpful. If as Rossett suggests, “Motivation = Value x Confidence” (1987, p. 38), then the survey indicates that most writers value both training and technology integration. They described themselves as somewhat confident (65% of respondents), so their motivation to do technology integration is high.

Writers were not held accountable for completing this instructional unit, but they are held accountable for their ability to integrate technology during the planning and execution phases of the revision of educational products.

**Instructional Context**
This instructional unit was administered in a blended learning environment, as research demonstrates the effectiveness of transformative learning in adult professional development in TPACK in both in-person and online contexts (Niess & Roschelle, 2018; Pareto & Willermark, 2019, Tondeur, 2020) with benefits of improving the integration of Web 2.0 tools at a lower cost than traditional learning (Sahin-Topalcengiz & Yildirim, 2020). A blended learning environment combines traditional classroom in-person learning experiences with online learning experiences (Hrastinski, 2019). Some coursework was asynchronous and completed online, with meetings being synchronous and occurring in person. Meetings had an online option for remote attendees.

This instructional unit was structured in the learning management system Canvas and used functions of the learning management system to help participants interact with Web 2.0 tools in a distance learning environment (Sahin-Topalcengiz & Yildirim, 2020). Embedded apps in Canvas made the unit self-paced and interactive with certain target dates and meeting goals. Interactions were between participants and/or between participants and facilitators. I modeled the navigation features of the learning management system in an introdutory video. The instructional unit was designed to take seven weeks to complete. After the instructional unit was placed into Canvas, participants were invited to join by email. The unit was chunked into modules defined by learning tasks. These sections were logically scaffolded to bring learners to the desired learning outcomes. The instructional unit included formative assessment to give feedback on progress and a summative assessment to evaluate growth. For example, in Module 4 participants learned about the TPACK framework using an instructional video.
and took a self-quiz to gain feedback on their progress in understanding the framework. The summative assessment to evaluate their growth was in the lesson evaluation at the end of the course as well as the post-assessment with the TPACK survey.

The instructional unit was developed using the Kemp model of the instructional design process (Morrison et al., 2013) because of its flexibility and ease of application to authentic instructional design (Obizoba, 2015). Best practices in online education such as blended course design, copyright considerations, Web 2.0 tools, and Universal Design for Learning were also implemented (Ko & Rossen, 2017). See Figures 3.1–3.5 for screenshots of the professional development course accessed through Canvas.

Figure 3.1

*Syllabus in the Professional Development Course*
### Figure 3.2

**Example of a Module in the Professional Development Course**

<table>
<thead>
<tr>
<th>Topic 4A: The TPACK Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Video: The TPACK Framework</strong></td>
</tr>
<tr>
<td><strong>Quiz 4.1 The TPACK Framework</strong></td>
</tr>
<tr>
<td>Febr 26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic 4B: Modeling the TPACK framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Models of Technology Integration</strong></td>
</tr>
<tr>
<td><strong>Activity 4.2: Journal Entry</strong></td>
</tr>
<tr>
<td>Febr 26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic 4C: Applying the TPACK Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity 4.3: Journal Entry</strong></td>
</tr>
<tr>
<td>Febr 26</td>
</tr>
</tbody>
</table>

### Figure 3.3

**Sample Module Overview**

*Overview for Module 4*

**Module 4: Learning**

Teaching, instruction, and writing is all about structure. A good structure can make or break a lesson. In this module you will learn about the TPACK framework, a model of technology integration that you can use to analyze your lesson design.

**Learning Objectives**

- Describe the TPACK framework and its domains.
- Identify interactions of the TPACK domain.
- Classify examples of instruction using the TPACK framework.
Writers were immediately able to use the knowledge and skills they developed in this instructional unit. They had ample opportunities to transfer knowledge and skills in
their regular work of educational content creation, especially considering the natural context of the professional development (Creswell, 2014; Flick, 2009).

Once this instructional unit was produced, posted, demonstrated, and used, writers had a greater responsibility to improve technology integration in educational products and to mentor other writers. Instructional Designers and Educational Technology Specialists provided support and accountability for transfer as they reviewed manuscripts of educational products. The general managers of Academic Integrity and Educational Technology also supported the improvement of technology integration, demonstrating a unity of purpose among involved departments.

**Implementation**

*The TPACK Framework*

The intervention for this action research used the TPACK framework as the conceptual framework because it has a strong presence in academic literature and is widely and effectively used for teacher professional development (Green, 2014; Hilton, 2015; Kimmons & Hall, 2018; Kuo, 2015). The literature reviewed has been transferred to the population under study through inductive analysis diagramed in Table 2.1. Professional development with the TPACK framework in this intervention involved learning activities that were authentic and content-specific with appropriate authentic assessment for developing writers’ TPACK competence (Harris et al., 2009) within a real-world context (Açıkgül & Aslaner, 2020; S. Tseng & Yeh, 2019). The use of the TPACK framework in professional development helped writers connect their beliefs and practices in education to their decision-making regarding technology use (L. Miller et al,
2019) and helped the writers to focus on technology-enabled learning rather than just technology integration (Green, 2014). Table 3.2 outlines the use of TPACK as a conceptual framework in this professional development course.

### Table 3.2

**Alignment of Research Questions to Professional Development Use of the TPACK Framework**

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Professional Development Module</th>
<th>TPACK Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1, RQ2</td>
<td>Module 0: Warming Up</td>
<td>Pre-assessment with TPACK Survey (Schmidt et al., 2009)</td>
</tr>
<tr>
<td>RQ1, RQ2, RQ3</td>
<td>Module 2: Self-evaluation</td>
<td>Technology Integration Assessment Rubric (Harris et al., 2010)</td>
</tr>
<tr>
<td>RQ1, RQ2, RQ3</td>
<td>Module 4: Learning</td>
<td>TPACK Framework (Koehler &amp; Mishra, 2006)</td>
</tr>
<tr>
<td>RQ1, RQ2</td>
<td>Module 5: Renovating</td>
<td>Technology Integration Assessment Rubric (Harris et al., 2010)</td>
</tr>
<tr>
<td>RQ1, RQ2, RQ3</td>
<td>Module 6: Collaborating</td>
<td>Technology Integration Assessment Rubric (Harris et al., 2010)</td>
</tr>
<tr>
<td>RQ3</td>
<td>Module 7: Thinking Forward</td>
<td>Post-assessment with TPACK Survey (Schmidt et al., 2009)</td>
</tr>
</tbody>
</table>

**Transformative Learning Theory**

This intervention employed the TPACK framework in combination with transformative learning theory as TPACK-in-Action (Harris & Hofer, 2006, 2009; Mouza, 2011; Paneru, 2018; Sahin Izmirli & Kabakçi Yurdakul, 2014). This combination in the intervention is effective for transforming teachers’ points of view and habits of mind in technology integration through discourse and reflection (Harris & Hofer, 2006, 2009; Illeris, 2018). This process helps teachers to be more creative in their technology
integration (Paneru, 2018), make their lesson designs more strategic, push their planning to be more student oriented, and improve the strategic nature of technology integration (Harris & Hofer, 2009). This intervention was structured to follow Mezirow’s transformative learning theory (1995) because of the context of adult education and the purpose of changing points of view and habits of mind in educational technology integration (Sahin Izmirli & Kabakçı Yurdakul, 2014). This literature has also been transferred to the population under study through inductive analysis diagramed in Table 2.1. Table 3.3 aligns the modules in this professional development course with transformative learning theory.

**Table 3.3**

*Alignment of Professional Development with Transformative Learning Theory*

<table>
<thead>
<tr>
<th>Professional Development Module</th>
<th>Transformative Learning Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 1: Introduction</td>
<td>Disorienting dilemma</td>
</tr>
<tr>
<td></td>
<td>Self-evaluation</td>
</tr>
<tr>
<td>Module 2: Self-evaluation</td>
<td>Critical assessment</td>
</tr>
<tr>
<td>Module 3: Planning</td>
<td>Recognition of shared experience</td>
</tr>
<tr>
<td></td>
<td>Exploring options for new behaviors</td>
</tr>
<tr>
<td></td>
<td>Planning a course of action</td>
</tr>
<tr>
<td>Module 4: Learning</td>
<td>Acquisition of knowledge</td>
</tr>
<tr>
<td>Module 5: Renovating</td>
<td>Trying new roles</td>
</tr>
<tr>
<td>Module 6: Collaborating</td>
<td>Building confidence</td>
</tr>
<tr>
<td>Module 7: Thinking Forward</td>
<td>Reintegration</td>
</tr>
</tbody>
</table>

This intervention employed several transformation strategies. The blended learning environment created a social context implementing discourse and reflection (Goodnough & Murphy, 2017; Gow et al., 2018; Heintink et al., 2016; Mezirow, 1994; Tondeur et al., 2020; Voogt et al., 2016). Participants noted that sufficient time was provided for growth in TPACK capabilities (Claesgens, et al., 2013; Ertmer, 1999; Young
The intervention also provided participants with opportunities to refine knowledge, practice technology integration, and collaborate with other writers with the coaching of facilitators who are subject experts (vanOostveen, 2017). Instruction also modeled best practices in technology integration (An & Reigeluth, 2011; Ertmer, 1999; Tondeur et al, 2020). The intervention leveraged participant-led instructional strategies for transformative learning (Açikgül & Aslaner, 2020; An & Reigeluth, 2011; Cranton, 2002; Dirkx, 1997) and created opportunities for active practice by involving learning activities that were content-specific for developing writers’ TPACK competence (An & Reigeluth, 2011; Harris et al., 2009).

**Assessment**

This intervention assessed participant progress in TPACK competency through a pretest-posttest application of the seminal TPACK survey (Schmidt et al., 2009), a commonly used survey that relies on educator self-reporting. The assessment was strengthened by combining this survey with a pretest-posttest analysis of lessons using the Technology Integration Assessment Rubric (Harris et al., 2010), a strong measure of TPACK competencies, to assess participant ability to connect theory with practice in technology integration (Craciun, 2019; Günes & Bahçivan, 2016; Torun, 2020).

**Data Collection Methods**

A mix of data collection methods was used to answer research questions regarding professional development for technology integration. Quantitative data collection methods included the TPACK Survey (Schmidt et al., 2009) and files of participant lessons assessed with the Technology Integration Assessment Rubric (Harris et al., 2010).
et al., 2010). Qualitative data collection methods included discussion posts, a focus
group, and semi-structured interviews. Table 3.4 aligns these data collection sources
with this study’s research questions.

Table 3.4

*Research Questions and TPACK and Data Collection Sources Alignment*

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Data Collection Sources</th>
</tr>
</thead>
</table>
| RQ1 How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals? | • TPACK Survey (Schmidt et al., 2009)  
• Participant Lessons  
• Discussion Posts  
• Focus Group  
• Semi-structured Interviews |
| RQ2 How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies? | • TPACK Survey (Schmidt et al., 2009)  
• Participant Lessons  
• Discussion Posts  
• Focus Group  
• Semi-structured Interviews |
| RQ3 How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework? | • Discussion Posts  
• Focus Group  
• Semi-structured Interviews |

**TPACK Survey**

Surveys are often used in research designs to measure the influence of a
treatment (Creswell, 2014). All six participants in this research design took a 46-item, 5-
point Likert-scale TPACK survey published and validated by Schmidt et al. (2009).
Participants accessed this survey from a link via the learning management system to a
Microsoft Form. The survey is structured by the three different domains of the TPACK framework and their interactions, with sections or subscales on technology knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content
knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK). See the TPACK survey in Appendix A, noting how Questions 43–46 were altered from the original survey with the population under study in mind. See Table 3.5 that aligns research questions to domains of the TPACK framework.

Table 3.5

**Research Questions and TPACK Domains**

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>TPACK Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1 How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals?</td>
<td>TK TCK</td>
</tr>
<tr>
<td>RQ2 How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies?</td>
<td>TPK TPACK</td>
</tr>
<tr>
<td>RQ3 How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?</td>
<td>NA</td>
</tr>
</tbody>
</table>

Construct validity of the TPACK survey developed and validated by Schmidt et al. (2009) was examined by a team of content validity experts using varimax rotation and Kaiser normalization, but factor analysis could not be determined because of the size of the survey and the research sample. The internal reliability has a Cronbach alpha coefficient of at least 0.78 in all categories, an acceptable reliability (George & Mallery, 2001). See Table 3.6 for the Cronbach alpha coefficients for all categories of the TPACK survey (Schmidt et al., 2009).
Table 3.6

TPACK Survey Reliability Scores, Version 1.1 (Schmidt et al., 2009)

<table>
<thead>
<tr>
<th>TPACK Domain</th>
<th>Internal Consistency (α)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Knowledge (TK)</td>
<td>0.86</td>
</tr>
<tr>
<td>Content Knowledge (CK)</td>
<td></td>
</tr>
<tr>
<td>Social Studies</td>
<td>0.82</td>
</tr>
<tr>
<td>Mathematics</td>
<td>0.83</td>
</tr>
<tr>
<td>Science</td>
<td>0.78</td>
</tr>
<tr>
<td>Literacy</td>
<td>0.83</td>
</tr>
<tr>
<td>Pedagogy Knowledge (PK)</td>
<td>0.87</td>
</tr>
<tr>
<td>Pedagogical Content Knowledge (PCK)</td>
<td>0.87</td>
</tr>
<tr>
<td>Technological Pedagogical Knowledge (TPK)</td>
<td>0.93</td>
</tr>
<tr>
<td>Technological Content Knowledge (TCK)</td>
<td>0.86</td>
</tr>
<tr>
<td>Technological Pedagogical Content Knowledge (TPACK)</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Participant Lessons—Technology Integration Assessment Rubric

Assessment for professional development for technology integration is insightful to actual practice if it involves evaluating educator-created lesson materials integrating technology in combination with the use of self-reporting through the TPACK survey (Craciun, 2019; Koh et al., 2015; Torun, 2020). This action research assessed participant lessons using the validated Technology Integration Assessment Rubric (Harris et al., 2010).

Harris et al. (2010) investigated construct and face validity using a team of six experts. Five of the six experts strongly supported the rubric’s construct validity, with the sixth expert not agreeing on a rubric format. All experts confirmed face validity. The interrater reliability of the rubric by a group of eight teachers yielded an overall rating of the total rubric at 84.1%, with a Cronbach’s alpha reliability of 0.911 (Harris et al., 2010).
Discussion Posts

During the course, writers participated in three discussions on Canvas during Modules 1, 2, and 7. Discussions were used in these modules to prompt reflection and discussion in connection with transformative learning theory. Writers were instructed to create an initial post in response to a writing prompt and respond to at least two other participants’ discussion posts during the module. This data collection method used the Internet to collect qualitative data (Flick, 2009). These discussion posts proved to be an insightful source of participant discourse and reflections as an assessment of TPACK-in-Action (Harris & Hofer, 2009; Illeris, 2018). See Table 3.7 for the discussion prompts used.

Table 3.7

Alignment of Discussion Post Prompts with Transformative Learning Theory

<table>
<thead>
<tr>
<th>Module</th>
<th>Discussion Prompt</th>
<th>Transformative Learning Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 1</td>
<td><strong>Discussion 1.2: Where are you now?</strong> What do you think about technology integration now? Has your attitude changed at all since before this course?</td>
<td>Reflection and discourse for self-evaluation</td>
</tr>
<tr>
<td>Module 2</td>
<td><strong>Discussion 2.3: How am I doing now?</strong> Where are you right now with your ability to integrate technology? What strengths and weaknesses do you currently have? What limits your improvement?</td>
<td>Reflection and discourse for critical assessment</td>
</tr>
<tr>
<td>Module 7</td>
<td><strong>Discussion 7.1: How have I changed?</strong> Now that you have finished your lesson design, let’s look back over the journey you’ve taken. Describe how your view of teaching and technology integration has changed.</td>
<td>Reflection and discourse for reintegration</td>
</tr>
</tbody>
</table>
Focus Group

A focus group of the participants was conducted to collect qualitative data on changes in practice and perception of technology integration because of collaboration. Collecting data on practice and perceptions is important for this action research because dispositions and motivation are significant barriers to technology integration (Günes & Bahçivan, 2016; Heintink et al., 2016; Rosenberg & An, 2019; Young et al., 2019). Collecting data on practice and perceptions also gave useful feedback on the relationship between teacher efficacy in technology integration and growth in TPACK capabilities (Foulger, et al., 2013; Tondeur et al., 2020) with regard to collaboration with peers. These perspectives and interpretations were best gathered through semi-structured interviews, allowing organic, emic narratives to emerge with the benefit of the structure of an interview protocol (Tracy, 2020). This generated descriptions with a rhetoric that exhibits both precise, technical, logical, and objective language and vivid, empathetic portrayals of relationships and observations (Frels & Onwuegbuzie, 2013).

The focus group was scheduled as part of the course to encourage discussion, debate, and reflection. Four participants met in person and one online, with researcher observations taking place within the interview protocol. One writer was unable to participate in the focus group. Recording of the interviews allowed for strategic extraction of thick, rich descriptions. The focus group collected data on participant growth in TPACK competencies, as well as growth in lesson design practices and design dispositions, especially as they relate to technology integration and collaboration.

Transcription took place simultaneously with the meeting in Microsoft Teams which was
exported as a Microsoft Word document. See Table 3.8 for interview protocol prompts alignment and Appendix C for the full interview protocol.

Table 3.8

**Sample Focus Group Protocol Prompts**

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Focus Group Protocol Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1 How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals?</td>
<td>1. Did collaborating with the Educational Technology Specialists change your perceptions of technology integration (Harris &amp; Hofer, 2009)?</td>
</tr>
<tr>
<td>RQ2 How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies?</td>
<td>2. Did collaborating with other writers change your perceptions of technology integration (Harris &amp; Hofer, 2009)? If so, how?</td>
</tr>
<tr>
<td>RQ3 How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?</td>
<td>3. Did your educational beliefs change because of the professional development and collaboration (Heintink et al., 2016; Mezirow, 1994)? If so, how?</td>
</tr>
<tr>
<td></td>
<td>4. Will you approach lesson design differently because of collaboration in this professional development course? If so, how? (An &amp; Reigeluth, 2011; Harris &amp; Hofer, 2009, 2010; Rosenberg &amp; An, 2019)? If so, how? Was the change negative or positive?</td>
</tr>
<tr>
<td></td>
<td>5. What suggestions do you have to improve the course to affect others’ perceptions of technology integration?</td>
</tr>
</tbody>
</table>

**Semi-Structured Interviews**

Individual interviews of the participants were also conducted to compare participants’ perceptions of technology integration before and after professional development in technology integration to discern changes in perception. Collecting data on individual perceptions is important for this action research for the same reasons as the focus group—because dispositions and motivation are significant barriers to
technology integration (Günes & Bahçivan, 2016; Heintink et al., 2016; Rosenberg & An, 2019; Young et al., 2019) and because it can reveal relationships between teacher efficacy in technology integration and growth in TPACK capabilities (Foulger, et al., 2013; Tondeur et al., 2020). Collecting additional qualitative data through individual interviews allowed for a greater exploration of themes and for additional opportunities to gather and weave thick, rich descriptions that empathetically portray individual and group perspectives (Tracy, 2020, Frels & Onwuegbuzie, 2013).

Participants took part in individual interviews after the completion of the course. Some interviews were conducted in person; some were conducted online through Microsoft Teams, with researcher observations taking place within the interview protocol. Transcription took place simultaneously with the meeting recording in Microsoft Teams, which was exported to a Microsoft Word document. Interviews collected data on changes in perceptions of technology integration by comparing perceptions and practices before and after the course. No meetings during this action research other than the focus group and interviews were observed as a data source. See Table 3.9 for sample interview protocol prompts alignment and Appendix D for the full interview protocol.

Table 3.9

Sample Interview Protocol Prompts

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Interview Protocol Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1 How does professional development in technology integration using the TPACK framework affect how Content</td>
<td>Before Professional Development</td>
</tr>
<tr>
<td>1. Describe your experiences integrating technology integration before the TPACK</td>
<td></td>
</tr>
<tr>
<td>Research Question</td>
<td>Interview Protocol Prompts</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Writers use technology to meet instructional goals?</td>
<td>professional development course (Ertmer, 2011).</td>
</tr>
<tr>
<td>RQ2 How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies?</td>
<td>2. Describe your readiness and confidence in integrating technology integration before the TPACK professional development course (Inan &amp; Lowther, 2010).</td>
</tr>
<tr>
<td>RQ3 How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?</td>
<td>3. Did you feel you had difficulties integrating technology before the professional development (Mouza, 2011)? What difficulties did you experience?</td>
</tr>
<tr>
<td></td>
<td><strong>After Professional Development</strong></td>
</tr>
<tr>
<td>4. Did the TPACK professional development course change your perceptions of technology integration (Mezirow, 1994)? If so, how? Was the change negative or positive?</td>
<td></td>
</tr>
<tr>
<td>5. Did your educational beliefs change as a result of the professional development (Heintink et al., 2016; Mezirow, 1994)? If so, how?</td>
<td></td>
</tr>
<tr>
<td>6. Will you approach lesson design differently because of this professional development course? If so, how? (An &amp; Reigeluth, 2011; Harris &amp; Hofer, 2009, 2010; Rosenberg &amp; An, 2019)?</td>
<td></td>
</tr>
<tr>
<td>7. What suggestions do you have to improve the course to affect others’ perceptions of technology integration?</td>
<td></td>
</tr>
</tbody>
</table>

**Data Analysis**

Quantitative and qualitative data analysis methods used in this mixed methods study included descriptive statistics and inductive analysis to create themes. Table 3.10 aligns these data analysis methods with this study’s research questions and data sources.
Table 3.10

Research Questions and Data Analysis Alignment

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Data Collection Sources</th>
<th>Data Analysis Methods</th>
</tr>
</thead>
</table>
| RQ1 How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals? | • TPACK Survey (Schmidt et al., 2009)  
• Participant Lessons  
• Discussion Posts  
• Focus Group  
• Semi-structured Interviews | • Descriptive statistics  
• Inductive analysis |
| RQ2 How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies? | • TPACK Survey (Schmidt et al., 2009)  
• Participant Lessons  
• Discussion Posts  
• Focus Group  
• Semi-structured Interviews | • Descriptive statistics  
• Inductive analysis |
| RQ3 How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework? | • Discussion Posts  
• Focus Group  
• Semi-structured Interviews | • Inductive analysis |

TPACK Survey

Participants completed a pretest and posttest TPACK Survey (Schmidt, et al., 2009) in Microsoft Forms accessed through the learning management system Canvas. Likert-items generated quantitative data that was analyzed with descriptive statistics to determine the measure of central tendency and standard deviation (Adams & Lawrence, 2019). The effect of the intervention on TPACK competencies was investigated by comparing the composite means of pretest and posttest scores for each subscale of the survey (Adams & Lawrence, 2019).
Participant Lessons—Technology Integration Assessment Rubric

Participants submitted a lesson before the course and resubmitted the revised lesson after the completion of the course in Microsoft Word through Canvas. Both pretest and revised lessons were analyzed quantitatively using the Technology Integration Assessment Rubric (Harris et al., 2010). This rubric evaluated TPACK competency, with four criteria rated on a scale from 0–4. These criteria are curriculum goals and technology, instructional strategies and technology, technology selection, and TPACK fit. See the Technology Integration Assessment Rubric in Appendix B.

Pretest and posttest scores were analyzed using descriptive statistics to determine central tendency and standard deviation (Adams & Lawrence, 2019). The effect of the intervention on technology integration in the lesson was investigated by comparing the composite means of pretest and posttest scores for each section of the rubric as well as for the entire rubric for each participant (Adams & Lawrence, 2019).

Discussion Posts

During the course, writers participated in three discussion posts on Canvas during Modules 1, 2, and 7. These discussion posts were transferred into a Microsoft Word document and then into Delve. Delve is a computer-aided qualitative data analysis (CAQDAS) program (Twenty to Nine LLC, 2021). The purpose of using Delve for qualitative data analysis was to aid in inductive analysis through coding. Inductive analysis is the process of analyzing qualitative data sources by using codes, words or phrases that summarize transcribed data (Creswell, 2014; Tracy, 2020). Codes are grouped into categories and grouped again to form broad themes were woven into rich,
thick narratives (Mertler, 2020; Creswell, 2017; Saldaña, 2013; Tracy, 2020. These narratives of participant experience were interpreted in the context of the TPACK framework and the transformative learning theory (Bernard et al., 2017).

Memos—observational notes and impressions of the discussion posts (Creswell, 2014; Flick, 2009) —were also recorded in Delve. Memos included segment memos and analytic memos (Creswell, 2017; Tracy, 2020). Segment memos are notes used as a jumpstart to coding (Creswell, 2017), and analytic memos are observations, thoughts, and relationships observed between ideas during the process of coding (Tracy, 2020).

Focus Group

A focus group was conducted and recorded in Microsoft Teams and transcribed with memoing, including segment memos and analytic memos (Creswell, 2017; Tracy, 2020). Transcription of the focus group was analyzed through inductive analysis by importing Microsoft Word documents of transcriptions into Delve and creating codes, categories, and themes through inductive analysis (Saldaña, 2013). These narratives of participant experience were interpreted with the discussion posts in the context of the TPACK framework and the transformative learning theory (Bernard et al., 2017).

Semi-Structured Interviews

Individual interviews were conducted and recorded in Microsoft Teams and transcribed with memoing, observational notes, and impressions of the interviews (Creswell, 2014). Memos included segment memos and analytic memos (Creswell, 2017; Tracy, 2020). Transcripts were imported into this program and tagged with open codes (Creswell, 2014; Tracy, 2020). Open codes are words organically assigned to passages of
text to convey meaning as directed by the text (Tracy, 2020). Transcriptions from the interviews had codes applied and evaluated in a reverberative process. These codes went through subsequent rounds of review to be categorized and described to form themes that were also woven into rich, thick narratives (Mertler, 2020; Creswell, 2017; Tracy, 2020). These narratives of participant experience were then compared with codes and themes from the discussion posts and focus group and interpreted in the context of the TPACK framework and the transformative learning theory (Bernard et al., 2017).

**Procedure and Timeline**

The procedure and timeline for the action research preparation, pretest phase, intervention, posttest phase, and finalization of action research is next discussed. Preparation lasted for one month, the pretest phase for one week, the intervention for seven weeks, the posttest phase for two weeks, and the finalization phase for three months. Greater detail for the timeline of each phase is outlined below.

**Preparation**

Two months before the pretest phase began, the Educational Technology Specialists and Instructional Design Specialists reviewed the professional development course to inspect construct validity and to serve as expert consultation. One week before the pretest phase began, an informational meeting was held to present the research plan to recruit participants and to secure participant consent. An incentive of a choice of a 64GB 10th generation iPad, an iPad mini, or a series 8 Apple watch was offered to increase the number of volunteers. A few days later, another informational
meeting was held to coordinate the course activities with facilitators in preparation for the professional development course.

**Pretest**

The pretest phase began on the first day of action research with the application of the TPACK survey to the participants (Schmidt et al., 2009). Participants submitted Microsoft Word documents of work representing lesson designs through Canvas. These lesson designs were assessed with the Technology Integration Assessment Rubric (Harris et al., 2010) and returned to participants a week after submission.

**Intervention**

The intervention phase of action research began the second week of the action research with the first module of a professional development course in technology integration using the TPACK framework. Each module took one week to complete, with the intervention phase lasting for a total seven weeks for the seven modules. The phases of the intervention follow Mezirow’s transformative learning theory (1995).

The introduction to the professional development course and reflection on current practice began Week 2 of the action research. A self-evaluation and discussion took place on Week 3 of the action research. Writers entered a planning phase on Week 4 and began instruction on the TPACK framework of technology integration on Week 5. Writers renovated submitted lessons in Week 6, culminating with a collaboration time. Writers submitted final lesson designs at the end of Week 7 and planned adjustments to current practice at the conclusion of the professional development course at the end of Week 8.
In Module 1 of the course, participants learned about the course and about each other and formed writing groups. Then they encountered information that caused them to question their basic assumptions about technology integration in the form of a video. They contributed to discussion posts to reflect on their current perceptions of technology integration.

In Module 2, participants learned about the Technology Integration Assessment Rubric used to score their lesson during the pretest phase and assessed their understanding with a self-quiz. Then participants used the rubric to self-evaluate their current lesson design. They contributed to a discussion post reflecting on their observations and limitations to growth in technology integration. They also scheduled a time to collaborate with facilitators to give them advice on improving their lesson design.

In Module 3, participants met with facilitators to formulate a plan for improving technology integration in their lesson. They documented this plan in a journal entry.

In Module 4, participants learned about the TPACK framework for professional development in technology integration. Participants assessed their understanding of the framework with a self-quiz. Participants used the framework to analyze model lessons and then apply the framework to their own lesson design. They again documented observations in a journal entry.

In Module 5, participants investigated technology resources to implement into their lesson design. Then they began the work of renovating their lesson based on the collaboration, learning, and reflection that they did on their current lesson design.
revisions were posted to a writing group for peer feedback. The module culminated in an in-person collaborative meeting in which participants received additional peer feedback (Gow et al., 2018) in a writing workshop style. A writing workshop is a format of writing instruction with opportunities for Writers to work independently in combination with peer and teacher conferencing in a supportive context (Calkins & Ehrenworth, 2016).

In Module 6, participants again submitted lesson designs to a collaborative writing group before finalizing the lesson design for submission.

In Module 7, participants reflected on how their thinking about technology integration changed during the course of the professional development by submitting to a discussion post. The professional development course culminated with a focus group in which participants discuss future practices in integrating technology. Transcription occurred during the focus group in Microsoft Teams.

Posttest

The posttest phase began on Week 8 of the action research during Module 7 with the posttest application of the TPACK survey (Schmidt et al., 2009). Participants also resubmitted edited files of work representing revised lesson designs. Individual interviews occurred in the posttest phase, with transcriptions occurring during the individual interviews in Microsoft Teams.

Finalization

Revised lesson designs were reassessed with the Technology Integration Assessment Rubric (Harris et al., 2010) during the finalization stage. After analysis of the
After the posttest phase, a peer debrief of the research was conducted with the facilitators of this action research. Member checking occurred after this peer debrief phase through emails and a finalization meeting. Six months after the posttest phase, a presentation of findings to the participants completed the member checking phase and the action research. See Table 3.11 for a summary of the procedures and timeline.

**Table 3.11**

*Summary of Procedure and Timeline*

<table>
<thead>
<tr>
<th>Action Research Phase</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparation</strong></td>
<td></td>
</tr>
<tr>
<td>Expert consultation</td>
<td>1 week, 2 months before pretest</td>
</tr>
<tr>
<td>Informational meeting with potential participants</td>
<td>1 day, Week 1 of the course</td>
</tr>
<tr>
<td>Informational meeting with facilitators</td>
<td>1 day, Week 1 of the course</td>
</tr>
<tr>
<td><strong>Pretest</strong></td>
<td></td>
</tr>
<tr>
<td>TPACK survey</td>
<td>Week 1</td>
</tr>
<tr>
<td>Lesson design submissions</td>
<td>Week 1</td>
</tr>
<tr>
<td>Lesson design assessment complete</td>
<td>Week 3</td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
<td></td>
</tr>
<tr>
<td>Module 1: Introduction</td>
<td>Week 2</td>
</tr>
<tr>
<td>Module 2: Self-evaluation</td>
<td>Week 3</td>
</tr>
<tr>
<td>Module 3: Planning</td>
<td>Week 4</td>
</tr>
<tr>
<td>Module 4: Learning</td>
<td>Week 5</td>
</tr>
<tr>
<td>Module 5: Renovating</td>
<td>Week 6</td>
</tr>
<tr>
<td>Module 6: Collaborating</td>
<td>Week 7</td>
</tr>
<tr>
<td>Module 7: Thinking forward</td>
<td>Week 8</td>
</tr>
<tr>
<td><strong>Posttest</strong></td>
<td></td>
</tr>
<tr>
<td>Lesson design submissions</td>
<td>Week 7</td>
</tr>
<tr>
<td>TPACK survey</td>
<td>Week 8</td>
</tr>
<tr>
<td>Focus group</td>
<td>Week 8</td>
</tr>
<tr>
<td>Interviews</td>
<td>1 week after course</td>
</tr>
<tr>
<td>Transcription completed</td>
<td>1 week after course</td>
</tr>
<tr>
<td><strong>Finalization</strong></td>
<td></td>
</tr>
<tr>
<td>Lesson design assessment complete</td>
<td>4 months after the course</td>
</tr>
<tr>
<td>Coding, survey and rubric analysis</td>
<td>5 months after the course</td>
</tr>
<tr>
<td>Action Research Phase</td>
<td>Timeline</td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Peer debriefing with facilitators</td>
<td>6 months after the course</td>
</tr>
<tr>
<td>Member checking</td>
<td>6 months after the course</td>
</tr>
<tr>
<td>Presentation of findings to participants</td>
<td>6 months after the course</td>
</tr>
</tbody>
</table>

**Rigor and Trustworthiness**

Several strategies were used to assure the rigor and trustworthiness of the analysis of qualitative data gathered through focus group and individual interviews. These strategies include using thick, rich, descriptions, an audit trail, triangulation, peer debriefing, and member checking.

**Thick, Rich Descriptions**

During the course, writers participated in discussion posts, a focus group, and interviews. Discussion posts and transcripts of the focus group and interview were imported into a Microsoft Word document and then into Delve for inductive analysis. In inductive analysis, codes are grouped into categories and grouped again to form broad themes. These themes are woven into rich, thick descriptions and narratives (Mertler, 2020; Creswell, 2017; Saldaña, 2013; Tracy, 2020. These narratives of participant experience were interpreted in the context of the TPACK framework and the transformative learning theory (Bernard et al., 2017). Segment and analytic memos were also recorded in Delve (Creswell, 2017; Tracy, 2020). These memos promoted reflexivity while constructing thick, rich descriptions.

**Audit Trail**

An audit trail is the practice of documenting the analysis process through the development of open codes, categories, and themes from qualitative data such as an interview transcription (Creswell, 2014, Nowell et al., 2017). This practice provides...
evidence for research decision making, facilitates repeatability, and requires reflexivity (Creswell, 2014; Nowell et al., 2017). I developed an audit trail using Delve. This program facilitated the simultaneous coding of multiple interviews and participant lessons and enabled saving progress to track the development of codes, categories, and themes. Simultaneous coding is the process of applying more than one code to a segment of text for inductive analysis (Mertler, 2020). This program also assisted in the development of a codebook, which is a diagram illustrating the relationships of codes, their descriptions, their categories, and the themes into which they were organized (Creswell, 2017; Nowell et al., 2017).

**Triangulation**

Triangulation is the process of collecting data from multiple sources to answer research questions (Tracy, 2020). Triangulation is helpful for assuring that the interpretation of qualitative data is credible by comparing it with other sources of data (Nowell et al., 2017; Tracy, 2020). Focus groups provide context to data collected through surveys in mixed methods studies (Caillaud & Flick, 2017). Triangulation is consistent with a pragmatic research paradigm (Miles et al., 2014). Using a focus group with multiple participants provided internal triangulation and provided context for individual interviews and discussion posts. Narratives of participant experience were compared with codes and themes from across the qualitative data sources and interpreted in the context of the TPACK framework and the transformative learning theory (Bernard et al., 2017).
Quantitative and qualitative data were converged in this mixed methods action research after both were independently analyzed. Then the results were compared and interpreted to connect participants’ self-reported TPACK competencies and lesson design changes with changes in disposition toward technology integration for individual participants in a side-by-side comparison (Creswell, 2014).

**Peer Debriefing**

Peer debriefing is the process of an outside review of findings through the involvement of another researcher to assure accuracy and relevance to the reading audience (Creswell, 2014; Nowell et al., 2017). Peer debriefing occurred through the reviews of facilitators in this action research project as well as through the feedback of my dissertation chair. During the peer debriefing stage, facilitators noted typos in the data analysis. My dissertation chair offered improvements to structure, wording, alignment, the compilation of evidence, and the strategic use of the literature.

**Member Checking**

The involvement of other participants as fellow researchers safeguarded rigor through member checking (Nowell et al., 2017). Member checking involves presenting participants with the analysis of the discussion posts, focus group, and individual interviews (Birt et al., 2016). Member checking occurred in a post-analysis meeting in which a paper with initial synthesized findings was available for review as well as for open discussion with participants. All participants were present for this meeting. The paper with initial findings was emailed to participants ahead of time to provide capacity for adequate review as well as to make the meeting more efficient. Participants were
invited to reflect on the initial findings before the meeting. The goal of these checks was to confirm accuracy of the inductive analysis and interpretation (Creswell, 2014; Nowell et al., 2017) or to assimilate diverging views (Birt et al., 2016). Participants pointed out a few textual and transcription errors and text to deidentify. One participant was surprised to see that he had classified himself as a digital native. Members also noted differences in how they worded quotes compared to verbal dialog.

Plan for Sharing and Communicating Findings

Because of my research positionality as an insider collaborating with insiders and because participants are viewed as fellow researchers (Herr & Anderson, 2005), it is crucial to plan for sharing and communicating findings with participants. Initial findings were communicated during a meeting with participants for member checking, and revised findings will be presented to participants and stakeholders after results have been finalized. A final published study will be made available to Educational Content and Creative Development employees.

When findings have been finalized, participants and stakeholders will be invited to a virtual meeting on Microsoft Teams to celebrate and reflect on the findings through dialog (Tracy, 2020). Supporting documents will be posted for analysis and reflection. Participants, stakeholders, and the populations they represent will be encouraged to ask questions and participate in reflection on video, in the meeting chat, or in a private chat or email if desired during or after the meeting. After the presentation to participants and stakeholders, I will post the findings to Educational Content and Creative Development.
Customers are also stakeholders in this action research project. Key customers will be informed of the findings of this action research at an annual meeting used to communicate yearly innovations. Confidentiality will be maintained during all research meetings, presentations, and publications by compiling results for the research group or by referring to individuals by pseudonyms with nonidentifying details (Kaiser, 2009).
CHAPTER 4: ANALYSIS AND FINDING

Introduction

The purpose of this action research was to implement a professional development program for Educational Content Writers in technology integration using the TPACK framework to affect the design of educational resources. This action research involved collecting both quantitative and qualitative data to address the research question: How does professional development in the TPACK framework affect the design of educational resources produced by Content Writers? Supporting research questions addressed by data are (1) How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals? (2) How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies? (3) How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework? This chapter will describe quantitative data and findings as well as qualitative findings and interpretations.

Quantitative Data Analysis and Findings

This action research collected quantitative data from participants to address Research Questions 1 and 2. Quantitative data was collected through the TPACK survey (Creswell, 2014; Schmidt et al., 2009) (see Appendix A) and through files of participant
work assessed with the Technology Integration Assessment Rubric (Harris et al., 2010) (see Appendix B). It was important to combine the TPACK survey with files of participant work as quantitative instruments to give a more complete picture of the effectiveness of the professional development course on changing practice (Craciun, 2019; Günes & Bahçivan, 2016; Torun, 2020).

The application of both the survey and the assessment of participant lessons followed a pretest-intervention-posttest design. The TPACK survey was administered both before and after the professional development course. Content Writers also submitted files of lessons to improve, which were assessed with the Technology Integration Assessment Rubric before the professional development course and after writers had made improvements to the lessons as a result of the course. This section will describe quantitative data and findings for both the TPACK survey and the files of participant lessons assessed with the Technology Integration Rubric.

**TPACK Survey**

The TPACK survey, created and validated by Schmidt et al. (2009), is a 46-item, 5-point Likert-scale survey. The survey is structured by the three different domains of the TPACK framework and their interactions, with sections or subscales on technology knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK). See Appendix A, noting how Questions 43-46 were altered from the original survey with this action research’s participants in mind. Participants accessed this survey
from a link via the learning management system Canvas to a Microsoft Form for both the pretest and posttest applications.

Pretest and posttest survey scores were exported from the Microsoft Forms as Microsoft Excel files. Scores were combined in Microsoft Excel and analyzed as composite scores for each subscale of the TPACK survey. Descriptive statistics were used to analyze the pretest and posttest scores in Microsoft Excel using the measure of central tendency and standard deviation (Adams & Lawrence, 2019). Descriptive statistics are appropriate for this mixed methods action research study considering both the sample size and the nature of this action research as a descriptive study with significant qualitative findings (Bloomberg & Volpe, 2016).

Composite scores related to content for the TPACK subscales including CK ($M = 3.7$ to $3.6$) and PCK ($M = 3.5$ to $3.4$) slightly decreased from pretest to posttest. All other subscales slightly increased from pretest to posttest, with the most significant increases being in subscales related to technology, or the T-dimensions, such as TK ($M = 3.2$ to $3.8$), TCK ($M = 3.1$ to $3.5$), TPACK, ($M = 3.2$ to $3.4$) and especially TPK ($M = 3.7$ to $4.6$). This is notable, as Scherer et al. (2017) has demonstrated no significant differentiation in measurements of the T-dimensions. See Table 4.1 for descriptive statistics of composite scores for each of the subscales of the TPACK Survey.

**Table 4.1**

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Pretest $M$ ($SD$)</th>
<th>Posttest $M$ ($SD$)</th>
<th>$M$ Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK</td>
<td>3.2 (0.7)</td>
<td>3.8 (0.9)</td>
<td>+0.6</td>
</tr>
<tr>
<td>CK</td>
<td>3.7 (0.5)</td>
<td>3.6 (0.6)</td>
<td>−0.1</td>
</tr>
<tr>
<td>PK</td>
<td>4.2 (0.4)</td>
<td>4.4 (0.5)</td>
<td>+0.2</td>
</tr>
</tbody>
</table>
Subscale | Pretest $M (SD)$ | Posttest $M (SD)$ | $M$ Difference
--- | --- | --- | ---
PCK | 3.5 (0.3) | 3.4 (0.5) | −0.1
TCK | 3.1 (0.6) | 3.5 (0.5) | +0.4
TPK | 3.7 (0.4) | 4.6 (0.4) | +0.9
TPACK | 3.2 (0.5) | 3.4 (0.4) | +0.2

**Participant Lessons—Technology Integration Assessment Rubric**

This action research assessed participant lessons using the published and validated Technology Integration Assessment Rubric (Harris et al., 2010). This rubric assesses four categories on a scale of 0 (poor) to 4 (excellent): (1) curriculum goals and technology, (2) instructional strategies and technologies, (3) technology selection, and 4) “fit.” The criteria “curriculum goals and technology” refers to how the technology is used to align with curriculum goals. The criteria “instructional strategies and technologies” refers to how well the technology supports the use of instructional strategies. The criteria “technology selection” refers to the appropriateness of the technology used, considering the curriculum goals and instructional strategies. The criteria “fit” refers to how well the content, pedagogy, and technology fit with each other. See Appendix B for the Technology Integration Assessment Rubric.

Participant lessons were scored with the rubric both at the beginning of the course and at the end of the course after participants made improvements to their lessons. Lessons with no technology integration were given a score of 0, with scores being assigned on a scale of 1–4 if technology was present. I noted objectives met using technology as part of the assessment, as well as noting the specific technologies used in analytic memos. Analytic memos were inserted as comments in the rubric (Creswell, 2017). Descriptive statistics were used to analyze the pretest and posttest composite
scores for each category on the rubric (Adams & Lawrence, 2019; Bloomberg & Volpe, 2016).

It is notable that the mean composite scores for every category on the Technology Integration Assessment Rubric slightly increased from the pretest to the posttest scoring, including curriculum goals and instruction ($M = 2.5$ to $3.6$), instructional strategies and technologies ($M = 2.2$ to $3.5$), and “fit” ($M = 2.2$ to $3.3$). The category experiencing the most improvement was the technology selection category ($M = 2.3$ to $3.7$). The total scores were a pretest composite score of $58\%$ ($M = 9.2$) compared to a posttest composite score of $89\%$ ($M = 14.2$) out of $16$ points. This represents an increase of $31.3\%$ in participant scores after the course. See Table 4.2 for lesson analysis using the Technology Integration Assessment Rubric.

**Table 4.2**

*Lesson Analysis Using the Technology Integration Assessment Rubric*

*(Note: Parentheses indicate the number of potential points.)*

<table>
<thead>
<tr>
<th>Rubric Category</th>
<th>Pretest $M (SD)$</th>
<th>Posttest $M (SD)$</th>
<th>$M$ Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum Goals &amp; Technologies (4)</td>
<td>2.5 (1.4)</td>
<td>3.6 (0.5)</td>
<td>+1.1</td>
</tr>
<tr>
<td>Instructional Strategies &amp; Technologies (4)</td>
<td>2.2 (1.2)</td>
<td>3.5 (0.8)</td>
<td>+1.3</td>
</tr>
<tr>
<td>Technology Selection(s) (4)</td>
<td>2.3 (1.2)</td>
<td>3.7 (0.5)</td>
<td>+1.4</td>
</tr>
<tr>
<td>“Fit” (4)</td>
<td>2.2 (1.2)</td>
<td>3.3 (0.8)</td>
<td>+1.1</td>
</tr>
<tr>
<td>Total Score (16):</td>
<td>9.2 (4.8)</td>
<td>14.2 (2.4)</td>
<td>+5.0</td>
</tr>
</tbody>
</table>

This section summarized the quantitative data and findings collected through a pretest and posttest application of the TPACK survey and a pretest and posttest assessment of participant lessons using the Technology Integration Assessment Rubric. Analysis through descriptive statistics demonstrated a small increase in most mean
composite scores in the subscales of the TPACK survey as well as a slight increase in the mean composite scores in all categories of lessons scored with the Technology integration Assessment Rubric when reviewing pretest and posttest scores.

**Qualitative Findings and Interpretations**

This action research also collected qualitative data from participants to address all research questions, with a special focus on Research Question 3, “How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?” Discussion post responses to writing prompts posted in Canvas during Modules 1, 2, and 7 revealed participant thoughts and perspectives during the course. A focus group at the end of the course and semi-structured interviews after the course produced organic, authentic narratives within a natural context (Creswell, 2014; Flick, 2009) with the benefit of the structure of an interview protocol (Tracy, 2020). Some participants met in person and some online for both the focus group and individual interviews, with researcher observations taking place within the interview protocol. Recordings of the focus group and individual interviews allowed for strategic extraction of thick, rich descriptions. The descriptions generated are both precise and empathetic (Freis & Onwuegbuzie, 2013). Participant responses stimulated ideas to improve the professional development course when it is offered to more participants in the next iteration of action research (Plano Clark & Ivankova, 2016; Mertler, 2020). This section will describe qualitative (1) sources, (2) analysis, and (3) findings.
Qualitative Sources

Qualitative data sources analyzed included 58 discussion posts, one focus group with five out of the six participants, and six individual interviews with all participants ($n = 6$) (Creswell, 2014). Table 4.3 summarizes qualitative data sources and demonstrates the richness of the data with the number of codes applied to the transcripts and discussion posts.

Table 4.3

Qualitative Data Sources and Codes

<table>
<thead>
<tr>
<th>Qualitative Data Sources</th>
<th>Number</th>
<th>Number of Codes Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion posts</td>
<td>58</td>
<td>183</td>
</tr>
<tr>
<td>One-on-one interviews</td>
<td>6</td>
<td>687</td>
</tr>
<tr>
<td>Focus group interview</td>
<td>1</td>
<td>212</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>10</strong></td>
<td><strong>1,082</strong></td>
</tr>
</tbody>
</table>

Demographics of the participants varied but also demonstrated patterns. Five of the participants were female, and one was male. Participants ranged in age from 20s–60s. Participant years of experience as a content writer varied from 6 months to 30 years, though 5 out of the 6 participants had less than 10 years of writing experience. Participants varied in their teaching experience from 6 years to 30 years. Five out of the six writers have masters’ degrees, and four out of the six have undergraduate degrees in some field of education. Two of the participants were teaching at the college level at the time of this action research.
Qualitative Data Analysis

Qualitative data analysis occurred in four rounds of first cycle coding, four rounds of second cycle coding, and two rounds of third cycle coding. Coding is the process of tagging segments of interviewee dialog and text with words and phrases that capture their essence to synthesize the participant’s story (Flick, 2009; Tracy, 2020). Analytic memos were added for reflection (Creswell, 2017; Merriam & Tisdell, 2016). A research journal was also maintained to record broader thoughts and impressions and maintain reflexivity while coding considering the interpersonal context of this research (Plano Clark & Ivankova, 2016; Creswell, 2014). Codes, categories, and themes were exported from Delve at regular intervals to create an audit trail (Creswell, 2014, Nowell et al., 2017). I have provided screenshots, photographs, and tables for transparency and accountability in qualitative data analysis for assuring rigor and trustworthiness (Bloomberg & Volpe, 2016; Creswell & Poth, 2018; Flick, 2018). This section will outline the process of qualitative data analysis, including details on first cycle coding with codes, second cycle coding with categories, and third cycle coding with themes.

Data Analysis Process. I analyzed qualitative data sources through the process of inductive analysis (Saldaña, 2013; Tracy, 2020). Interviews and the focus group were recorded in Microsoft Teams and simultaneously transcribed as Microsoft Word documents. These documents were stored in OneDrive and imported into Delve. The transcripts were then tagged with simultaneous, eclectic codes in a reverberative process (Bloomberg & Volpe, 2016; Creswell, 2014; Saldaña, 2013; Tracy, 2020) first on paper and then in Delve. Eclectic codes are codes from a variety categories, and
Simultaneous codes are multiple codes that are applied to the same data (Saldaña, 2013). These codes went through subsequent rounds of review. The development of categories and themes occurred in Microsoft Word documents stored in OneDrive. These categories and themes were then inputted into Delve after each round of coding. Themes were woven into rich, thick narratives using reflection through concept mapping on paper and the development of assumption (Bloomberg & Volpe, 2016; Creswell, 2017; Saldaña, 2013; Tracy, 2020).

Peer debriefing, the outside review of findings by a peer to assure accuracy and relevance (Creswell, 2014; Nowell et al., 2017), occurred regularly during qualitative data analysis through regular meetings with my dissertation chair for continued rigor and trustworthiness. Communication with the dissertation chair occurred through emails, Microsoft Teams meetings, and through a shared Microsoft Word document tracking questions, issues, needs, notes from meetings, and next steps. My dissertation chair did not interact with qualitative data in Delve; interaction was limited to comments on data extracted in PDF files.

**First Cycle Coding.** The purpose of the first cycle of coding was to capture the essential meaning of participants’ narratives and experiences by assigning initial codes to portions of all three qualitative data sources (Flick, 2009; Tracy, 2020). The first cycle of coding consisted of four rounds. The first round of coding involved coding a portion of the focus group and verifying the variety and meaning of codes through a peer debrief with the dissertation chair (Creswell, 2014; Nowell et al., 2017). The second cycle of coding consisted of subsequently assigning initial codes and subcodes to all qualitative
data sources, including the focus group, individual interviews, and discussion posts. The third round of coding consisted of going back through all codes to determine if codes needed to be added or split. The fourth round of coding consisted of classifying codes into types and renaming codes to limit the codes to four classifications (Saldaña, 2013). Each of these rounds of first cycle coding will be discussed in greater detail.

First Round of First Cycle Coding. In the first round of first cycle coding, I imported the first 10 pages of the focus group transcript into a table with three columns. The center column contained the transcript, the column to the right contained initial codes, and the column to the left contained analytic memos. This table was printed out, and codes and memos were added by hand. Codes were transferred from paper to a Microsoft Word document. The dissertation chair reviewed preliminary coding exported into a PDF file in a peer debrief. See Figure 4.1 for a segment of first round of coding after being transferred to Microsoft Word.

<table>
<thead>
<tr>
<th>Analytic Memos</th>
<th>Transcription</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>misunderstanding the goal of technology integration. She seems a bit bashful about this.</td>
<td>even tell stories or experiences before, after those are all wonderful, and they provide what researchers call thick, rich descriptions. So if you have any to add, that’s really fantastic. So, so. Do you feel like collaborating with the educational technology specialists? Change your perception of technology integration and it’s OK, yes, no it fine.</td>
<td>Teacher-driven tech</td>
</tr>
<tr>
<td>wanting to equip students with tech but not knowing how, even when given professional development in specific tech tools.</td>
<td>Well I thought technology integration was just the teacher doing things, I didn’t actually realize it meant this students accessing technology to do their work. So I was just like, oh, I saw a few videos and I have done it. So I just didn’t get it. So kind of was not quite that same path. Not what I meant! But I was adding a lot of things for the teachers, but didn’t know how to add things for the students. I was, and I, you know. shows us all these different things on that Monday morning thing that we have and I had no idea what to do with it. And this helped.</td>
<td>Student-driven tech</td>
</tr>
<tr>
<td>Can data be linked with more than one code? I think this is appropriate here.</td>
<td>nothing that bad! (both laughing)</td>
<td>Just videos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teacher-driven tech</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failure to transfer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ed tech specialist</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Specific tech ideas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Personal help</td>
</tr>
</tbody>
</table>

Figure 4.1

Sample of First Round Coding in Microsoft Word in First Cycle Coding
The purpose for beginning the first round of coding on paper was to have a manual sense of control over the data (Saldaña, 2013, Tracy, 2020). This also allowed me to become familiar with the coding process and to practice comparing passages coded with the same word using a more manageable number of codes. This process is a practice called the constant comparative method (Tracy, 2020). The codes recorded on paper and then in Microsoft Word were then transferred to the transcript of the focus group imported into Delve. The first round of first cycle coding produced 42 codes.

**Second Round of First Cycle Coding.** The second round of coding continued in Delve with coding the remaining qualitative data sources, including the remainder of the focus group interview, all individual interviews, and the discussion posts. Codes used analogies (Merriam & Tisdell, 2016) and mnemonic devices such as abbreviations and acronyms for convenience (Tracy, 2020). Codes in round 2 were eclectic, using codes of multiple categories. Coding in round 2 also involved simultaneous coding. See Figure 4.2 for a screenshot of coding in Delve, including simultaneous coding and eclectic coding.
Figure 4.2

Second Round Coding in Delve in First Cycle Coding

Journaling promoted reflexivity and occurred throughout the coding process using analytic memos and a research journal (Creswell, 2014; Merriam & Tisdell, 2016). Bracketing, the documentation of one’s preconceptions in coding, was accomplished through analytic memos in Delve (Tufford & Newman, 2010). A codebook—a diagram (see Figure 4.3) illustrating the relationships of codes, their descriptions, their categories, and the themes (Creswell, 2017; Nowell et al., 2017)—was also formed in Delve during the second round of coding (Tracy, 2020). The purpose of the second round of first cycle coding was to extend the constant comparative method to all data sources with additional codes (Tracy, 2020). This involved “having a conversation with the data” to probe for meaning (Merriam & Tisdell, 2016). The second round of first cycle coding ended with 139 codes applied across all qualitative data sources.
Figure 4.3

**Codebook Begun During the Second Round Coding in Delve in First Cycle Coding**

**Third Round of First Cycle Coding.** The third round of first cycle coding continued in Delve. Qualitative data sources were analyzed afresh to extract finer codes. Care was taken to be thorough with analytic memos and the use of emotion codes. Emotion codes that identify the emotion of the speaker in the passage (Saldaña, 2013). The purpose of the third round of coding was to refine codes in an iterative process of improvement (Flick, 2009; Tracy, 2020) and to increasingly get to “know” my data (Bloomberg & Volpe, 2016; Mertler, 2020). The third round of first cycle coding ended with a total of 143 codes.

**Fourth Round of First Cycle Coding.** The fourth round of first cycle coding began by extracting codes from Delve into a Microsoft Word document so they could be classified. There were initially six code types in extracted codes. Attribute codes and emotion codes were renamed so that they could be reclassified into four types for manageability (Saldaña, 2013). Attribute codes are codes that summarize a
characteristic of a speaker, such as gender or teaching experience (Saldaña, 2013).

Several codes merged in this process, and some descriptive codes were renamed as *in vivo* codes. *In vivo* codes use wording directly from a quote as the code, and descriptive codes are words or phrases that describe a quote (Saldaña, 2013). Structural codes, codes that segment data based on a characteristic, were used to classify data by the phases of research in both Round 3 and Round 4 (Saldaña, 2013). Table 4.4 compares the classifications of codes used in the third round with renamed and reclassified codes in the fourth round of first cycle coding.

**Table 4.4**

*Classifications of Round 3 and Round 4 Codes of First Cycle Coding*

*(Note: Parentheses indicate the number of codes.)*

<table>
<thead>
<tr>
<th>Round 3 Code Types</th>
<th>Round 4 Code Types</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>in vivo</em> codes (28)</td>
<td><em>in vivo</em> codes (33)</td>
</tr>
<tr>
<td>structural codes (14)</td>
<td>structural codes (15)</td>
</tr>
<tr>
<td>value codes (12)</td>
<td>value codes (22)</td>
</tr>
<tr>
<td>descriptive codes (74)</td>
<td>descriptive codes (68)</td>
</tr>
<tr>
<td>attribute codes (5)</td>
<td></td>
</tr>
<tr>
<td>emotion codes (7)</td>
<td></td>
</tr>
<tr>
<td><strong>Total: 140</strong></td>
<td><strong>Total: 138</strong></td>
</tr>
</tbody>
</table>

**Second cycle coding.** The purpose of the second cycle of coding was to group codes into categories. The second cycle of coding consisted of four rounds. The first round of second cycle coding involved establishing initial categories (Flick, 2009; Merriam & Tisdell, 2016). The second round involved renaming some categories to be more active in their descriptions to better tell the participants’ story in a way that is “vivid and interesting” (Bloomberg & Volpe, 2016). The third round consisted of recategorizing all codes afresh. The fourth round consisted of splitting some third-round
categories into finer categories based on round-2 categories. Each of these rounds of second cycle coding will be discussed in greater detail.

**First Round of Second Cycle Coding.** The first round of second cycle coding began by adding suffixes to all codes in Delve to track their classification established during the fourth round of first cycle coding (Flick, 2009). All codes were then exported a second time to a Microsoft Word document where they could be arranged into categories that were exhaustive, congruent, and mutually exclusive (Merriam & Tisdell, 2016). Exhaustive, mutually exclusive categories are those that capture all codes. See Figure 4.4 for a segment of the first round of second cycle coding in Microsoft Word. Categories from the Microsoft Word document were inputted into Delve, and codes were moved into these categories.

**collaboration with writers during the course**

**writers help with wording: dc (3)**
Participants express that fellow writers helped with wording regarding integrating technology.

**writers help with TPACK: dc (3)**
Participants express that fellow writers were a source of ideas to link content, pedagogy and technology tools

**a different writer perspective: dc (3)**
Writers with different content knowledge help with pedagogy.

**encouraging implementation: ve (10)**
Participants encourage others to take action on what they have learned

**experiences in the course**

**content connections: dc (5)**
Technology integration was connected to specific content.

Figure 4.4

*First Round Coding in Microsoft Word in Second Cycle Coding*
The purpose of the creation of categories in the first round of second cycle of coding was to begin to connect qualitative data into a logical narrative by linking initial codes in a way that allows meaning to emerge (Saldaña, 2013; Tracy 2020). The first round of second cycle coding produced 19 categories.

**Second Round of Second Cycle Coding.** The second round of second cycle coding continued in Delve. Category names were analyzed and some were renamed to better tell the participant story using active descriptions (Flick, 2009; Saldaña, 2013). No categories were added or removed in this round. The number of codes in each category remained unchanged at 19 categories.

**Third Round of Second Cycle Coding.** The third round of second cycle coding took place in Microsoft Word. Relationships among round-1 codes extracted from Delve were reexamined for new relationships. Categories from the first round were deleted, and codes were reorganized into new categories. I felt that these new categories more accurately represented the story of the data as it related to the professional development course. These categories were inputted into Delve, and codes were reorganized in these categories. See Figure 4.5 for a screenshot of round 3 categories in Delve.
Figure 4.5

**Third Round Coding in Delve in Second Cycle Coding**

The purpose of these new categories was to better understand what information the qualitative data offered concerning the effectiveness of the professional development course. The third round of second cycle coding ended with 13 categories.

**Fourth Round of Second Cycle Coding.** The fourth round of second cycle coding took place in the Word document of codes extracted from Delve. Some categories from round 2 were added to categories from round 3. Some smaller categories from round 2 replaced larger categories from round 3. Codes were reorganized into these finer categories. Categories were then split in Delve. The purpose of splitting categories was to prevent premature synthesis in ways that buried meaning essential to understanding how participants’ perceptions of technology integration changed during the course. This allowed me to achieve saturation, the point at which no new breakthroughs are discovered during qualitative analysis (Hennick et al., 2017). I concluded that saturation
had occurred when further analysis yielded no new codes and categories. The second cycle of coding ended with 19 categories. See Table 4.5 that compares categories in all four rounds of second cycle coding.

Table 4.5

*Comparison of the Categories in Rounds of Second Cycle Coding*

*(Note: Parentheses in the heading row indicate the number of categories; parentheses in the cells indicate the number of codes in each category.)*

<table>
<thead>
<tr>
<th>Round 1 Categories (19)</th>
<th>Round 2 Categories (19)</th>
<th>Round 3 Categories (13)</th>
<th>Round 4 Categories (19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>difficulties with technology (12)</td>
<td>difficulties with technology (12)</td>
<td>struggling to learn technology before the course (33)</td>
<td>difficulties learning technology before the course (13)</td>
</tr>
<tr>
<td>negative views of technology (10)</td>
<td>negative views of technology (10)</td>
<td></td>
<td>negative views of technology (17)</td>
</tr>
<tr>
<td>student uses of technology (3)</td>
<td>highs and lows of student technology use (3)</td>
<td>struggling to use technology for instruction before the course (9)</td>
<td></td>
</tr>
<tr>
<td>struggling to integrate technology (13)</td>
<td>struggling to integrate technology (13)</td>
<td>evaluating leaders and technology (4)</td>
<td>,struggling to integrate technology before the course (8)</td>
</tr>
<tr>
<td>leadership and technology (4)</td>
<td>evaluating school leaders and technology (4)</td>
<td>leading with technology before the course (9)</td>
<td>evaluating leaders and technology (4)</td>
</tr>
<tr>
<td>adept at technology integration (9)</td>
<td>adept at technology integration (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student perceptions of technology (3)</td>
<td>remembering student perceptions of technology (3)</td>
<td>leading with technology before the course (21)</td>
<td>remembering student perceptions of technology before the course (5)</td>
</tr>
<tr>
<td>positive views of technology (16)</td>
<td>positive views of technology (16)</td>
<td></td>
<td>positive views of technology (7)</td>
</tr>
<tr>
<td>participant background (7)</td>
<td>participant background (7)</td>
<td>writing before the course (7)</td>
<td>writing before the course (8)</td>
</tr>
<tr>
<td>Round 1 Categories (19)</td>
<td>Round 2 Categories (19)</td>
<td>Round 3 Categories (13)</td>
<td>Round 4 Categories (19)</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>experiences in the course (3)</td>
<td>making connections in the course (3)</td>
<td>gaining perspective during the course (11)</td>
<td>gaining perspective during the course (6)</td>
</tr>
<tr>
<td>views of the course (8)</td>
<td>enriched by the course (8)</td>
<td>sharing experiences during the course (2)</td>
<td>sharing experiences during the course (2)</td>
</tr>
<tr>
<td>collaboration with writers during the course (4)</td>
<td>collaboration with writers during the course (4)</td>
<td>collaborating during the course (8)</td>
<td>collaboration with writers during the course (4)</td>
</tr>
<tr>
<td>collaboration with Ed Tech during the course (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>course changing mindset (6)</td>
<td>course changing mindset (6)</td>
<td>new perspectives after the course (11)</td>
<td>new perspectives after the course (10)</td>
</tr>
<tr>
<td>technology and pedagogy (12)</td>
<td>learning to connect technology and pedagogy (12)</td>
<td>new strategies after the course (8)</td>
<td>new strategies after the course (8)</td>
</tr>
<tr>
<td>course changing knowledge and skills (7)</td>
<td>course changing knowledge and skills (7)</td>
<td>new knowledge after the course (10)</td>
<td>new knowledge after the course (5)</td>
</tr>
<tr>
<td>using technology tools (8)</td>
<td>learning to use technology tools (8)</td>
<td>new skills after the course (10)</td>
<td>new skills after the course (5)</td>
</tr>
<tr>
<td>managing the course (7)</td>
<td>reflecting on the course experience (y)</td>
<td>feedback on the course experience (7)</td>
<td>feedback on the course experience (7)</td>
</tr>
<tr>
<td>adding to the course design (5)</td>
<td>wanting more in the course design (5)</td>
<td>sharing ideas for improving the course (5)</td>
<td>sharing ideas for improving the course experience for others (6)</td>
</tr>
</tbody>
</table>
First Round of Third Cycle Coding. The first round of third cycle coding took place in the Microsoft Word document of categories extracted from Delve used in the second cycle. Categories were organized into initial themes in the Microsoft Word document while examining portions of transcripts in Delve (Flick, 2009). I also sketched out a preliminary concept map of initial themes with paper and pen by connecting categories with preliminary themes as they were organized in the Microsoft Word documents to visualize and test their interactions (Merriam & Tisdell, 2016). Initial themes were placed in Delve with codes and categories organized under these preliminary themes. See Figure 4.6 for a preliminary concept map of round 1 themes.
The purpose of this round was to begin to unearth meaning saturation now that data saturation had been obtained (Hennink et al., 2017). Round 1 of third cycle coding ended with five themes.

After a peer debrief of first round preliminary themes, my dissertation chair observed that the temporal nature of some of my themes might limit my ability to
classify codes and categories to accurately tell my participants’ story. For example, some participants expressed confidence in technology integration before the course, while others expressed confidence because of the activities of the course. The variety in when participants expressed confidence would limit placing the code of confidence into a category or theme that was temporally bound as before, during, or after the course. This limitation to current themes prevented the emergence of significant findings (Tracy, 2020) and required a second round of analysis.

Second Round of Third Cycle Coding. The second round of third cycle coding began by printing out codes and categories. These codes and categories were written on a large concept map using sticky notes and a large piece of paper. This concept map included all categories and codes from first and second cycle coding. This process proceeded by writing codes around each of the final categories from the second cycle of coding on the large paper. I circled significant codes with a marker for emphasis. Lines were drawn to connect codes and categories. I wrote new themes and placed them near the greatest intersection of lines, with themes representing the relationships of the lines drawn and representing the meaning of the categories and codes they contained. Writing the themes on sticky notes allowed for testing out different themes and moving them on the concept map to see how they contained codes and categories. Some codes were moved to different categories based on this concept mapping. See Figure 4.7 for a photograph of this concept map.
Figure 4.7

**Concept Mapping to Determine Themes from Categories and Codes in Round 2 of Third Cycle Coding**

New themes emerged from this process of concept mapping. Selected codes were moved to new categories, and categories were organized into themes in Delve to match the physical concept map. See Figure 4.8 for a screenshot with the final organization of codes, categories, and themes in Delve.

Figure 4.8

**Final Organization of Codes, Categories, and Themes in Delve at the end of Third Cycle Coding**
Tracy (2020) notes that flowcharts like the one I created are helpful for analyzing the relationships between codes, categories, and themes to yield significant results.

Round 2 of third cycle coding ended with three themes. See Table 4.6 for a comparison of round 1 and round 2 themes during third cycle coding.

**Table 4.6**

*Comparing Round 1 and Round 2 Themes During Third Cycle Coding*

<table>
<thead>
<tr>
<th>Round 1 Themes</th>
<th>Round 1 Categories</th>
<th>Round 2 Themes</th>
<th>Round 2 Categories</th>
</tr>
</thead>
</table>
| persevering in technology integration before the course | difficulties learning technology before the course  
struggling to integrate technology before the course  
leading with technology before the course  
writing before the course  
remembering student perceptions of technology before the course | struggles integrating technology                                                                 | difficulties learning technology before the course  
struggling to integrate technology before the course  
leading with technology before the course  
writing before the course  
remembering student perceptions of technology before the course |
| forming opinions of technology use    | negative views of technology  
evaluating leaders and technology  
positive views of technology |  | negative views of technology  
evaluating leaders and technology  
positive views of technology |
| growth during the course              | gaining perspective during the course  
sharing experiences during the course  
collaborating with Ed Tech during the course  
collaborating writers during the course | motivated to integrate technology | positive views of technology  
gaining perspective during the course  
sharing experiences during the course  
collaborating with Ed Tech during the course  
collaborating with writers during the course |
<table>
<thead>
<tr>
<th>Round 1 Themes</th>
<th>Round 1 Categories</th>
<th>Round 2 Themes</th>
<th>Round 2 Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>prepared and inspired after the course</td>
<td>new perspectives after the course new interests after the course new strategies after the course new knowledge after the course new skills after the course</td>
<td>new perspectives after the course new interests after the course</td>
<td>new strategies after the course new knowledge after the course new skills after the course</td>
</tr>
<tr>
<td>improving the course</td>
<td>feedback on the course experience sharing ideas for improving the course experience for others</td>
<td>confident in integrating technology</td>
<td>feedback on the course experience sharing ideas for improving the course experience for others</td>
</tr>
</tbody>
</table>

The third cycle of coding concluded with the following themes:

1. Participants voiced struggles in integrating technology both in teaching and in writing educational products.

2. Participants expressed beliefs and experiences that motivate them to push through struggles to integrate technology into lesson designs.

3. Participants identified knowledge and skills that give them confidence in integrating technology into lesson designs.

**Qualitative Themes**

Each of the three above themes from qualitative sources were used to address Research Question 3, “How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?”

Themes from qualitative sources are appropriate to address this research question because participant perceptions are best described through stories woven from thick, rich descriptions (Flick, 2009; Tondeur et al., 2020; Torun, 2020).
Justification for each theme includes concept maps, connections to the literature, and participant quotes as evidence of themes and assertions (Belzer & Ryan, 2013). These evidences will connect themes to the participants’ experience with triangulation to support conclusions (Bloomberg & Volpe, 2016; Flick, 2009; Creswell, 2014). Pseudonyms protected the privacy of the participants while still allowing the portrayal of research team dynamics (Plano Clark & Ivankova, 2016). Thick, rich descriptions in the insights to themes rely heavily on direct quotes from qualitative data sources to showcase rather than just describe participant experiences (Flick, 2009; Tracy, 2020). These narratives of participant experience were interpreted in the context of the TPACK framework and the transformative learning theory (Bernard et al., 2017; Flick, 2009). Words and phrases in italics indicate that they are codes. See Table 4.7, which outlines themes, related categories, selected codes, and assertions.

Table 4.7

**Themes, Related Categories, and Assertions**

<table>
<thead>
<tr>
<th>Themes, Categories, and Selected Codes</th>
<th>Assertions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme 1: Participants voiced struggles in integrating technology both in teaching and in writing educational products.</td>
<td><strong>Assertion 1</strong>: Writers connected struggles in integrating technology in their writing to barriers to integrating technology in their teaching.</td>
</tr>
<tr>
<td>- evaluating leaders and technology</td>
<td>- difficulty accessing technology</td>
</tr>
<tr>
<td></td>
<td>- lack of professional development</td>
</tr>
<tr>
<td>- difficulties learning technology before the course.</td>
<td>- lacking time to explore</td>
</tr>
<tr>
<td></td>
<td>- struggling to integrate technology before the course</td>
</tr>
<tr>
<td></td>
<td>- digital immigrants</td>
</tr>
<tr>
<td></td>
<td>- low view of self</td>
</tr>
<tr>
<td></td>
<td>- negative views of technology</td>
</tr>
<tr>
<td></td>
<td>- “hate video”</td>
</tr>
<tr>
<td>Themes, Categories, and Selected Codes</td>
<td>Assertions</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>• technology as a threat</td>
<td></td>
</tr>
<tr>
<td>• teacher-driven technology</td>
<td></td>
</tr>
<tr>
<td>• leading with technology before the course</td>
<td></td>
</tr>
<tr>
<td>• digital native</td>
<td></td>
</tr>
<tr>
<td>• helping others integrate technology</td>
<td></td>
</tr>
<tr>
<td>• “helping helped me learn”</td>
<td></td>
</tr>
<tr>
<td>• remembering student perceptions of technology before the course</td>
<td></td>
</tr>
<tr>
<td>• experiences integrating technology</td>
<td></td>
</tr>
<tr>
<td>• bad experience using technology</td>
<td></td>
</tr>
<tr>
<td>• “they loved it”</td>
<td></td>
</tr>
<tr>
<td>• writing before the course</td>
<td></td>
</tr>
<tr>
<td>• teaching experience</td>
<td></td>
</tr>
<tr>
<td>• already tools to work with</td>
<td></td>
</tr>
</tbody>
</table>

**Theme 2: Participants expressed beliefs and experiences that motivate them to push through struggles to integrate technology into lesson designs.**

- positive views of technology
  - technology tools for collaboration
  - technology for engagement
- gaining perspective during the course
  - desire to use tech
- sharing experiences during the course
  - recognition of shared experience
  - discussions in the course helpful
- collaborating with writers during the course
  - writers help with wording
  - different writer perspective
  - encouraging implementation
- collaborating with Ed Tech during the course
  - specific technology ideas
- new perspectives after the course
  - intention to implement new knowledge
- new interests after the course
  - technology for differentiated instruction
  - technology for interdisciplinary approaches
  - “intrigued” by tech-enabled gamification

**Assertion 2:** Positive experiences strengthened beliefs that generated motivation to integrate technology.

**Theme 3: Participants identified knowledge and skills that give them confidence in integrating technology into lesson designs.**

**Assertion 3:** The course was successful in equipping writers with
Themes, Categories, and Selected Codes

<table>
<thead>
<tr>
<th>Assertions</th>
</tr>
</thead>
<tbody>
<tr>
<td>new knowledge after the course</td>
</tr>
<tr>
<td>- student-driven technology integration</td>
</tr>
<tr>
<td>new skills after the course</td>
</tr>
<tr>
<td>- learning about tools</td>
</tr>
<tr>
<td>- “I have more tools!”</td>
</tr>
<tr>
<td>new strategies after the course</td>
</tr>
<tr>
<td>- changing lesson-writing habits</td>
</tr>
<tr>
<td>- connecting technology integration to teaching strategies</td>
</tr>
<tr>
<td>feedback on the course experience</td>
</tr>
<tr>
<td>- time</td>
</tr>
<tr>
<td>sharing ideas for improving the course experience for others</td>
</tr>
<tr>
<td>- explaining the TPACK survey</td>
</tr>
<tr>
<td>- more technology tools</td>
</tr>
<tr>
<td>- organizing tech tools by function rather than content</td>
</tr>
<tr>
<td>- applications of TPACK</td>
</tr>
<tr>
<td>- confidence is key</td>
</tr>
</tbody>
</table>

**Insights into Theme 1**

**Theme 1: Participants voiced struggles in integrating technology both in teaching and in writing educational products.**

Theme 1 describes how participants voiced struggles in integrating technology both in teaching and in writing educational products. Barriers to technology integration featured prominently in participant descriptions in this study as well in the literature among teachers. All participants expressed struggles integrating technology, some in teaching before being employed as a content writer, and some also experienced struggles as a content writer.

This section discusses Theme 1 categories and significant codes. Theme 1 categories include (1) evaluating leaders and technology, (2) difficulties learning technology, (3) struggling to integrate technology before the course, (4) negative views
of technology, (5) leading with technology before the course, (6) remembering student perceptions of technology before the course, and (7) writing before the course. See Figure 4.9 that relates Theme 1 to its categories and significant codes discussed in this section.

**Figure 4.9**

*Theme 1 Categories and Selected Codes Concept Map*

(Note: Themes are in blue, categories are in orange, and selected codes are in black.)
**Evaluating Leaders and Technology.** Participants described some leadership unsupportive of technology integration (An & Reigeluth, 2011; Ertmer, 1999), both as a writer and teacher, reflecting a similar phenomenon amongst a quarter of U.S. schools (Gray & Lewis, 2021, Young et al.; 2019). Significant codes discussed in this category include *difficulty accessing technology* and *a lack of professional development*.

First-order barriers reflected in participants included *difficulty accessing technology* (Günes & Bahçivan, 2016; Young et al., 2019), whether it be from not having technology available or from not having funds to access cloud-based technologies. Several participants expressed frustration with technology tools that required subscriptions. Jack and Shari described these frustrations, including a lack of funding to pay for subscriptions for tools they wanted to use.

Jack: I sometimes get frustrated with looking for different tech tools because so many of them require a subscription... . I know as a teacher I would not be willing to pay that much money to try out new tech tools, and there was only so much money my school had for technology (even though they were very tech friendly).

Shari said, “But the [company wasn’t gonna pay for me to get [Kahoot]. And I’m not gonna pay for it for myself.” Brandy’s difficulty accessing technology was different than Shari’s because it was related to hardware. Leadership at her school did not provide the hardware that she requested for her technology integration.

Brandy The school that I came from—this is probably a good history for you—the school that I came from didn’t have technology for
elementary... And the last year I was there, I was pushing and
pushing and pushing to get the computers that were left over from
the high school as a computer lab for the elementary, and it never
happened.

Participants seemed to indicate that the root of this difficulty was leadership
failing to provide either technology or funds for technology integration. However, not all
participant dialog about leadership was negative; some indicated that leadership was
supportive and inspiring for technology integration.

Participants also observed a lack of professional development in some of their
working contexts. This observation aligns with research highlighting that the availability
of professional development is essential to strategic technology integration (M. Miller,
2017; Tarling & Ng’ambi, 2016). Some participants expressed that they received no
training for technology integration, while others expressed that there was some training
but that it was inadequate to help them feel confident in integrating technology. Absent
or poor professional development is another first-order barrier to technology
integration (Claesgens et al., 2013; Ertmer, 1999, S. Tseng & Yeh, 2019).

A lack of professional development occurred both in teaching and writing
contexts. Shari was unusual in that, though she was forced to use Google Classroom in
her teaching and she received no training, she still saw the value in this technology
integration.
Shari: Using Google Classroom I felt, you know, we... and we were forced to do it at the Academy. I embraced it. I mean I was like, yes, this is good. I need to do this. But there wasn’t really any training.

Brandy, on the other hand, described a lack of professional development in a writing context. She described early attempts to integrate technology into her lesson writing: “I think because there wasn’t a whole lot of instruction on how to do it and everybody was kind of doing it differently.”

Overall, participants described a mix of experiences with professional development ranging from sufficient training, to little training, to no training.

**Difficulties Learning Technology Before the Course.** This section will discuss difficulties in learning technology before the course, including, most significantly, lacking time to explore technology tools.

Participants expressed frustration that they were lacking time to explore to learn new technologies to integrate into instruction (Claesgens et al., 2013; S. Tseng & Yeh, 2019) and plan (Ertmer, 1999). They felt that the time demands of teaching and lesson preparation crowded out time for exploring new technology tools. Jenny described this barrier as one that affected her especially during teaching. She related, “I think with technology especially like as a, you know, first or second year teacher, the hardest thing can be like just time because usually you’re restricted of just getting a lesson done to present the next day.” However, Jack described this barrier as a current factor in his technology integration. He said, “It’s just not having the time to try out new things... and
also the time to explore new tools and I feel like that’s my biggest impediment right now."

In a twist on the limitations of time on technology integration, one participant also indicated that in some cases she quickly forgot training in technology tools if it was not immediately applied. Emily, when relating computer training to use PowerPoint, said, “I definitely think that’s true, because even like the days that I’ve spent a whole day in computer training, you know, three weeks later I can’t remember...because it was too condensed.”

A lack of time was a common frustration among the participants as an impediment to integrating technology.

**Struggling to Integrate Technology Before the Course.** Participants described frustrations of several kinds in this category, including describing experiences with teaching during COVID lockdown and hybrid teaching after COVID. Significant codes discussed in this category related to second-order barriers to technology integration and included “digital immigrant” and a low view of self.

Several participants willingly describing struggles with technology (Inan & Lowther, 2010) and revealed that they viewed themselves as digital immigrants. Emily was one, though she did not specifically label herself as such, elaborating on her difficulty applying her training in the use of PowerPoint referred to previously.

Emily: Well, I do feel like over the years I’ve...I’ve had to learn you know, a lot of different iterations of technologies like technology has changed a lot over the years, and like, especially with my teaching.
You know, I remember when I started realizing, you know, I just need to make PowerPoints... That was back when they had the computer training courses as something you could opt into as part of your job. So, I think I took the PowerPoint training at three different times. Like, I went through the whole, like, however many levels.

Shari, another participant who struggled with PowerPoint, was a self-proclaimed digital immigrant. Shari consistently displayed a low view of self. This is an example of a second-order barrier to technology integration (Wright & Akgunduz, 2018). She described her struggles with PowerPoint.

Shari: You simply cannot imagine how awful learning to use PowerPoint was!...And I asked [my daughter], please help me. And she's like, Mom, you...I can't even teach you how to do this. You are...You are just too dumb. So I...I just. I like when I say it is not intuitive. I...I mean really not intuitive. So when we moved to [another state] and—so this would have been like 10 years ago—the first class I took for my master’s degree was educational technology... . I like to learn, and it is super exciting when I have climbed the Everest of Technology without falling off a cliff or getting snowed under in an avalanche of frustration.

Participants both comfortable and uncomfortable with technology expressed the struggle with striking a balance in their technology use, often expressing that the
technology is the tool and not the goal of learning. There was some discussion of what balanced technology use looks like, with participants expressing an awareness that students often do a poor job using technology in balanced ways when left to themselves. Participants seemed to agree that there should be both technology-infused lessons and technology-free lessons, with the use of technology being intentional.

**Negative Views of Technology.** Both participants who were confident and unconfident with technology experienced second-order barriers (Ertmer, 1999) to technology and expressed negative views of technology. Significant codes in this category included viewing technology as a threat, having a misunderstanding of technology as teacher-driven tech, and that participants “hate video” when referring to videos they recorded of their instruction.

Several participants see the potential of technology as a threat in social, emotional, physical, and even academic ways. This is another example of a second-order barrier to technology integration (Young et al., 2019). Both Brandy and Jack noted all the time that students spend on their phones, something that makes writers more hesitant to use technology for learning. Brandy related, “Yes, I agree there are some students that spend way too much time on their phones or other devices. This can have social, emotional, and even physical consequences.” Jack had similar concerns.

Jack: On the other hand, I am concerned about the downsides that come from living in a tech-saturated world. When I taught high school, I saw my students constantly on their phones before and after school, and many told me of how they spent most of their
free time playing video games or engaging in social media. I was concerned about the effects this was having on their lives and was reluctant to make them spend even more time on screens in my class. What I ended up doing was using technology when I saw that it would add value to the lesson, but also having many tech-free lessons so students would learn to think and communicate without the use of digital devices.

Participants’ concern for students’ overuse or overreliance on technology made them hesitant to use it without a strategic purpose for instruction.

Several of the writers mentioned that their initial understanding of technology integration was that it was something that the teacher uses, and not the student. Several participants mentioned their reliance on teacher-driven technology, especially video, as being their understanding of technology integration. Brandy and Emily were two participants that had this view. Brandy reflected, “First of all, [I] see that I was only doing things mainly for the teacher and not as much for the student.” Emily echoed this initial misunderstanding, “This is something I learned too—I had a lot of teacher-facing technology in my lessons but not nearly as much student-facing technology.”

Though Jack did not have this misunderstanding of technology integration, he noted how easy it is to just include a video as token technology integration without considering the tactical nature of the technology used.

Jack: So I think that’s ... something like, OK, [I’m] showing you a video. Sometimes I feel like as a teacher that could be the easy way out.
That was gonna be helpful and there might be some good information, but they are just sitting there and passively taking stuff in.

The perspective of teacher-driven technology integration rather than technology integration for the student is a prevalent misunderstanding among teachers reflected in the research (An & Reigeluth, 2011; Rosenberg & An, 2019). This is an example of another second-order barrier to technology integration.

Participants recounted experiences using technology for instruction during COVID lockdown, and they expressed that when recording for remote and hybrid instruction they “hate video.” Emily expressed her discomfort with being on video, “We had to start recording, you know, like videoing our courses when people were absent with COVID and I, I just hate video, as you know.” Jenny expressed frustration with Web 2.0 tools used for recording video for remote and hybrid instruction.

Jenny: Yes, Loom, because I was like, [it was] the popular one at the time, I think, and I realized that the audio wasn’t working or something wasn’t working when I recorded the whole thing. I have to do it again, so no, there’s definitely that where when technology doesn’t work, it can be really frustrating.

It is significant to note that the conversations around negative views of technology often came back to video, both creating it and using it for instruction.

**Leading with Technology Before the Course.** Despite struggles, both those who identified themselves as digital natives and digital immigrants related experiences in
which they led with technology. Significant codes in this category discussed in this section include “digital native,” helping others integrate technology, and the perspective that “helping helped me learn.”

Though those who thought of themselves as “digital natives” were quicker to describe themselves as leaders in technology integration, participants who thought of themselves as “digital immigrants” also described situations in which they took a leadership position by helping others integrate technology. Despite different comfort levels with technology and different views of self-efficacy and self-concept, both groups demonstrated struggles and capability with technology. These observations in participants line up well with research, which indicates that age and years of teaching experience does not seem to be a significant factor in predicting teachers’ technology integration (Lowther, 2010).

Shari was a self-described digital immigrant with a low view of self. She described an instance in which she led with technology, despite not having been trained herself.

Shari: Like when [a teacher] replaced me at the Academy for senior English. You know, she had not ever used Google Classroom. And so and I saved everything like I gave all of my all of my stuff to her. So even just a little bit of a lesson in ... doing that. You know, here’s how. Here’s how you can set up your... your files, and here’s how you can drop assignments in.
Jack describes being comfortable with technology, and he related leading professional development using the Web 2.0 tool Vocabulary.com. “It’s funny; I actually led a professional development session and, you know, introduced my colleagues to Vocabulary.com.” Though Jenny did not describe herself as a digital native, she displayed a high level of comfort and confidence in technology. She relates how both she and her husband led in professional development during their teaching.

Jenny: Independently, I and [my husband] both did a lot of helping of other teachers. And I remember one time is the before school year started, the teachers all came back, and [Jenny’s husband] had coaching for soccer, so he couldn’t help. And I led like a little group of like, here’s Google Classroom. And here’s like the changes. And here’s how you create a form, and here’s how like you make sure you have like a code to get in so students don’t see the quiz even if you post it and stuff like that. So at [a previous school] we had to do a lot of helping with like Google Classroom specifically.

Some participants noted that “helping helped me learn.” Emily was a participant who had to work hard to learn technology, and she expressed that this improved her own understanding.

Emily: I did have another teacher that was teaching adjunct and working over here. Like she...she had someone put her stuff on Canvas, but she didn't really know how to use it. So a lot of times I would go over there and try to figure out, you know, how to do things and
that kind of helped me learn too, because I didn't know all the ins and outs and all the info.

I believe that the voluntary nature of this course attracted participants who valued technology integration and were more likely to have helped colleagues because of these values.

**Remembering Student Perceptions.** Participants recounted student perceptions of technology, with significant codes discussed from this category including *experiences integrating technology, bad experience using technology,* and the recollections that “*they loved it.*”

Participants reflected on their students’ perceptions of their *experiences integrating technology* when they were teachers. Participants often commented on how technology integration improved their relationships with their students. Brandy commented on integrating technology while homeschooling her son, “I had a much better relationship.” Rebecca noted that it took some time for students to respond to the technology.

**Rebecca:** The [informational technology] took a little time. You know, the first time I introduced it, they were not too sure about, about what this was or how this was gonna work, you know? So the first time.

You know I... they struggled, but after a couple times of trying it out and umm, persisting with it, they... they really seem to catch on and... . and we ended up having some good discussions with that.
Even a bad experience using technology was instructive for participants, including Shari, who despite her struggles was persistent in her technology integration.

Shari: So they were making comments in Google Classroom, but some of them were also making comments to each other, and they didn’t realize that I could see those comments and so it kind of backfired. ... I had a really squirrely class of seniors. They were just some of them were just bad, bad boys. And so I didn’t know enough about technology to be able to turn off that function so that they could only do what I told them to do. So ...that was a bad thing.

Several commented that “they loved it,” indicated that students and teachers had positive experiences in technology integration as well. There were more comments about positive experiences integrating technology than negative experiences, explaining why participants push through the struggles to integrate technology. Brandy revisited video again, and noted how, despite the limitations of video, students found them engaging.

Brandy: They loved the videos that we had... .. They loved, they loved it. The one they really loved the most was the history one in 6th grade where they... It was an... in...it was a museum, and a curator was going around stealing artifacts from different museums, and those artifacts had to do with whatever chapter we were talking about like Ancient China, Ancient Japan.... Every time [I put on a video,] they put the pencil down, and they just stopped. Some of
the others, they didn’t watch as much but they listened and they liked them, and then they were disappointed when they never caught the curator at the end!

Jack also remembered positive student experiences with technology integration, including the use of Nearpod that his administrator inspired and supported with training. “They loved it. They loved it. I remember ... I overheard when [they’re] saying, ‘I hope we get to use Nearpod in this next class that we have.’ So they really enjoyed it.”

These positive student perceptions encouraged participants to push through the difficult experience to continue to integrate technology.

**Writing Before the Course.** Participants frequently pivoted from discussing their teaching experiences integrating technology to their writing experiences. Significant codes discussed in this category include that *teaching experience helps with writing lessons that integrate technology* and that they *already had tools to work with*.

When reflecting on their teaching experiences in comparison to their writing experiences, several participants concluded that *teaching experience helps with writing lessons that integrate technology*. Rebecca described how teaching made it easier for her to visualize how technology could be used in the classroom.

Rebecca: I think it definitely made a difference for me because having taught in the classroom and... and seeing how students use technology and...and respond to technology definitely makes a difference as I’m looking for different technological tools to use in the curriculum that we’re writing.
However, not all participants had experience teaching with technology. If writers were familiar technology, they were more likely to use it in their writing, even if they had not used it as a teacher. Brandy described herself as having this limitation, “So yeah, I didn’t have a lot of technology experience in the classroom, even though I knew technology. I didn’t have a lot of experience in the classroom with it. So very little is my answer.”

Several participants indicated that they had improved in their ability to integrate technology as a writer after leaving teaching. This may be due to increased time to explore, more perspective on their teaching experiences, or more opportunities for professional development.

Participants also indicated that they already had tools to work with in integrating technology. These tools were often ones they drew from previous teaching experiences. Jenny, a writer who recently left the classroom, listed off all the Web 2.0 tools she used, including Kahoot, Quizziz, Blooket, and Desmos, along with graphing calculators. She describes learning to use these tools both in hybrid and in-person instruction.

Jenny: So I was teaching [students in person and online] so being able to like use technology so like things like Kahoots and things like that worked really well in the classroom because if they were at home, they could just easily join. So I think that technology-wise I did a lot of integration with like the classroom response systems that was kind of like my go-to. Kahoot, Quizziz, and recently Blooket is like a newer one that I used last year in public school when I taught. So
that would be kind of my go-to for technology integration, and then with math Desmos also. Outside of being a graphing calculator, it had activities that I did last year in the classroom. The other teachers had already created [some] that are similar. You know—like finding the slope and students would drag points around to see how it changed. So, I used that a lot last year teaching as well.

Participants’ teaching experiences deeply affected their views of technology integration. This observation in the participants’ story strengthened the application of the research on professional development for preservice (Arya et al., 2020; Günes & Bahçivan, 2016; Schmidt et al., 2009) and in-service teachers (Aldosmani, 2020) to the population under study, though there are currently no published research studies on Educational Content Writers.

Writers demonstrated first-and second-order barriers (Ertmer, 1999) to technology integration especially in the context of teaching. They also viewed their efforts to write lessons integrating technology through the lens of teaching, often using tools that they used as a teacher. My assertion about Theme 1 is that writers connected struggles in integrating technology in their writing to barriers to integrating technology in their teaching.
Insights into Theme 2

Theme 2: Participants expressed beliefs and experiences that motivate them to push through struggles to integrate technology into lesson designs.

Theme 2 describes how participants articulated beliefs and experiences in writing and especially teaching that motivate them to integrate technology. Participant experiences shaping beliefs about technology integration took place both before and during the course, and positive views of technology were largely in place before the professional development course. Participant beliefs aligning with research include using technology for student engagement and for developing 21st century skills. Participants were especially interested in collaboration using technology. Participants gave evidence that transformative learning theory strategies were effective in strengthening beliefs about integrating technology through TPACK-in-Action.

This section discusses Theme 2 categories and significant codes. Theme 2 categories include (1) positive views of technology, (2) gaining perspective during the course, (3) sharing experiences during the course, (4) collaborating with writers during the course, (5) collaborating with Ed Tech during the course, (6) new perspectives after the course, and (7) new interests after the course. See Figure 4.10 that relates Theme 2 to its categories and significant codes discussed in this section.
Theme 2: Participants expressed beliefs and experiences that motivate them to push through struggles to integrate technology in writing lessons.

**Figure 4.10**

**Theme 2 Categories and Selected Codes Concept Map**

(Note: Themes are in blue, categories are in orange, and selected codes are in black.)

**Positive Views of Technology.** Participants were quick to demonstrate positive views of technology that helped them to see it as an asset in education. Positive views of technology that participants held included *technology tools for collaboration* and *technology for engagement.*
Participants related technology integration to the development of 21st century skills such as using technology tools for collaboration. This aligns with research describing the connection between collaboration and technology integration (Almerich et al., 2020; Aprinaldi et al., 2018). Participants commented on the ability of technology to extend collaboration beyond the classroom time and classroom walls. Shari was excited about the possibilities, “And it was just, whoa, now I’ve got these platforms where they can collaborate at home because they can use like the shared whiteboard or some of the other ones that [an Education Technology specialist] talked to me about.”

Participants noted that students may be more willing to communicate online than in person. Jenny mentioned that students may use other students and teachers as a resource more willingly if interaction is through technology rather than in person.

Jenny: Technology can also allow teachers to facilitate discussions so that students can have more resources for homework, helpful hints, and studying for tests (with teacher supervision) since often times many students are more apt to communicate via technology with both teachers and peers where they would otherwise be hesitant to interact in person.

Rebecca noted that it is even more likely that they will participate if their participation was anonymous, even if students can figure out who said what. She thought that even if their contributions were displayed in class, they would be more willing to participate.
Rebecca: I would ask like questions like discussion questions and students could respond, but not everybody. I mean, they, over time, they probably figured out who was who. If I raised my hand, it’s more obvious versus, you know, putting it in this discussion board.

Participants also noted the potential of more students to be involved in discussions because of the online environment, especially quieter students.

Brandy: Well, if I use a whiteboard or some form of online platform, students can post two or three questions and then they can answer two or three questions and every student is involved in more questions. In my mind, the strategy and the technology are similar, but you can choose to do it in the classroom or you can choose to do it on technology.

Participants also noted additional accountability for involvement when participation is not anonymous. Shari commended, “There’s a lot of potential for collaboration and being able to actually see who is doing what, at least [in] Google Classroom.”

Participants also described experiences from the past to note the potential of the use of technology for engagement for a variety of students. These observations resonate with research studies cited in Chapter 2 conducted in a variety of settings, with a variety of content, and in varying student populations (Autio et al., 2019; Hediansah & Surjono, 2019). Participants saw the potential of technology to break up lectures with students’ use of interactive technology. Emily said, “Because I can’t just stand up here and talk. It’s not engaging to this generation.” Jack also saw the need to break up
lectures with technology-enabled interactivity. He said, “You know, they say we
shouldn’t be the sage on the stage anymore. But I...I could go longer with that because
I’m interspersing with all these interactions.”

The use of technology for engagement is especially noticed in the use of Web 2.0
tools for technology integration (Adiguzel et al., 2020). Rebecca named some Web 2.0
tools she had used, “I have used tools such as Mentimeter, Kahoot!, Nearpod, and Khan
Academy. They have been a tremendous aid in engaging students while helping them
grasp concepts and meet objectives.”

Jack linked technology for engagement with motivation. Autio et al. (2019)
studied students’ “technological will.” Researchers defined this as a student’s desire to
participate in instruction involving technology. Autio et al. (2019) found that
“technological will” was guided by human emotions, motivation, values, and personal
qualities that are shaped by the history of educational technology and the pedagogy at
work.

Jack: On one hand, [I] see the benefits [that] technology has in the
classroom to enhance many aspects of teaching such as student
engagement, classroom management, critical thinking, and
differentiated instruction... . What I really like is when you go into
the hallway and you hear students talk about, or you’re at the
lunch counter and you hear students talk about what they did in
English class. So that’s really fun.
**Gaining Perspective During the Course.** As the writers participated in course activities, they began to connect what they were learning with their previous experiences in integrating technology to gain perspective. A significant code in this category included a *desire to use technology*.

Participants noted students’ familiarity and use of technology and expressed a *desire to use technology* for the benefit of both teacher and students. The benefits of technology integration for teachers’ modeling of 21st century skills (Hursen, 2021; Yamaç and Öztürk, 2019), and for students’ learning 21st century skills (Almerich et al., 2020; Aprinaldi et al., 2018; Law et al., 2016) is demonstrated by research and noted by participants.

Many participants were focused on their own development of 21st century skills. This may be explained by the fact that participants were not in-service teachers with students to focus on. Emily was especially focused on developing her own skills.

Emily: I’m open to learning more about how to do this, but I feel like I need guidance for how to discover and familiarize myself with these resources and to know which are the more “classic,” stay-around-for-awhile technologies as opposed to the fly-by-night ones.

Brandy expressed that she wasn’t just open; she wanted to learn: “I think I’ve kind of always wanted to include [technology], I just didn’t know how, but this has allowed me to understand how to do it.” Jenny noted that technology use for the teacher has the potential to save time and make teaching easier.
Jenny: I’ve learned in this course that technology integration can not only aid in student engagement, but it can also make lesson planning easier for the teacher as well. It may seem like a daunting task to integrate technology from the outset, but the reward will far outweigh any hesitations.

Rebecca and Jenny had just recently left the classroom, and they were quicker to link technology integration to the students’ development of 21st century skills.

Rebecca: Today’s students grew up with devices, the Internet, and the proficiency to use them. Because of this, a teacher would be wise to take advantage of resources that students can understand, relate to, and enjoy to help them learn and grow. That being said, I think that technology is a tool, not the primary vehicle. I do believe that technology has made a profound difference in helping students learn.

Jenny echoed Rebecca’s observations. However, Jenny deepened the idea by highlighting the necessity of technology use in learning. She said, “In today’s schools, almost every student will have some sort of technology in hand, whether it be a Chromebook provided to them or their own personal smartphone. Technology integration is a necessary component of lesson planning and curriculum writing.”

**Sharing Experiences During the Course.** As writers interacted with each other during the course, they articulated an awareness that other writers had similar
experiences with integrating technology in the past. Significant codes in this category include a recognition of shared experience and discussions in the course helpful.

Participants found that they shared some of the same viewpoints and struggles with technology. This recognition of a shared experience began very quickly in the course and is one of the earlier steps of transformative learning theory (Cranton, 2002; Mezirow, 1995). Rebecca specifically expressed the realization that others shared her perspectives of technology integration. She recounted, “I might have a certain focus on something, and...and then I see what somebody else has said [in a discussion post] and...and I realize oh, you know, that that’s actually true for me as well.”

As Rebecca mentioned, the discussions in the course were helpful for building an awareness of shared experiences. Discourse and reflection, as prompted by the discussion posts, is a prominent strategy of TPACK-in-Action for transforming educator points of view and habits of mind in technology integration (Harris & Hofer, 2009; Illeris, 2018). Shari reflected on how a video in the first module of the course was successful as an activating event for transformation (Açikgül & Aslaner, 2020; Cranton, 2002). She said, “I was challenged by the speaker on the first video [in the course] and how he was proud of not using technology and then later ashamed because it can be such a useful tool.” Writers also used the discussion posts to voice views of technology which they shared with others. Jack also enjoyed sharing his thoughts in discussion posts.

Jack: Also I brought into one of the discussions the concern I’ve had of just seeing students always on their screens and devices, so just
trying to get them to think critically without the aid of technology, I think it’s also important.

The group of writers that participated in this action research study developed a unity of spirit that reflected this awareness of a shared experience. They developed a growing respect for the other participating writers.

**Collaborating with Writers.** Participants expressed how their collaboration during the course, specifically with writers, helped them explore options for new behaviors and plan a course of action. This exploration of new behaviors and the development of a plan of action are also steps in transformative learning theory (Mezirow, 1995) (See Figure 2.2). Participants expressed how *writers helped with wording* and they were exposed to *different writer perspectives*, often *encouraging implementation*.

Some writers had the experience of collaborating with writers in the same content area who could *help with wording*. This collaboration happened both in person and online. For example, Jack and Shari are both ELA writers. Jack noted the difference between collaborating with a writer in his content area as compared even with other facilitators.

Jack: It’s helpful that the technology specialist can give us the tools and the ideas, but it’s also helpful having someone who has taught English and written English textbooks read what I wrote and see if that makes sense, and they intuitively know how to implement that into their lesson plans.
Jack’s response highlights that he valued the input of the educational technology specialist and the input of a fellow writer in different ways.

However, some writers collaborated with writers in a different content area, offering different writer perspectives. This collaboration also occurred both in person and online. For example, Jenny, a math writer, worked with Rebecca, another ELA writer.

Jenny: It was nice to be able to collaborate with somebody that was in a different discipline. So she’s English and I’m math, because especially I think with writing math books, it’s easy to kind of think only on like my level in the sense of like, you know, I’ve taught it like I, you know, understand it. But like, you know, math is especially something that not everybody likes, I guess, as much as I might!

Jenny’s words show the value of a different perspective that might be more like student perspectives than her own.

Both types of collaboration, between writers in similar content and those in different content, were important in transforming learner perspectives through the development of an authentic, social context (Gow et al., 2018; Tondeur et al., 2020; Voogt et al., 2016). This collaboration encouraged implementation through active practice, a strategy of TPACK-in-Action, since writers use peer reviews in the lesson writing process (Koh et al., 2015; Pareto & Willermark, 2019). This collaboration gave
opportunities for peer observation as a participant-led strategy in TPACK-in-Action (Açikgül & Aslaner, 2020; Cranton, 2002; Heintink et al., 2016).

I observed writers encouraging implementation of new knowledge in integrating technology. This was very exciting for me to observe, and I believe it contributed to the respect, unity, and the sense of shared experience. Writers praised each other for trying out new technologies. For example, Jack learned about Padlet during the professional development course and related to the group how he had implemented it in the college course he was teaching to great effect. Jack was also quick to praise Jenny, who had recently transitioned from teaching to writing, for trying out new technology.

Jack: Great job learning how to use these platforms! I must admit that I have still never used Kahoot. Also, never be afraid to ask for help. I think a good teacher is first a good learner who admits what he doesn’t know and does his best to learn about it. This often means talking to more knowledgeable people. Since none of us know about everything, asking questions is something we all should be doing.

Other writers encouraged each other to keep innovating and try new things and be willing to branch out of the familiar patterns of teaching and writing. Jenny expressed this most clearly.

Jenny: I agree that students appreciate even an attempt at incorporating technology. I think that anything that deviates from the traditional ‘lecture, question, homework’ teaching style piques their interest.
to at least try to pay attention more. And if the technology doesn’t work and the lesson falls apart? Well at least now you know for next time. But just trying something new will resonate with students. And often times with technology issues that may arise in a classroom, there’s at least one technologically-minded student that can help a teacher figure out what may be wrong.

Emily made the connection between exploring new technologies and being afraid.

Emily: Shari, I think having a desire to learn is a real strength! That’s so much better than ignoring technology or being too scared to try it. I think too that students respect teachers who try to develop new technology skills, even if it’s frustrating for them.

An innovative community of educators emboldens them to explore and support each other in their exploration. This professional development course developed a community that emboldened exploration.

**Collaborating with Educational Technology Specialists.** Participants also collaborated with Educational Technology Specialists during the course, who offered specific technology ideas. This was crucial for the success of this action research project.

Transformative learning theory requires the involvement of a knowledgeable facilitator and mentor (Tondeur et al., 2020; vanOostveen, 2017; Voogt et al., 2016). Though I was principally responsible for the course as the researcher, I relied on the departments of Instructional Design, Biblical Worldview, and especially Educational Technology as facilitators. Participants responded with strong appreciation for the
facilitation and mentorship of Educational Technology Specialists both before and
during the professional development course. They especially noted that Educational
Technology Specialists acting as facilitators offered specific technology ideas for their
content that was helpful.

Jack: Emily, I also found it helpful to collaborate with Ed Tech
[Educational Technology Specialists]. Their knowledge of digital
resources helped me enhance my lesson in ways I couldn’t do on
my own.

Emily also expressed appreciation for specific ideas for her lesson. “It was especially
helpful to collaborate with Ed Tech and get ideas for integrating technology in specific
areas of my lesson.”

Brandy: I’m thankful we have the tech team. But once...once [an
Educational Technology Specialist] and I worked through the lesson
and he’s like, OK, well, let’s try this and this and this that really,
you know, it really helped. See, OK, these are things the teacher
could have the students do instead of the classroom strategy that I
had suggested. So it really has helped.

A future goal in further iterations of this action research is that more writers will
develop a similar new appreciation for the Educational Technology Specialists. The
purpose of this goal of the course is that this mindset toward the department will carry
over to new educational product development as writers continue to work with these
specialists.
**New Perspectives After the Course.** Participants also had new perspectives after the course which built an *intention to implement new knowledge*.

Participants articulated that they had gained an *intention to implement new knowledge* during the course. This desire is evidence that they had indeed experienced transformed points of view and habits of mind in technology integration (Harris & Hofer, 2009; Illeris, 2018).

Jack: So my overall philosophy has not changed. The technology is, it’s a tool just like any other tool that we have. Textbooks are a tool. And we don’t want to structure something for the purpose of using the tool. But we do want to look at our…our…what content we need to teach, the pedagogical methods that we need to use, and then say, alright, is this the lesson where technology can really help? In some cases it can really help; sometimes it might not be as necessary.

Emily: I don’t know that my view of the value of technology has really changed—I knew that it was valuable and helpful before the course—but I think I grew in my knowledge of what’s available to use and my understanding that students themselves need to be able to use technology at times for greater engagement and memorable learning.

It is important to note that research identifies perceptions and motivation as the most significant barriers to technology integration (Günes & Bahçivan, 2016; Heintink et al., 2016; Rosenberg & An, 2019; Young et al., 2019). Because participants of this study
were volunteers, all demonstrated views of technology that are favorable to technology integration. This was a key factor in the success of the course. Many participants indicated that their beliefs in the value of integrating technology did not change, but rather deepened. For example, Rebecca was encouraged to continue to use technology. She said, “I think more than anything it ...just encouraged me even more about the usefulness of technology.” Shari said, “It’s more that [my educational beliefs and values about technology integration] intensified.” Others echoed this sentiment.

Emily: And then also I think I’ll just have a little more confidence that, you know, I...I could probably find something you know, to make this a technology activity rather than just waiting and asking, you know, I...I think I would have a little more knowledge to do that myself than asking somebody else.

Jenny: Through this course, I learned that there are a variety of technology integration techniques. Technology can be used in ways that may not have even been the initial purpose of that specific tool. For example, while Google Slides was created to present material to students, similar to PowerPoint, it can also be used as a collaborative learning space for students to work on and share ideas.

Though values largely did not change for many of these participants, transformation of habits and frames of mind (Harris & Hofer, 2009; Illeris, 2018) took place in practices of lesson design (Koh et al., 2015). The participants of this action
research study are in a good position to mentor other writers and pass on their enthusiasm for technology integration.

**New Interests After the Course.** Participants ended the course with a renewed passion for integrating technology, as evidenced by areas of new interest for leveraging technology for learning. These areas of new interest involved *technology for differentiated instruction, technology for interdisciplinary approaches*, and especially participants were “intrigued” by *technology-enabled gamification*. These areas of new interest align with the step in the transformative learning theory in which learners try new roles (Mezirow, 1995).

Participants saw the potential of *technology for differentiated instruction*, especially in their content areas. Several commented on the ability of technology to be a tool for differentiation in the hands of a teacher seeking to meet individual student needs. Emily was one, “I think as a teacher I would appreciate having the ideas there to use and to be able to pick and choose based on perceived needs of my students.” Though Emily spoke generally about meeting student needs, Rebecca spoke specifically about reading level and English language learners.

**Rebecca:** I really like how technology allows the teacher to adjust the texts for various reading levels for individual students. I can see how this would be so helpful for students who may be struggling or who do not speak English as their first language!

Both Rebecca and Emily commented on how technology is a tool to differentiate instruction for different student needs.
Several participants mentioned adaptive assessments as being an example of using technology for differentiated instruction. Jack mentioned specific assessments using adaptive technologies to help students learn and improve.

Jack: Yes, I agree that technology is particularly advantageous for differentiating instruction. I remember my school using Renaissance Learning software to administer a diagnostic test that could identify their reading and critical thinking skills. If a student got a question right, the next question was harder. If the student got a question wrong, the next question was easier. After about forty questions, the program was able to tell me each student’s strengths and weaknesses. The students would take this test again at the end of the year to see if their skills have improved. I greatly enjoyed using this technology for this precise assessment.

Jack’s comments indicate that he has had experience specifically with diagnostic testing as a subgroup of adaptive assessments. His experience in adaptive assessments was unique in the group of participants.

A few participants more comfortable with technology talked through ways that technology could be used to bring disciplines together in technology for interdisciplinary approaches. Both Jenny and Jack connected their own disciplines with other disciplines with technology. They were from different content areas but shared the ability to think creatively about technology and lead with technology use.
Jenny: So like you know with, you know, math can sometimes be the hardest one, but like you know in geometry we have like you know math and history sections. So like there’s a little bit of history in there and so there is ways to connect them into discipline and then the technology can also kind of balance that out.

Jenny had mentioned that she had previous opportunities to train others in technology use. Jack recounted an experience in which an opportunity for training led him to help others make interdisciplinary connections.

Jack: It’s funny; I actually led a professional development session and, you know, introduced my colleagues to Vocabulary.com. And I talked about how I said, Oh, even if you don’t teach literature, you can drop the Declaration of Independence in here. And I’ll pull out the vocabulary words. It’ll help your students. And history teacher said, “I’m just about to teach Declaration of Independence and I’m wondering how I could get students acquainted with vocabulary words!” So it’s just perfect.

A common feeling at the end of the course was that participants were “intrigued” by technology-enabled gamification. The focus group crescendoed in a very enthusiastic discussion about this interest. Several participants could not envision how digital games could be used in education, so I shared several examples, including one student example and several papers I had written on specific games. Brandy said, “So I
will say the one on *Minecraft*—it intrigues me.” Jack linked the use of games with increased motivation for students, “I found that gamification, whether it’s through technology or just through a class for traditional classroom game, that really helps because it gets up the dopamine.”

As the course progressed, writers demonstrated that they had established beliefs in the importance of technology through transformative learning strategies enacted as TPACK-in-Action (Flick, 2009; Koh et al., 2015; Pareto & Willermark, 2019). They gained perspective on these positive views during the course. The course, which implemented strategies of transformative learning theory, gave participants opportunities to demonstrate that the writers were changing habits of mind that would result in more and better technology integration because of shared experiences and collaboration. My assertion about Theme 2 is that positive experiences strengthened beliefs that generated motivation to integrate technology.

**Insights into Theme 3**

**Theme 3: Participants identified knowledge and skills that give them confidence in integrating technology into lesson designs.**

Theme 3 expresses how participants identified knowledge and skills that give them confidence in integrating technology into lesson designs. Participants gave evidence in the interviews and focus group that TPACK-in-Action had been successful in changing their points of view and habits of mind (Harris & Hofer, 2009; Illeris, 2018). I categorized evidences for this transformation as new knowledge, new skills, and new
strategies. Participants also gave feedback on the course experience and shared ideas for improving the course so that others could build confidence as they did.

This section discusses Theme 3 categories and significant codes. Theme 3 categories include (1) new knowledge after the course, (2) new skills after the course, (3) new strategies after the course, (4) feedback on the course experience, and (5) sharing ideas to improve the course for others. See Figure 4.11 that relates Theme 3 to its categories and significant codes discussed in this section.

**Figure 4.11**

*Theme 3 Categories and Selected Codes Concept Map*

(Note: Themes are in blue, categories are in orange, and selected codes are in black.)

**New Knowledge After the Course.** Participants expressed gaining new knowledge because of the course. As previously noted, several participants mistakenly
thought of technology integration as *teacher-driven technology integration*. This section describes how participants replaced that misunderstanding with a new knowledge of *student-driven technology integration*.

One common comment from several participants was their desire to integrate technology in ways that are oriented toward the student after gaining some knowledge that technology integration is not only for the teacher, but also, more strategically, for the student. *Student-driven technology* integration is a hallmark product of TPACK-in-Action (Harris & Hoffer, 2009). Shari and Brandy were both participants who gained knowledge and perspective of technology integration as being especially for the student. Shari describes her previous understanding of technology integration as teacher centric, “The biggest thing was that I thought it was enough if I used PowerPoint or showed videos as a way of integrating technology.” Brandy described how the course refocused her technology integration efforts on the student.

Brandy: Through this course, I’ve realized that I have focused more on including technology for the teacher to use, and less on technology for the student to use. I was able to learn about some student-friendly technology and how it can be implemented in our lessons.

Though Rebecca had experience using student-driven technology integration in the past, she developed new knowledge about how to make technology use strategic for the student because of the course. Rebecca noted the intentional student use of technology as opening opportunities for student collaboration and interactivity, extending the learning beyond class.
Rebecca: Through taking this course, I have learned more about how technology can be integrated into the classroom. I have used technology somewhat in the past, but I did not realize the extent to which technological tools can be used and integrated. As a teacher, it can be easy to pass out sheets of paper and have the students fill out a graphic organizer by hand. But this course has been helpful in revealing more ways that students can use online resources such as Padlet. I also like how students can create and upload something such as a graphic organizer and allow other students to respond to what they have put. Technology is such a useful tool for allowing students to interact with each other’s work not just in the classroom but also when they are home. This allows the class discussion to continue well past the classroom hour. I am encouraged by the developing tools that will allow both the teacher and the students to grow and develop as learners (and me as well 😊).

The course was strategic in transforming some participants’ view of technology integration from being predominantly for the teacher to being, more strategically, for the student.

**New Skills After the Course.** Participants also gave evidence of TPACK-in-Action with the demonstration of new skills. Participant described *learning about tools* and
commented, “I have more tools!” This section describes new participant skills after the course.

One of the most common skills that participants mentioned developing through the course is figuring out and using Web 2.0 technology tools. This idea was captured in the code learning about tools. This observation clearly aligns with research linking professional development in technology integration and the use of Web 2.0 tools for instructional strategies (Sahin-Topalcengiz & Yildirim, 2020; Tarling & Ng’ambi, 2016; Wright & Akgunduz, 2018). The format of the course facilitated this development through instruction in Web 2.0 tools in irregular, dispersed formats with autonomy given to participants to choose the best technology for the teaching goal (Tarling & Ng’ambi, 2016; Grabove, 1997). Though all participants learned about new tools, Brandy and Emily seemed to especially appreciate the exposure to new tools. Brandy said, “And the more recent resources, I understand how they work.” Emily also commented on having more tools. “I think just knowing what my options are or at least having a few more options in my tool belt now will really help me going forward as I approach a lesson like, Oh, I could do this or this or this.”

Other writers more comfortable with technology saw immediate applications and took possession of these tools for use. This adoption of new technology tools is captured by the code, “I have more tools!” Jack and Jenny described how they learned about new tools, with Jack describing immediate implementation and Jenny planning implementation in a new book she was beginning.
Jack: This course helped me realize all the good options that are out there. I sometimes get frustrated with looking for different tech tools because so many of them require a subscription. However, many of the resources I learned about in this course are free. It was good for me to experiment with some of these tools. I actually started using Padlet in my En[GLISH] 103 class, and it worked really well!

Jenny: I specifically enjoyed learning about the collaborative workspaces such as Flipgrid and Padlet. While taking this course, there were times I wished I was still a teacher so I could have implemented these tools in my classroom. However, instead now I have the opportunity to implement them into a curriculum so even more teachers can see the many technological possibilities when it comes to presenting the material.

Participants who identified both digital immigrants and digital natives learned about and adopted Web 2.0 tools.

**New Strategies After the Course.** Participants also gave evidence of TPACK-in-Action with the demonstration of new strategies. Participants described how they were changing lesson-writing habits and had formulated writing strategies connecting technology integration to teaching strategies. This section describes new participant strategies after the course.
Participants voiced that the course was effective in changing lesson-writing habits, a key product of TPACK-in-Action (Harris & Hofer, 2009; Paneru, 2018). Participants described forming new strategies to integrate technology into their lessons. All participants gave evidence that their habits of technology integration had improved. These results are better than the results of professional development in some research studies (Mouza, 2011). I attribute this to the voluntary nature of this action research.

Rebecca relates that her habits had changed, as evidenced by the changes she had made to her lesson and her intention to use this strategy in future lessons.

Rebecca: I will [approach writing lessons differently]. I’ll give you the best example. In the lesson that I was working on with this course, we have a chart that we use that’s called a fact-question-response-chart, and I used it. I had used it for [Literature] 8. Well, in this course, [Ed Tech], who I was working with, had suggested using Padlet to have the students fill it out together for the first time just to become familiar with how it works. And so I...I did that. I added the Padlet in with this with the first time that they’re gonna be using this FQR [fact-question-response] chart.

Jack mentioned how the course honed his skill to keep technology options in mind in ways that enhance the lesson. Though the professional development course did not instruct writers in the SAMR model of technology integration, Jack made the connections himself.
Jack: Like I said, those reminders to try to think in the back of my mind, alright, I can...we use technology in this way, especially in those ways, where it really enhances the lesson. That’s why I really enjoy using technology. I can't remember where it falls in the SAMR model, which letter that is, the one where the lesson would not be as good if you didn’t use the technology.

Both Jack and Rebecca, along with all other participants, gave evidence that their lesson-writing habits had changed because of the course. This is evidence of TPACK-in-Action.

Several participants mentioned one specific strategy for integrating technology—looking for technology options that connected with teaching strategies. This strategy of connecting technology with teaching strategies is captured in the code *connecting technology integration to teaching strategies*.

Several participants implied that collaborating with the Educational Technology Specialists was key to *connecting technology integration to teaching strategies*.

Emily: Collaborating with Ed Tech was a valuable part of this course and really opened my eyes to see how many classroom strategies could be adapted to an online platform for students to use! I also like the idea of giving teachers the option of using either an ‘in class’ strategy or a technological strategy to help their students learn the subject matter.
Emily and Brandy implied that they would start with the teaching strategies they had formulated and then think of technology options. Emily said, “I think I will definitely try to look for more technological options to include, you know, even for strategies that might not have to be technology, but just think of a way to give teachers a technology option.” Brady echoed the approach of strategy-then-technology: “Adding technology is a benefit to have already written those different strategies, because now I can take those different strategies and add technology and give the teacher another option to the technology.”

On the other hand, some participants began by thinking of strategies with a technology option already in mind. Jenny was an example of assuming technology use with a strategy but then analyzing the technology for effectiveness.

Jenny: Like I said similarly, just having like the tools that are provided that can be used with different teaching strategies and even like if it’s a teaching strategy I’ve all already used, but technology can kind of support that teaching strategy. So it’s not like the technology has to be the end-all-be-all, of like use this specific app or use this, you know. So you can be like, use this to guide a discussion, maybe use Padlet to do that, because it’s a great way for students to talk with each other. So it’s like again, it’s not like you use technology and every single piece of information you’re giving, but it’s like a suggestion of technologies there. And you’re doing the same [thing]; you’re doing it already, it’s just another way.
Most participants expressed that they had formulated new strategies for integrating technology into the lessons they write because of the course. Several also specifically connected teaching strategies with technology integration, an idea that was prompted for several through collaboration with their Education Technology specialist.

Feedback on the Course Experience. Participants desired to help others build confidence in technology integration by giving feedback on the course experience. Participants commented on the scope of the course, especially commenting on the time for the course. This section describes participant feedback on the course experience.

Writers had a variety of thoughts about the course experience, but one of the most common comments was the reasonable timeframe of the course. These thoughts were captured by the code time for course. I set a relatively leisurely schedule for the course, considering that the effectiveness of professional development relies on sufficient time (Claesgens, et al., 2013; Ertmer, 1999; Young et al., 2019). Shari said, “[The course] wasn’t heavy, and honestly if you can tell people this is not a heavy, it’s not heavy at all.” Emily said, “It was very doable... especially since we were working with lessons we had already written. Yes, that would have been a huge part of it.” Jenny said, “I felt like I didn’t have a problem completing the assignments or the activities, and I felt like they made sense as to why I was doing them.” Rebecca said, “I think especially because it helps [to] spread the material out. So we didn’t have as much to do in one week. I think that for me that was helpful.”
All participants felt that the time demands of the course were reasonable, a factor that research describes as contributing to the success of professional development in technology integration (Claesgens, et al., 2013).

**Sharing Ideas for Improving the Course Experience for Others.** Participants desired to help others build confidence in technology integration by giving ideas for improving the course experience for others. This category is related to the theme of confidence because participants shared ideas that either prevented or helped them learn to develop confidence. Participants made several recommendations, including better explaining the TPACK survey, including more technology tools, organizing tech tools by function rather than content, and providing models and applications of TPACK. Several of these suggestions for improvement align with research. Participants also demonstrated that confidence is key because of the course experience. This section describes participant feedback on the course experience.

Four of the six participants requested that the instructions in the course do a better job explaining the TPACK survey (Schmidt, 2009) that they took at the beginning and end of the course. Writers seemed confused most often by the content questions on the survey. Brandy said, “I did find it a little hard because I’m a history writer answering the math and the science questions. Like, do I feel able to write this or that?” Jack mentioned this confusion as well: “Giving a little bit more context before they took the TPACK survey the first time [would be helpful], because [questions] were a little confus[ing].” Emily echoed this feeling of confusion.
Emily: Yeah, I...I was a little puzzled by some of the survey questions where I was asked how comfortable I was you know, integrating technology in a math lesson... . So I don’t know if there’s a way to make it specific to individual.” Though many teachers teach more than one subject, Content Writers are dedicated to a specific subject, making the content sections of the TPACK survey feel uncomfortable for them.

Writers requested ideas for more technology tools that were content-specific. This desire aligns with research that demonstrates that professional development with the TPACK framework should involve learning activities that are authentic and content-specific with appropriate assessment for developing teachers’ TPACK competence (Harris et al., 2009). Participants seemed to find security in the guided exploration of technology tools, even self-professing digital immigrants. Shari said, “Yes, I think practice on, yeah, just more tools for us to play with... No, no, no, we wanna, we wanna look at them all. Yeah. It was fun!”

Some writers less comfortable with technology tended to focus on technology integration that was more obviously related the content area in which they write. For example, Brandy, a history writer, focused on history resources.

Brandy: I will say with the videos and the things that we were looking at, you know, I looked at it too, specifically for history. You know, I may have looked at a couple others and I’m like, well, they don’t...
I don’t know how to use that in history. Yes, so I kind of just focused on those.

Other writers more comfortable with technology felt secure enough to explore technology tools that seemed to be oriented toward content outside of their content area. For example, Jack, an English Language Arts writer, described his curiosity about the history computer game, *Age of Empires*.

Jack: Well, more information on the different tools that are out there is always gonna be helpful. So I appreciate getting acquainted with some of those tools. I saw one of those like *Age of Empires*. I was really intrigued on how we could use that for the classroom.

However, Jenny departed from this pattern of a focus on content to advocate for a focus on the function of technology. She suggested that technology tools be organized by function rather than content. My hypothesis is that Jenny could make content applications more readily having taught a broad range of subjects.

Jenny: I guess like I am unique, [since I] actually taught a lot of different disciplines. So, I’ve taught history and English. Science is the only one I haven’t actually taught, which is ironic since that usually goes with math... I think the module like I’m going back to, as it might be in Module 5 where you had listed all of the different videos. I went back to those. I watched them all, and then I went back to them if I was writing something I felt like I remembered a video that referenced a good tool. So even like organizing those videos to
be like, you know, here are specific technology that’s for collaboration. Here are specific videos that are for in a classroom response or a journal or something like that. So you know, having an organization of like which strategy kind of technology go with which strategy.

Jack was the only participant who suggested adding applications of TPACK, perhaps offering a lesson that is a model of TPACK for analysis. This excellent idea aligns with research recommending that facilitators model best practices in technology integration for best results in professional development (An & Reigeluth, 2011; Ertmer, 1999; Tondeur et al, 2020).

Jack: Yes, I’m trying... to trying to think, especially if you’re talking about there, there are some people who aren’t as comfortable with technology, you’re not sure how to use it. Perhaps delving a little bit more into the TPACK and thinking through how to, you know... I know you had some questions already. Where does this fit? That’s helpful. That’s a good place to start. And we did have to revise our lesson plan and look at it, I don’t know. Perhaps more... . I’m thinking perhaps another step that might make things even easier because there’s new information like maybe if we had a, you know, a meeting, we collaborated where we looked at a sample lesson and talked through like as a group. All right, where does this fall into TPACK? and, you know, kind of hashing all that out?
Participants gave feedback about the course and shared ideas for improving the course experience for others. This is especially profitable considering the iterative nature of action research (Mertler, 2020). Both I and the assistant director of Educational Technology intend to offer the course again to both writers and online instructors, and our desire is to implement suggestions from this pilot group for improved results.

All participants expressed confidence in integrating technology by the end of the course, aligning with the process in transformative learning theory in which learners build confidence before reintegrating back into their working environment (Mezirow, 1995). In transformative learning theory, confidence is key.

Jenny and Jack expressed confidence in technology integration before taking the course, though they both readily admitted the need to continue to learn. Jenny said, “So I guess just I felt pretty confident going into technology integration, but I feel like it is something that always changes.” Jack shared this sentiment of comfort and confidence.

Jack: Yeah, I’m fairly confident as I was sharing with you, I’m... I’m used to using technology. There’s always more things to learn to different platforms, but also having used computers since I was young, I remember like we got our first computer and that didn’t even have Internet. Yeah, but still like I guess being a millennial, you kind of have to know how to use technology to some extent. So I’m comfortable with using it.
Others lacked confidence before the course and developed it because of the course, demonstrating that professional development can build teacher confidence and shape their core dispositions toward technology integration for sustained change (Günes & Bahçivan, 2016; Tarling & Ng’ambi, 2016; Tondeur et al., 2020). Shari said, “Well yeah, because I feel more confident. I definitely can enjoy [it] more.” Brandy uniquely expressed that she did not feel the need to understand everything about the technology; having a working knowledge of its function was enough to integrate it into educational materials. She expressed how the course had helped her.

Brandy: More confident. And the more recent resources. I understand how they work. I don’t even have to go on to Kahoot to know how it works or onto a whiteboard to know how it works. I just need to know it works. And then I can suggest it in my lesson.

Emily: I do think it made me feel more confident. Just like seeing some technology and how it worked. And... and then I actually I opened up Padlet and I figured it out all by myself! I figured out how to do a little timeline on it.

Emily expressed this growing confidence on more than one occasion.

Emily: Yeah, it definitely changed my confidence level a little bit because I, I do feel, you know, like there are you know, like I tried out Padlet all by myself and no one was helping me, and I figured it out! So you know that gave me a little confidence and...and some of the other apps, you know the...the Flip thing was doing that at
home and there was no one to help me, and I did have a few hiccups in that process. But you know, I...I thought, well, you know I can eventually figure these things out. And so just getting that confidence level a little higher.

Though Rebecca demonstrated some facility with technology before the course, she also expressed an increase in confidence because of the course.

Rebecca: I think it’s strengthened my confidence in using technology because kind of like what Jack had said. I was the same way and just trying to find things and...and not being able to find exactly...And what I or finding things that I wanted to use, but of—quite often, again—you had to have a subscription to it. And so this really encouraged me in that way.

As the course finished, all writers described an increase in confidence in integrating technology, demonstrating that confidence is key. This increase in confidence was strengthened by the evidence of TPACK-in-Action, including a desire for student-driven technology integration, increased facility in Web 2.0 tools, and a change in habits of lesson writing. My assertion about Theme 3 is that the course was successful in equipping writers with knowledge, skills, and strategies and that improved their confidence in integrating technology.

This section presented insights for each theme with their categories with triangulation through supporting concept maps, connections to the literature, and participant quotes.
Summary of Qualitative Findings

The qualitative findings and interpretation have been discussed, including the qualitative data sources of discussion posts, a focus group, and interviews. The process of qualitative data analysis through first cycle coding with codes, second cycle coding with categories, and third cycle coding with themes was described. Then a presentation of themes and interpretations developed insights into each theme with their assertions. These themes and assertions are as follows:

1. **Theme 1:** Participants voiced struggles in integrating technology both in teaching and in writing educational products.

   **Assertion 1:** Writers connected struggles in integrating technology in their writing to barriers to integrating technology in their teaching.

2. **Theme 2:** Participants expressed beliefs and experiences that motivate them to push through struggles to integrate technology into lesson designs.

   **Assertion 2:** Positive experiences strengthened beliefs that generated motivation to integrate technology.

3. **Theme 3:** Participants identified knowledge and skills that give them confidence in integrating technology into lesson designs.

   **Assertion 3:** The course was successful in equipping writers with knowledge, skills, and strategies that improved their confidence in integrating technology.

Chapter Summary

This chapter has presented quantitative data and findings as well as qualitative findings and interpretations. Quantitative data collected using the pretest and posttest
application TPACK survey was presented along with the findings. Quantitative data collected from pretest and posttest assessment of participant lessons with the Technology Integration Assessment Rubric was also discussed. Qualitative findings and interpretations were also presented, involving the three cycles of coding and interpretation of the final themes with a presentation of the research assertions.
CHAPTER 5: ANALYSIS AND FINDINGS

This chapter presents answers to the research questions of this descriptive action research study. Data from a variety of sources will be situated within pertinent literature (Belzer & Ryan, 2013). This predominantly qualitative mixed methods action research project involved creating, implementing, and evaluating a professional development course in technology integration for Educational Content Writers at a publisher in the Southeastern United States. The creation, implementation, and evaluation of the course occurred in the context of a combination of the TPACK framework (Koehler & Mishra, 2006) and transformative learning theory (Mezirow, 1995) as TPACK-in-Action (Harris & Hofer, 2009). This study implemented an intervention with a mixed methods analysis. Data collection methods included the TPACK Survey (Schmidt et al., 2009) and the Technology Integration Assessment Rubric (Harris et al. 2010) to evaluate changes in the lesson designs of six Educational Content Writers. Analysis of discussion posts, a focus group, and individual interviews produced three themes on changes in writer perceptions of technology integration (see Table 4.7). This chapter will present the conclusions of this descriptive action research study by discussing answers to the research questions as well as presenting implications and limitations of the research study with closing remarks.
Discussion

This discussion section has two purposes. The first is to position data collected during this action research within the literature by connecting this research study to the work of other researchers to determine meaning (Belzer & Ryan, 2013). The second is to draw conclusions to research questions by interpreting the combined data (Buss and Zambo, 2014) within the context of the TPACK framework and transformative learning theory. The research questions for this descriptive action research study form the structure for the discussion in this section. These research questions are as follows:

- Research Question 1: How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals?
- Research Question 2: How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies?
- Research Question 3: How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?

The discussion of research questions that follows will consist of a systematic review of the research data and the literature within the context of the TPACK framework and transformative theory.
Research Question 1: How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to meet instructional goals?

The professional development course in technology integration using the TPACK framework may have improved Content Writers’ use of technology to meet instructional goals based on participant quotes. Quantitative and qualitative data on participants’ technology selection (TK) is discussed. Participants’ use of technology in connection with instructional goals (TCK) will be interpreted within the context of relevant literature and analysis of quotes extracted from discussion posts, a focus group, and individual interviews. This section will examine data and literature in both the TK and TCK dimensions within the context of transformative learning theory.

**Technology Selection (TK).** In order for Writers to use technology to meet instructional goals in a lesson, they needed to develop technology knowledge. This professional development course purposefully built technology knowledge for participants by removing first-order barriers to technology integration in three different ways. This course (1) facilitated access to Web 2.0 tools (Günes & Bahçivan, 2016; Young et al., 2019), (2) provided time (An & Reigeluth, 2011; Claesgens et al., 2013; Ertmer, 1999, S. Tseng & Yeh, 2019; vanOostveen, 2017), and (3) provided leadership support for technology integration to improve technology selection.

*Providing Access to Web 2.0 Tools.* This professional development course removed a first-order barrier to technology integration by providing convenient access to Web 2.0 tools (Günes & Bahçivan, 2016; Young et al., 2019). Providing access to
technology was essential to improving technology selection. Participants’ experience harmonized with research that found a strong correlation between confidence in TPACK competencies and the integration of Web 2.0 tools (Wright and Akgunduz, 2018). Developing confidence in technology tools occurred even in the context of distance learning (Sahin-Topalcengiz and Yildirim, 2020). Participants were exposed to these tools in unregulated, dispersed formats in the course and given the autonomy to choose the best technology for content-specific purposes when improving lessons (Grabove, 1997; Tarling & Ng’ambi, 2016). Module 5 showcased Web 2.0 tools and modeled how they could be used in teaching and learning experiences. Several participants mentioned exploring and using Web 2.0 tools that they accessed during the professional development course. See Figure 5.1 for a screenshot of a showcase of Web 2.0 tools in Module 5.
This freedom to explore Web 2.0 tools in the course and use them in lessons may have contributed to an improvement in participant scores in the Technology Knowledge (TK) domain on the TPACK survey when reviewing pretest and posttest applications of the survey ($n = 6$). The population size of this action research prevented the use of inferential statistics to confirm the significance of the difference between pretest and posttest scores. However, descriptive analysis of composite pretest survey scores revealed a slight increase in the TK score.
**Providing Time.** This professional development course provided participants with time for technology integration. Writers were given time to collaborate with facilitators and other writers (vanOostveen, 2017). Writers were given time to plan technology integration (Ertmer, 1999). This involved practicing technology integration in authentic contexts (Claesgens et al., 2013; S. Tseng & Yeh, 2019). Writers were also given time to produce lessons (An & Reigeluth, 2011, Ertmer 1999). Participant voiced that providing time helped them overcome several barriers to technology integration, a finding that is consistent with the literature.

**Providing Leadership Support.** Research indicates that leadership support is key to the availability of technology (Günes & Bahçivan, 2016), time (Ertmer, 1999), and professional development (Young et al., 2019) for quality technology integration. This course provided all three through leadership support (Teo et al., 2021). Management’s support for this action research was crucial to its success. Management provided support by authorizing this action research on company time with company equipment and involving company personnel. Managers were also involved as facilitators and observers of this action research project. Management also funded compensation for participants by providing a choice of a 64GB 10th generation iPad, an iPad mini, or a series 8 Apple watch.

Removing first-order barriers to technology integration through the course may have improved participant lessons scored with the Technology Integration Rubric in the “Technology Selection” category. When reviewing pretest and posttest assessment of participant lessons (composite pretest and posttest scores had a slight increase. The
combination of slightly increased scores in the TK dimension of the survey and the “Technology Selection” criteria of the lesson rubric along with participant quotes may indicate that this course was successful in building technology knowledge (Koehler & Mishra, 2006).

**Technology and Instructional Goals (TCK).** Though technology knowledge was essential to develop as a first step to technology integration, Research Question 1 inquired as to the use of technology to meet instructional goals. This professional development course also built technology content knowledge using transformative learning strategies as TPACK-in-Action (Harris & Hofer, 2009). These strategies included (1) creating an authentic, content-specific context for learning and (2) creating a social context for learning.

**Creating an Authentic, Content-Specific Context.** This professional development course created an authentic, content-specific context that offered appropriate assessment for TPACK competencies (An & Reigeluth, 2011; Harris et al., 2009). The purpose of the technology use was technology-enabled learning in the context of specific content (Green, 2014). Module 4 provided models of technology use within the context of specific content. This context is also authentic in that the technology use appears within the context of a planned learning experience. Some writers focused on technology use in their content, while others explored technology resources outside of the content for which they write. See Figure 5.2 for a screenshot of technology content models in Module 4.
The authentic, content-specific context of the course may have contributed to a slight improvement in participant scores in the Technology Content Knowledge (TCK) domain on the TPACK survey based on participant quotes when reviewing pretest and posttest applications of the survey \( n = 6 \) with descriptive statistics. Composite pretest and posttest scores slightly increased.

**Creating a Social Context.** This professional development course created a social context that promoted interaction between writers and facilitators in similar content areas. This social context is natural (Creswell, 2014; Flick, 2009), as it is the context and process in which Content Writers usually encounter the challenges of integrating technology into instruction during the preparation of educational materials. This social
context was also a key transformational strategy, as it promoted discourse and reflection (Goodnough & Murphy, 2017; Gow et al., 2018; Heintink et al., 2016; Tondeur et al., 2020; Voogt et al., 2016). Collaboration occurred between writers in discussion posts, in writing groups, and in documents as writers peer-reviewed each other’s lessons. Collaboration also occurred with facilitators in collaborative groups.

Creating an authentic, content-specific, social context in the course may have produced a slight improvement in participant lessons scored with the Technology Integration Rubric in the “Curriculum Goals & Technologies” category based on participant quotes. When reviewing pretest and posttest assessment of participant lessons (n = 6), composite pretest and posttest scores had a slight increase. The combination of slightly increased scores in the TCK dimension of the survey and the “Curriculum Goals & Technologies” criteria of the lesson rubric with participant quotes may indicate that this course was successful in building technology content knowledge (Koehler & Mishra, 2006).

For Research Question 1, I concluded that the professional development course in technology integration using the TPACK framework may have improved Content Writers’ use of technology to meet instructional goals based on participant quotes. Using technology to meet instructional goals involved efforts to improve technology knowledge (TK) by providing access to Web 2.0 tools, time, and leadership support. Using technology to meet instructional goals also involved efforts to improving technology content knowledge (TCK) by creating an authentic, content-specific, and social context.
Research Question 2: How does professional development in technology integration using the TPACK framework affect how Content Writers use technology to support instructional strategies?

The professional development course in technology integration using the TPACK framework may have improved Content Writers’ use of student-oriented technology to support instructional strategies based on participant quotes. Qualitative data on participants’ technological pedagogical knowledge (TPK) as well as their use of technology in connection with instructional strategies to teach content (TPACK) will be examined. The discussion for Research Question 2 considers relevant literature, TPACK survey results, lessons assessed with the technology integration assessment rubric, and analysis of supporting quotes extracted from discussion posts, a focus group, and individual interviews. This section will examine data and literature in both the TPK and TPACK dimensions within the context of transformative learning theory.

To improve Content Writers’ use of technology to support instructional strategies, this professional development course utilized transformative learning strategies. Transformative learning strategies to build technological pedagogical content knowledge included providing a knowledgeable mentor and leveraging participant-led strategies. Transformative learning strategies to build technological pedagogical content knowledge included providing models of TPACK and creating opportunities for active practice. These strategies could be used effectively in a blended learning environment (Gow et al., 2018; Niess & Roschelle, 2018; Pareto & Willermark, 2019, Tondeur, 2020; Zhou et al., 2007).
Technology and Instructional Strategies (TPK). Transformative strategies building technological pedagogical knowledge included (1) providing a knowledgeable mentor and (2) leveraging participant-led strategies.

Providing a Knowledgeable Mentor. The professional development course provided several knowledgeable mentors for participants to learn about technology integration, including Instructional Designers, Biblical Worldview Specialists, Educational Technology Specialists, and me as the researcher-facilitator. Research highlights the necessity of a knowledgeable facilitator and mentor in professional development in technology integration (Tondeur et al., 2020; vanOostveen, 2017; Voogt et al., 2016).

The Educational Technology Specialists had the most notable contributions to changing participants’ habits and frames of mind in technology integration (Harris & Hofer, 2009; Illeris, 2018) based on several participant quotes. Changes in thinking were especially significant as participants began to consider student uses of technology and not just teacher uses. The use of student-oriented technology is a notable result of TPACK-in-action (Harris & Hoffer, 2009). Participants also described how the Educational Technology Specialists helped them begin to link technology integration with instructional strategies. The tactic of combining technology with instructional strategies is a hallmark of technological pedagogical knowledge (Koehler & Mishra, 2006, 2009).

The guidance of a knowledgeable facilitator in the course may have contributed to an improvement in participant scores in the Technological Pedagogical Knowledge (TPK) domain on the TPACK survey based on participant quotes. When reviewing pretest
and posttest applications of the survey ($n = 6$), there was a slight increase in composite pretest and posttest scores, the largest change in a domain on the survey.

**Leveraging Participant-Led Strategies.** The professional development course also leveraged participant-led strategies for transformative learning within the context of adult education (Açikgül & Aslaner, 2020; An & Reigeluth, 2011; Cranton, 2002; Dirkx, 1997). Participant-led transformation strategies included an activating event, self-reflection, and peer observation.

Transformation began with an activating event in Module 1 with the use of a video to provide a disorienting dilemma to kickstart transformation (Açikgül & Aslaner, 2020; Cranton, 2002; Mezirow, 1995). Participants reflected on how the video in Module 1 was successful as an activating event for transformation (Açikgül & Aslaner, 2020; Cranton, 2002). Participants indicated that the activating event was something memorable as a pivotal moment. See Figure 5.2 for a screenshot of the activating videos in Module 1.
Transformation continued during the course by participants’ articulating assumptions and self-reflection through journaling and discussion posts (Cranton, 2002). Writers participated in private journals and public discussion posts to promote self-reflection on their views and use of technology. Though private journals were not observed as part of the data collection, discussion posts in Modules 1 and 2 revealed beginning thoughts and attitudes toward technology. Participants contributed to a discussion post in Module 2 to the prompts, “Where are you right now with your ability to integrate technology? What strengths and weaknesses do you currently have? What limits your improvement?” Participants revealed that their posture towards technology integration in this first discussion post as being positive but experiencing first-order barriers. See Figure 5.4 for a screenshot of this discussion blog in Module 2.
As the course progressed, transformation continued through peer observations as participants shared experiences and collaborated to improve their lessons (Açıkgül & Aslaner, 2020; Cranton, 2002; Heintink et al., 2016). Writers observed and praised each other for efforts to use technology and encouraged each other to explore more.

Providing a knowledgeable facilitator and leveraging participant-led strategies in the course may have contributed to a small improvement in participant lessons scored with the Technology Integration Rubric in the “Instructional Strategies & Technologies” category based on participant quotes. When reviewing pretest and posttest assessment of participant lessons (n = 6), there was a slight increase from composite pretest to posttest scores.

The purposeful use of transformative learning strategies to change writers’ educational beliefs for technology integration can produce new habits of mind that
result in changes in practice. Participant quotes and an observed small increase in scores in the TPK dimension of the survey and the “Instructional Strategies & Technologies” criteria of the lesson rubric may indicate that this course was successful in building technological pedagogical knowledge (Koehler & Mishra, 2006).

**Technology Fit (TPACK).** Transformative strategies building technological pedagogical content knowledge included (1) providing models of TPACK and (2) creating opportunities for active practice.

**Providing Models of TPACK.** The professional development course provided models of TPACK in two different ways, through video lesson models and through the course itself as a model. Video lesson models were provided in Module 4. In this module, participants learned about the TPACK framework for professional development in technology integration. Participants assessed their understanding of the framework with a self-quiz. Participants used the framework to analyze video lesson models of TPACK and then apply the TPACK framework to their own written lesson design (An & Reigeluth, 2011; Ertmer, 1999; Tondeur et al, 2020). See Figure 5.5 for a screenshot of Module 4 that guides participants to analyze video lesson models of TPACK.
Though one participant described these models as “helpful,” he also described the models as “a good start.” Transfer is required for participants to translate from an observed learning experience to a written lesson. Jack suggested adding applications of TPACK, perhaps offering a written lesson that is a model of TPACK for analysis. This recommendation aligns with research that facilitators model best practices in technology integration for best results in professional development (An & Reigeluth, 2011; Ertmer, 1999; Tondeur et al, 2020). Written models of TPACK would facilitate transfer for participants to apply the TPACK framework to their own written lessons.

The second way that the course provided models of TPACK was the structure of the course itself an example of TPACK-in-Action. As the facilitator, I modeled best practices in technology integration (vanOostveen, 2017). Within Mezirow’s ten steps of
transformative learning (1978), I exposed participants to a disruptive dilemma, created the social context, fueled discourse, and prompted and guided transformative learning (Cranton, 2002; Mezirow, 1995).

There is insufficient evidence to draw conclusions on the effectiveness of providing models of TPACK. There were not enough quotes from participants to gauge their experience, and inferences cannot be drawn from the descriptive statistical analysis of the results from the TPACK portion of the TPACK survey.

**Creating Opportunities for Active Practice.** A final transformative learning strategy in the course was creating opportunities for active practice (Açıkgül & Aslaner, 2020; Harris et al., 2009; Irdalisa et al., 2020; J.-J. Tseng, 2019; S. Tseng & Yeh, 2019; Voogt et al., 2016). Active practice in the course involved project-based learning (S. Tseng & Yeh, 2019) and guided inquiry (Irdalisa et al., 2020) through lesson design (Koh et al., 2015; Pareto & Willermark, 2019). Active practice helped writers develop mastery in principles of technology integration by learning these principles and then applying them to revise and improve their lessons.

Several writers mentioned that when choosing a lesson to revise for the course they chose one that they recognized as needing improvement. Writers saw that they needed to learn in order to improve these lessons. As the course progressed, participants learned about technology tools that they could implement in their lessons within the TPACK framework.

The combination of lesson revision and the use of the TPACK survey had the potential to highlight gaps between participants’ espoused TPACK and their TPACK in
use (Voogt et al., 2016). Active practice was essential for TPACK-in-Action to give participants opportunities to explore options for new behaviors, plan a course of action, try new roles, and act on new perspectives gained during the course (Mezirow & Taylor, 2009). Several participants commented on feeling equipped to implement their new knowledge in future lessons as they learned about free tools. One writer uniquely described internalizing the TPACK framework as changing the way he thought about technology integration. Though writers described that their philosophy of teaching had not necessarily changed, their thinking about technology integration had become more structured. Participants also expressed how the course had helped them develop confidence about using technology tools.

Creating opportunities for active practice may have contributed to a small improvement in participant lessons scored with the Technology Integration Rubric in the “Fit” category based on participant quotes. When reviewing pretest and posttest assessment of participant lessons (n = 6), composite pretest scores increased. The slightly increased scores in the “Fit” criteria of the lesson rubric with participant quotes may be an indication that this course was successful in building technological pedagogical content knowledge (Koehler & Mishra, 2006).

For Research Question 2, I concluded that the professional development course in technology integration using the TPACK framework may have improved Content Writers’ use of student-oriented technology to support instructional strategies based on participant quotes. Using technology to support instructional strategies involved efforts to improve technological pedagogical knowledge (TPK) by providing a knowledgeable
mentor and by leveraging participant-led strategies. Using technology to support instructional strategies also involved efforts to improve technological pedagogical content knowledge (TPACK) by providing models of TPACK and creating opportunities for active practice.

Research Question 3: How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?

Participants perceived that technology can be integrated with confidence through completing this professional development course. Participants grew in confidence through this professional development course, no matter their age or experience, as revealed by participant quotes. Writers who participated in this action research fell into three different groups based on their age and experience. These three groups will first be examined. Then representative quotes from each of these groups will be used to demonstrate how participants from all three groups described struggles in technology integration, motivation in technology integration, and growing confidence in technology integration through this professional development course.

Groups of Writers. Writers who participated in this action research fell into three different groups based on their perceptions of their ability to integrate technology.

Shari and Emily were in the first group. Shari labeled herself as a digital immigrant and called herself “a dinosaur,” being the oldest writer in the group and
describing her significant struggles in learning to use technology. Shari tended to
describe herself and her work in ways that projected a low view of self.

Shari: I have always thought that integration was important—but I have
an extremely narrow vision of how I can integrate it, and being the
digital immigrant that I am, I am not aware of so many applications
that are available.

Emily similarly was an older writer in the group, also describing her struggles in
learning to use technology. She described herself as someone who “didn't grow up as a
digital native,” though she did not explicitly identity as a digital immigrant.

Emily: Well, I do feel like over the years I’ve...I’ve had to learn you know,
a lot of different iterations of technologies like technology has
changed a lot over the years, and like, especially with my teaching.
You know, I remember when I started realizing, you know, I just
need to make PowerPoints... . That was back when they had the
computer training courses as something you could opt into as part
of your job. So, I think I took the PowerPoint training at three
different times. Like, I went through the whole, like, however many
levels.

The term “digital immigrant” was coined by Presky (2001) to refer to those “who were
not born into the digital world but have, at some later point in our lives, become
fascinated by and adopted many or most aspects of the new technology” (pp. 3-4). Both
Shari and Emily exhibited the characteristics of digital immigrants.
Jack and Jenny were in the second group. Jack labeled himself as a digital native, being one of the youngest members in the group. He said, “I am a bit of an odd hybrid because I am a digital native who personally tends to minimize my use of technology (I didn’t get a smartphone until 2019).” He demonstrated his ease with technology and his facility with technology use as a teacher and writer, including his use of Web 2.0 tools. He described leading professional development at a previous school, “I actually led a professional development session and, you know, introduced my colleagues to Vocabulary.com.”

Jenny similarly was one of the youngest members of the group who also demonstrated her ease and facility with technology use, though she did not explicitly identify as a digital native.

Jenny: Independently, [Jenny and her husband] both did a lot of helping of other teachers. And I remember one time is the before school year started, the teachers all came back, and [Jenny’s husband] had coaching for soccer, so he couldn’t help. And I led like a little group of like, here’s Google Classroom. And here’s like the changes. And here’s how you create a form, and here’s how like you make sure you have like a code to get in so students don’t see the quiz even if you post it and stuff like that. So at [a previous school] we had to do a lot of helping with like Google Classroom specifically.
Both Jack and Jenny indicated that they had experiences in conducting professional
development in technology integration in schools in which they previously taught. They
exhibited the characteristics of digital natives. Presky (2001) defines *digital natives* as
the “‘native speakers’ of the digital language of computers, video games and the
Internet” (p. 3).

In the third group were Brandy and Rebecca, demonstrating characteristics of
both digital natives and digital immigrants. Though not the youngest or oldest writers,
they demonstrated ease in learning technology and significant use of technology,
though they were also quick to describe frustrations with technology use. Brandy
described frustrations with access to technology while teaching at a particular school.

Brandy: The school that I came from—this is probably a good history for
you—the school that I came from didn’t have technology for
elementary... . And the last year I was there, I was pushing and
pushing and pushing to get the computers that were left over from
the high school as a computer lab for the elementary, and it never
happened... . So we didn’t have technology available other than
the computer and the screen in my classroom.

Though eager, Brandy also described having difficulty integrating technology as a writer.
She viewed her lack of knowledge with frustration. “Oh, I...I was a bundle of questions!
OK, like, what do I use? How do I put it in? Umm, how do you know? Do I replace the
strategy with the technology?... What am I supposed to do? It was just a lot of
questions... . What do I include? What do I not include? But I guess that was kind of
As to how much I included for the student, it tended toward helping the teacher.

Like Brandy, Rebecca described ease with using technology but also working through issues to integrate technology.

Rebecca: The [informational technology] took a little time. You know, the first time I introduced it, they were not too sure about, about what this was or how this was gonna work, you know? So the first time. You know I... they struggled, but after a couple times of trying it out and umm, persisting with it, they... they really seem to catch on.

Rebecca and Brandy both demonstrated an ease in learning technology but described frustration in its integration.

The perspectives in these three groups toward technology integration seemed to be largely generational. Representative quotes are significant to examine when considering the connection of the three qualitative themes and assumptions to see how this professional development course created participant perception that technology can be integrated with confidence. See Table 5.1 for a summary of the groups of writers.

Table 5.1

*Writers Grouped by Characteristics (Presky, 2001)*

<table>
<thead>
<tr>
<th>Groups of Writers</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics of digital immigrants</td>
<td>Shari</td>
</tr>
<tr>
<td></td>
<td>Emily</td>
</tr>
<tr>
<td>Characteristics of digital natives</td>
<td>Jack</td>
</tr>
<tr>
<td></td>
<td>Jenny</td>
</tr>
</tbody>
</table>
Groups of Writers | Participants
--- | ---
Characteristics of both digital immigrants and natives | Brandy
 | Rebecca

**Struggles in Technology Integration.** Theme 1 of the qualitative data describes how participants voiced struggles in integrating technology both in teaching and in writing educational products. The research assumption is that writers connected struggles in integrating technology in their writing to barriers to integrating technology in their teaching. Struggles in technology integration relate both to negative views of technology and to previous experiences with technology integration in teaching and writing.

**Negative Views of Technology.** Writers from all three groups expressed negative views of technology, including the negative effects of technology on students and frustration using technology.

Writers having the qualities of digital natives expressed more concern over the negative effects of technology on students than writers having the qualities of digital immigrants. Writers in all three groups thought that teachers should have a balanced use of technology considering its negative effects on students. Jack, a digital native, had the most criticism of technology.

Jack: I am concerned about the downsides that come from living in a tech-saturated world. When I taught high school, I saw my students constantly on their phones before and after school, and many told me of how they spent most of their free time playing video games or engaging in social media. I was concerned about the effects this was having on their lives and was reluctant to make
them spend even more time on screens in my class. What I ended up doing was using technology when I saw that it would add value to the lesson, but also having many tech-free lessons so students would learn to think and communicate without the use of digital devices.

Brandy, from group 3, agreed with Jack, though did not express her concerns as strongly. Emily, in contrast to Jack and Brandy, focused on the idea of balance in technology use, considering the negative effects on students, which is interesting for an educator with the characteristics of a digital immigrant. Emily’s goal of balance is the answer to observations of the negative effects of technology on students. Brandy agreed with this conclusion.

Balance is key in technology integration and requires a strategy. Research shows that in the K–12 context, technology integration is largely nonstrategic, teacher-led, and mundane (An & Reigeluth, 2011; Ertmer, 2011; Selwyn et al., 2017). In addition, teachers misalign their pedagogical reasoning and use of technology, though those that integrated technology at high levels expressed reasoning that aligned technology use with student-led strategies (Heintink et al., 2016). Writers in all three groups had a vision of technology integration beyond the common use. The key to avoiding mundane technology integration is professional development, a need that this course supplied (Selwyn et al., 2017; Tarling & Ng’ambi, 2016).

All three groups of writers expressed some level of frustration using technology, though writers exhibiting the characteristics of digital immigrants were quicker to
express frustration. Shari was the most vocal about her difficulties learning about technology. The writers’ frustration with learning technology is all about time, a first-order barrier to technology integration (An & Reigeluth, 2011; Claesgens et al., 2013; Ertmer, 1999, S. Tseng & Yeh, 2019; vanOostveen, 2017). Educators need collaboration time with other educators (vanOostveen, 2017), practice time in professional development (Claesgens et al., 2013; S. Tseng & Yeh, 2019), and planning time (Ertmer, 1999). As noted previously, this professional development course helped overcome this barrier to technology integration.

Another frustration that writers expressed was that of the student responses to technology integration. This frustration is echoed in the research. Selwyn et al. (2017) also noted the common misuse of technology by students and significant time off task, resulting in unmemorable lessons. This is a discouraging reality for many teachers without well-thought-out technology integration.

Writers from all three groups expressed negative views of technology, including the negative effects of technology on students and frustration using technology.

**Previous Experiences with Technology Integration.** Writers from all three groups described both positive and negative previous experiences with technology integration both in their teaching and in their writing.

Writers described technology-infused teaching experiences in their discussion posts, the focus group, and individual interviews. Rebecca, demonstrating characteristics of both digital immigrants and digital natives, described pushing through
the struggles of integrating technology in her teaching to reap the benefits of student learning.

Rebecca: The [informational technology] took a little time. You know, the first time I introduced it, they were not too sure about, about what this was or how this was gonna work, you know? So, the first time. You know I... they struggled, but after a couple times of trying it out and umm, persisting with it, they... they really seem to catch on and...we ended up having some good discussions with that.

Rebecca had an overall positive experience, though not trouble-free. Shari described a negative experience with technology integration in her teaching, though she also described learning from it. Though Shari was the only participant who described a significantly bad experience, it may not be correlated to her self-identification as a digital immigrant. On the other hand, other writers described positive experiences integrating technology in a way that motivated them to continue to learn. Their positive experiences may not correlate to their categorization into one of the three groups.

Inan and Lowther (2010) concluded that age and years of teaching experience do not seem to be the leading factors in predicting teachers’ technology integration.

Teacher perceptions and motivation are some of the most significant barriers to technology integration (Günes & Bahçivan, 2016; Heintink et al., 2016; Rosenberg & An, 2019; Young et al., 2019). Related to this is teacher readiness for technology integration (Inan & Lowther, 2010). Günes and Bahçivan (2016) judged teacher motivation to be the greatest predictor of teachers’ successful technology integration.
Writers from all three groups described how their experience with technology integration affected their mindset toward integrating technology while writing educational content. Writers from all three groups described taking the technology tools from teaching to use in their writing. It was also easier for them to visualize how technology could be used in the classroom. However, lack of technology access had an impact on writers’ ability to integrate technology while writing. A lack of access to technology as a teacher made it difficult for Brandy to integrate technology as a writer. Though Brandy’s knowledge of technology was limited, confusion about how to integrate technology in published materials is a matter of organizational confusion. Several other writers expressed this same organizational confusion in translating a classroom experience to published educational materials. Other writers expressed the lack of access to technology affecting their writing in a different way: lack of finances to access Web 2.0 tools requiring a subscription. These writers often linked this limitation with their teaching experiences.

Writers from all three different groups expressed limitations in integrating technology into their writing based on first-order barriers which stem from a lack of leadership support for technology integration. Leadership support of schools at which writers previously taught limited writers’ technology integration as teachers. Leadership support is a first-order barrier for technology integration (An & Reigeluth, 2011; Ertmer, 1999). Research indicates that educational leadership support for technology integration may be related to the quality of technology integration (Raman et al., 2019; Young et al.; 2019). It is noteworthy that leadership at the publisher that sponsored this
action research project supported some aspects of technology integration but did not support others.

Theme 1 of the qualitative data describes how participants voiced struggles in integrating technology both in teaching and in writing educational products. The research assumption is that writers connected struggles in integrating technology in their writing to barriers to integrating technology in their teaching. All three groups of writers described struggles in integrating technology in their negative views of technology and in previous teaching and writing experiences with technology integration.

**Motivation in Technology Integration.** Theme 2 of the qualitative data describes how participants expressed beliefs and experiences that motivate them to push through struggles to integrate technology into lesson designs. The research assumption is that positive experiences strengthened beliefs that generated motivation to integrate technology. Motivation in technology integration relates to positive views of technology and to shared course experiences.

**Positive Views of Technology.** Writers from all three groups described positive views of technology that motivate them to push through struggles to integrate technology in their past teaching and presently in their writing. These positive views were largely in place before the professional development course. Positive views of technology among writers involved technology integration for engagement, 21st century learning student collaboration, and differentiating instruction through adaptive assessments.
One of the positive views that writers had about technology integration was its ability to boost engagement. Writers from all three groups revealed that they believed that technology integration had the power to engage a variety of students. These positive views of technology integration agree with the research studies cited in Chapter 2 conducted in a variety of settings, with a variety of content, and in varying student populations that technology engages students (Autio et al., 2019; Hediansah & Surjono, 2019). Other positive views of technology of all three groups included the development of 21st century learning, especially to hone collaboration skills in students. These positive views of technology integration agree with the literature, which correlates technology integration with the 21st century skills of collaboration, problem-solving, and critical thinking (Almerich et al., 2020; Aprinaldi et al., 2018; Law et al., 2016).

Jack, one of the digital natives, highlighted the ability of technology to serve individual student needs through differentiated instruction by adaptive assessment. Jack’s positive view of adaptive assessment as a valuable tool of technology integration is one that is highlighted in the research. Other educational publishers are looking to incorporate adaptive assessments to meet teacher needs (McKenzie, 2018). Adaptive assessments are a technology tool that can highly influence learning environments (Farmer et al., 2020).

Writers from all three groups expressed positive views of technology, including technology for engagement, 21st century learning, student collaboration, and differentiating instruction through adaptive assessments.
**Shared Course Experiences.** Writers deepened their positive views and motivation to integrate technology as they developed shared experiences through the course. These shared experiences involved discussion posts on shared values, collaboration in current struggles to integrate technology, and shared learning experiences through the course. Writers with the mindset of digital immigrants, digital natives, or both, experienced these shared course experiences. This knowledge of a shared experience is an early step in transformative learning theory (Mezirow, 1995).

Writers revealed that one of the experience that changed their perception of technology integration was collaborating with Educational Technology Specialists, especially as it related to student-oriented technology integration. This was a critical take-away for several participants. Student-oriented technology integration is a distinctive product of TPACK-in-Action as participants engage in discourse in a social context to express reasoning for technology integration (Ertmer, 1999; Harris & Hoffer, 2009; Heintink et al., 2016).

Writers from all three groups noted that the discussion posts were helpful for sharing thoughts about technology integration. Writers also used the discussion posts to communicate how they shared views of technology integration with other participants. All participants leveraged the discussion posts effectively for learning and sharing the course experience with other participants.

Writers from all three groups expressed positive views of technology and shared course experiences that motivate them to integrate technology. It is notable how strategic this discussion posts were in building this motivation. These discussion posts
proved to be an insightful source of participant discourse and reflections as an assessment of TPACK-in-Action (Harris & Hofer, 2009; Illeris, 2018).

Theme 2 of the qualitative data describes how participants expressed beliefs and experiences that motivate them to push through struggles to integrate technology into lesson designs. The research assumption is that positive experiences strengthened beliefs that generated motivation to integrate technology. All three groups of writers expressed motivation in technology integration because of positive views of technology and because of shared course experiences.

**Confident in Technology Integration.** Theme 3 of the qualitative data describes how participants identified knowledge and skills that give them confidence in integrating technology into lesson designs. The research assertion is that the course was successful in equipping writers with knowledge, skills, and strategies that improved their confidence in integrating technology. Confidence in technology integration relates to new knowledge, new skills, and new strategies gained in the course.

**New Knowledge After the Course.** Writers from all three groups described having gained new knowledge during the course. This knowledge included understanding the strategic nature of student-driven technology and new knowledge of technology tools. Writers having the characteristics of digital immigrants tended to describe a new knowledge of student-driven technology and technology tools, while writers having the characteristics of only digital natives tended to describe a new knowledge of only technology tools.
Participants extensively discussed their views of using video for instruction. They expressed their overreliance on video for technology integration and noted that it is a passive form of instruction for students. Writers acknowledging an overreliance on video were also writers who had mistakenly thought of technology integration as being primarily for the teacher.

Four of the six writers communicated that they had gained knowledge about strategically integrating technology for student use. Writers classified as digital natives already had this view. The knowledge that technology integration is most strategic in the hands of students aligns with research that students’ use of technology helps them develop 21\textsuperscript{st} century skills (Almerich et al., 2020; Aprinaldi et al., 2018; Law et al., 2016). The development of digital literacy is especially effective through student use of Web 2.0 tools (Adiguzel et al., 2020; Railean, 2014; Selwood et al., 2016; Uçak, 2019; Wright & Akgunduz, 2018). Student use of technology is also shown to improve engagement (Kuo-Hung et al., 2016; Hadiansah & Surjono, 2019).

Though writers with the characteristics of digital natives did not wrestle with a misconception of technology integration in the hands of students, they did express appreciation for learning the TPACK framework and for getting ideas to “spice things up.” They described getting the vision to integrate technology into a lesson already strong in content and pedagogy. This vision is notable, as the TPACK framework has a strong presence in academic literature and is widely used for teacher professional development (Green, 2014; Hilton, 2015; Kimmons & Hall, 2019; Kuo, 2015).
Professional development within the real-world context of lesson design has been
demonstrated to be successful in building TPACK knowledge (Açikgül & Aslaner, 2020; S.
Tseng & Yeh, 2019). Building TPACK knowledge involved thinking more holistically about
technology used (Hilton, 2016) and a focus on technology-enabled learning rather than
just technology integration (Green, 2014). This aspect of TPACK was reflected in writers’
conversations about striking a balance with technology use. Ultimately, professional
development using the TPACK framework has been shown to be effective at improving
technology integration (Kuo, 2015; Voithofer et al., 2019; Wright & Akgunduz, 2018).

**New Skills After the Course.** Writers from all three groups—digital natives,
digital immigrants, and those who exhibited characteristics of both—gained new skills in
understanding and using technology tools, especially Web 2.0 tools. Digital natives
noted that they also picked up a few ideas. Emily’s thoughts about the skills she gained
through the course as a writer with the characteristics of a digital immigrant summed it
up well.

Emily: And then also I think I’ll just have a little more confidence that, you
know, I...I could probably find something you know, to make this a
technology activity rather than just waiting and asking, you know, I
...I think I would have a little more knowledge to do that myself
than asking somebody else.

Emily directly related skills gained through the course in the use of Web 2.0 tools to
confidence in integrating technology as her perception. This perception clearly aligns
with research linking professional development in technology integration and the use of
Web 2.0 tools (Sahin-Topalcengiz & Yildirim, 2020; Tarling & Ng’ambi, 2016; Wright & Akgunduz, 2018). This outcome of the course is notable, as educator perceptions and motivation are some of the most significant barriers to technology integration (Günes & Bahçivan, 2016; Heintink et al., 2016; Rosenberg & An, 2019; Young et al., 2019). Readiness and confidence for technology integration is related to educator perceptions and motivations (Inan & Lowther, 2010).

**New Strategies After the Course.** Writers from all three groups gained new strategies from the professional development course. I attribute these new strategies to the TPACK conceptual framework. Writers excitedly described integrating technology into lessons in ways that enhanced the lesson by using technology to complement the content and pedagogy, supported instructional strategies, and give teachers ideas for technology to integrate. Writers indicated that their lesson-writing habits had changed (Harris & Hofer, 2009). Jack, a digital native who noted how he learned about the TPACK framework, linked his new strategy of aiming for TPACK competency with enjoying the use of technology. Brandy, a writer with characteristics of both digital natives and immigrants, described thinking about lesson designs with giving strategies and technology that supported those strategies. Emily, a digital immigrant who gained significant confidence through Web 2.0 use, indicated an intention to implement her new knowledge, skill, and strategies in her lesson writing habits.

Participants from all three groups of writers indicated that they had changed their lesson-writing habits through gaining new knowledge, new skills, and new strategies. This is a key product of TPACK-in-Action (Harris & Hofer, 2009; Paneru, 2018).
All participants expressed confidence in integrating technology by the end of the course, aligning with the process in transformative learning theory in which learners build confidence before reintegrating back into their working environment (Mezirow, 1995). Assessment in this professional development course in technology integration was insightful to actual practice because it involved evaluating lesson materials integrating technology in combination with the use of the TPACK survey (Craciun, 2019; Günes & Bahçivan, 2016; Torun, 2020). Participants gained confidence, but they also gained in the ability to integrate technology with confidence.

Theme 3 of the qualitative data describes how participants identified knowledge and skills that give them confidence in integrating technology into lesson designs. The research assertion is that the course was successful in equipping writers with knowledge, skills, and strategies that improved their confidence in integrating technology. Confidence in technology integration relates to new knowledge, new skills, and new strategies gained in the course.

For Research Question 3, I concluded that participants perceived that technology can be integrated with confidence through completing this professional development course as revealed by participant quotes. Participants in all three groups of writers—those with the qualities of digital natives, digital immigrants, and both digital natives and immigrants—described struggles in technology integration, motivation in technology integration, and growing confidence in technology integration through this professional development course based on codes, categories, themes, and quotes.
Summary of the Discussion. This discussion positioned data collected in the context of the literature and drew conclusions to research questions. I formed these conclusions by interpreting the combined data within the TPACK framework and transformative learning theory as TPACK-in-Action. For Research Question 1, I concluded that the professional development course may have improved Content Writers’ use of technology to meet instructional goals. For Research Question 2, I concluded that the professional development course in technology integration using the TPACK framework may have improved Content Writers’ use of student-oriented technology to support instructional strategies based on participant quotes. For Research Question 3, I concluded that participants perceived that technology can be integrated with confidence through completing this professional development course based on codes, categories, themes, and quotes.

Implications

This action research study investigated a common research problem of professional development in technology integration with a unique population of Educational Content Writers. This combination of problem and population produced unique implications. This section will discuss (1) personal implications for me as the researcher, (2) practical implications for the publishing company of this action research project, and (3) research implications for the field of educational technology.

Personal Implications

Personal implications for this action research involve my research design, participants, and conceptual framework. I experienced the process of action research
through a descriptive research design with significant qualitative findings. I learned about and from my participants, working to shift interpretivist frameworks for technology integration in my participants to reduce marginalization. I observed the effectiveness of the TPACK framework in professional development, building momentum for technology integration in my local context. Each of these personal implications will be discussed.

**Conducting Descriptive Research.** The process of conducting descriptive research taught me how to learn from others through listening. It also taught me how to build a collaborative community in my local context. Conducting descriptive research with a small population of writers necessitated collecting large amounts of qualitative data to give weight to quantitative data that could not be analyzed with inferential statistics because of population size (Adams & Lawrence, 2019; Bloomberg & Volpe, 2016; Halcomb & Hickman, 2015).

Collecting and analyzing qualitative data taught me the discipline and practice of listening carefully to the people I work with most closely to generate empathetic portrayals and thick, rich descriptions within a pragmatic paradigm (Frels & Onwuegbuzie, 2013; Tracy, 2020). The habit of careful, empathetic listening and reflective analysis is a healthy practice to foster in any working environment. There is much benefit from learning the practice of qualitative analysis within the context of action research to solve local problems and create local improvement (Mertler, 2020; O’Gorman & MacIntosh, 2014).
The process of conducting descriptive research also taught me how to build a collaborative community in my local context. I viewed participants in this action research project as collaborators by contributing to the data and even the design to bring about positive change (Herr & Anderson, 2005; Mertler, 2020; Tracy, 2020). One of the significant findings in the qualitative analysis was gathering feedback to improve the professional development course for further iterations of research as well as unearthing areas in which leadership can provide greater support for technology integration (Tarling & Ng’ambi, 2016; Teo et al.; 2021). The skill in listening with reflexivity (Creswell, 2017) has great profit for creating a collaborative community with shared experiences (Herr & Anderson, 2005; Mezirow, 1994).

**Shifting Interpretivist Frameworks for Technology Integration.** Very quickly after beginning the professional development course during this action research project, I observed an interpretivist framework emerge among my participants that seemed to shape their perceptions of their ability to integrate technology. This interpretivist framework is best described as deterministic (Creswell & Poth, 2018). This interpretive framework was that of “digital native” and “digital immigrant” (Prensky, 2001). I have even heard an older employee at my organization refer to herself as a “digital alien.”

I consider this interpretivist framework as potentially oppressive and marginalizing. My participants may consider themselves deficient in using technology in education because of their age. Quotes from individual interviews coded with *low view of self* reflected this framework at work in selected participants. The potential for marginalization is especially true as the writers have an average age that is older than
the average ages of other departments. Younger writers in my organization may consider themselves more technologically savvy than older writers. However, research has demonstrated that the age of the educator is not a significant factor in the use of Web 2.0 tools and the development of TPACK competencies (Inan & Lowther, 2010). A more significant factor is educator attitudes toward technology integration (Günes & Bahçivan, 2016; Heintink et al., 2016; Rosenberg & An, 2019; Young et al., 2019). This also calls to mind the fixed mindset and growth mindset framework described by Dweck (2006). The work to transform a fixed mindset to a growth mindset is significant (Bernard et al., 2017; Mezirow, 1994).

I observed that participants who identified as digital immigrants demonstrated excellent technology integration and growing TPACK competency. Though they had to work harder to learn Web 2.0 tools, they persevered with good results. When describing past experiences with technology integration, even digital immigrants described mentoring other teachers in learning technology. In future iterations of this professional development course (Mertler, 2020), I intend to help participants shift the deterministic interpretivist framework of digital natives and digital immigrants to help them develop TPACK competencies with confidence (Tarling & Ng’ambi, 2016; Wright and Akgunduz, 2018).

**Observing the Effectiveness of TPACK.** Though the SAMR model of technology integration has a large following among practitioners (Puentadora, 2006), I chose to use the TPACK framework (Koehler & Mishra, 2006, 2009) because of its significant effectiveness for professional development in technology integration in the literature
(Kuo, 2015; Voithofer et al., 2019; Wright & Akgunduz, 2018). The TPACK framework was new to those at the educational publisher at which this action research was conducted. I observed how practical the TPACK framework was for my participants to grasp and apply to their work.

There is potential for greater leverage of the TPACK framework as the Educational Technology Specialists continue to work with writers and instructors for more strategic technology integration, especially in connection with the Technology Integration Rubric (Harris et al., 2010). There is also potential for professional development beyond the writers and instructors at the educational publisher under study. This professional development course offers inspiration and opportunities for me to offer professional development to the teachers that use the educational products produced by the publisher of this action research project.

**Building Momentum in Technology Integration.** The participants in this action research exhibited a sense of adventure and a feeling of being appreciated, perceptions that were enhanced by management support through compensation for participants. Participation in action research (Mertler, 2020) as well as a realization of shared experience (Mezirow, 1994) fostered a unity of spirit and a respect for fellow participants. My aim was to realize research goals shared by participants in my professional community, with emphasis on contributing to this community with compassion and integrity. The focus group ending the professional development course crescendoed with a spirit of curiosity and innovation. Further iterations of this
professional development course have the potential to build on this momentum in technology integration, using these initial participants as mentors.

Personal implications discussed for this action research included learning through conducting descriptive research, working to shift interpretivist frameworks for technology integration in my participants to reduce marginalization, observing the effectiveness of the TPACK framework in professional development, and building momentum for technology integration.

Practical Implications

Practical implications for this action research include improving the professional development course that this action research project employed and continuing to offer the improved course to more employees in my local context.

Improving the Course. Improvements to the professional development course that this action research employed were informed by qualitative data gathered through discussion posts, the focus group, and individual interviews. Improvements to the professional development course include setting more context for the TPACK survey, adding a written, model lesson applying TPACK, adding more technology tools, organizing tools by function as well as by content, and involving previous participants as mentors.

Setting More Context for the TPACK Survey. Four out of the six participants were confused by the initial application of the TPACK survey (Schmidt, 2009), especially by the content sections of the survey. A few sentences explaining the purpose and structure of the survey should alleviate this confusion.
**Adding a Model TPACK Lesson.** One participant suggested adding a written lesson that modeled TPACK competency, a recommendation that aligns with research suggesting that facilitators model best practices in technology integration for best results in professional development (An & Reigeluth, 2011; Ertmer, 1999; Tondeur et al., 2020). Providing a written model rather than a video model will facilitate transfer to the natural setting of the challenges of technology integration as writers prepare lessons (Açikgül & Aslaner, 2020; Flick, 2009; J.-J. Tseng, 2019). If time and resources permit, adding a model lesson for different subject areas of content would facilitate transfer for the TPACK framework in content-specific applications (An & Reigeluth, 2011; Harris et al., 2009). Having participants meet to discuss the model would further expand the learning and promote reflection (Goodnough & Murphy, 2017).

**Adding More Technology Tools.** Writers requested more technology tools that involve not just exposure to the tools but practice in using the tools (Harris et al., 2009). Several tools that were offered to the writers in the course for exposure could be implemented into course activities for more active practice through guided inquiry (Irdalisa et al., 2020).

**Organizing Tools by Function and Content.** Though several writers described that they explored technology tools related to their content area, other writers expressed interest in having tools organized by function. Having technology tools organized by function and content would promote flexibility of learning and give options for customization while preserving the content and pedagogy connections of the technology (Harris et al., 2009).
**Involving Mentor Writers.** Involving writers who were previously participants in this professional development course aligns with research on professional development providing a knowledgeable facilitator and mentor (Tondeur et al., 2020; vanOostveen, 2017; Voogt et al., 2016). This improvement to the course also aligns with steps in transformative learning theory (Mezirow, 1995) and encourages implementation through active practice. Collaboration with a previous participant is especially effective if the mentor writer shares the area of content with the mentoree (Açıkgül & Aslaner, 2020; Cranton, 2002; Heintink et al., 2016). Involving previous participants also aligns with the personal implication of building momentum for technology integration in my local context.

Improvements to the professional development course include setting more context for the TPACK survey, adding a written, model lesson applying TPACK, adding more technology tools, organizing tools by function as well as by content, and involving previous participants as mentors.

**Offering the Improved Course.** After improving the course, it should be offered again to other writers that were unable to participate in this action research project in the first iteration. Offering the course a second time is consistent with the iterative nature of action research (O’Gorman & Maclntosh, 2014; Mertler, 2020). When I extended an initial invitation to writers to participate in the professional development course, several writers indicated that they were interested but were unable to participate for a variety of reasons. Offering the course a second time will give these writers an opportunity to participate.
The population of this research was Educational Content Writers who share many characteristics with pre-service and in-service teachers. Literature on professional development in technology integration was applied to this population through induction (Barnes, et al., 2005; Eldredge et al., 2014). However, the educational publisher that employs writers also employs Digital Instructors. The Digital Instructors share all of the same characteristics as Educational Content Writers and pre-service teachers (see Table 2.1 on p. 205), allowing the literature to be applied to the population of Digital Instructors as well. It logically follows that Digital Instructors could gain the same benefits as the writers if this professional development course is also offered to this population in my local context.

In the first iteration of this professional development course, the Educational Technology Specialists acted as facilitators. Quotes from participants that their mentorship was effective have been noted. In future iterations of this professional development course, Educational Technology Specialists should continue to be involved to provide participants the benefits of their involvement (Tondeur et al., 2020; vanOostveen, 2017; Voogt et al., 2016) and raise awareness of the value and role of this department.

Practical implications for this action research include improving the professional development course that this action research project employed and continuing to offer the improved course to more employees in my local context. Improvements to the professional development course include setting more context for the TPACK survey, adding a written, model lesson applying TPACK, adding more technology tools,
organizing tools by function as well as by content, and involving previous participants as mentors. When the improved course is offered, the invitation should be extended to writers who were unable to participate the first time and to Digital Instructors. Educational Technology Specialists should also continue to function as facilitators.

**Research Implications**

There is a large body of literature on professional development in technology integration. Of the literature reviewed, no research probed my population of study, Educational Content Writers. The lack of research studies on Educational Content Writers is most likely due to the availability of participants from such a population for study and represents a gap in the literature. Possible future research could explore the effect of professional development on this population. This research is especially strategic to consider, as Educational Content Writers have a more wide-reaching influence on students than teachers (Simba Information, 2019). This influence on students is growing through digital resources and courseware (Simba Information, 2019).

**Limitations**

The conclusions of this action research were triangulated with multiple data sources and aligned with literature on professional development in technology integration (Belzer & Ryan, 2013; Flick, 2009). Limitations in the research methods are important to consider and report for honesty and trustworthiness (Greener, 2018; Nowell et al., 2017). The participants of this action research study had a significant and unique effect on the generalizability of the findings. There is a lack of research on the
effects of professional development on Educational Content Writers, representing a gap in the literature. The Educational Content Writers in my local context may not be representative of the writers at other educational publishers, a characteristic consistent with mixed methods action research (Creswell, 2014; Mertler, 2020) and a dissertation in practice (Belzer & Ryan, 2013). Because writers volunteered to participate in this professional development course, the participants may have exhibited volunteer bias (Brownell et al., 2013). Participants may or may not represent the viewpoints and mindset of other writers in my local context or at other publishers (Belzer & Ryan, 2013; Saldaña, 2013).

The most significant limitation to generalizability was the sample size \(n = 6\) generating the descriptive approach to this action research (Creswell & Poth, 2018). However, thick, rich descriptions and participant narratives and viewpoints gave a deeper view into the struggles, motivations, and confidence that participants associated with this professional development course (Saldaña, 2013; Tracy, 2020). Descriptive data produced helpful feedback for improvements to the course for future iterations. In the next round of action research, I will extend the invitation to participate in the professional development course to a wider population including both Educational Content Writers and Digital Instructors with the potential of generating statistically significant results (Adams & Lawrence, 2019; Plano Clark & Ivankova, 2016).

This action research project used the TPACK survey (Schmidt et al., 2009) a common tool for the quantitative assessment of professional development in technology integration employing the TPACK framework. This survey is a self-reporting
instrument. Scherer et al. (2017) has demonstrated no significant differentiation in measurements of the T-dimensions with the application of the TPACK survey. In addition, researchers have recognized that using solely a TPACK survey for assessing the effectiveness of professional development can give an inaccurate assessment of teachers’ ability to connect theory with practice in technology integration (Craciun, 2019; Koh et al., 2015; Rolando et al., 2021; Schmidt et al., 2009; Torun, 2020). Teachers can misalign their pedagogical reasoning and use of technology (Heintink et al., 2016). This research design met the challenge of using a self-reporting instrument by combining the use of the TPACK survey with direct assessment of lesson designs through the Technology Integration Assessment Rubric (Harris et al., 2010).

This action research had limitations in its findings. The sample size prevented inferential analysis of pretest and posttest scores on the TPACK survey and the pretest and posttest analysis of lessons with the Technology Integration Assessment Assessment Rubric to determine statistical significance (Adams & Lawrence, 2019). In addition to the small sample size, the effectiveness of providing models of TPACK for building TPACK competencies was unable to be determined because of insufficient qualitative data (Creswell & Poth, 2018). An additional limitation to the findings is that I was the only researcher scoring lessons using the Technology Integration Assessment Rubric, preventing determinations of interrater reliability to safeguard accuracy of measurement (McHugh, 2012).
Closing Thoughts

Educational Content Writers can integrate technology with confidence through completing professional development that integrates an effective conceptual framework (Kimmons & Hall, 2017; J.-J. Tseng, 2019). Professional development for writers is more strategic than professional development for teachers. Writers have a more wide-reaching influence on students than teachers because they can affect the learning environments of hundreds of classrooms and thousands of students (Simba Information, 2019). Textbook publishers are one of the most common providers of standards-based instructional materials. These materials can integrate technology to profoundly influence the learning environment in strategic ways (Aprinaldi et al., 2018; Coskun et al., 2017; Selwyn et al., 2017).

Integrating technology into educational materials can help students develop 21st century skills such as critical thinking, collaboration, and authentic problem solving (Coskun et al., 2017; M. Miller, 2017; Tarling & Ng’amb, 2016). Teachers can use educational materials that develop 21st century skills (Partnership for 21st Century Learning, 2019) to prepare students to be well-equipped, future contributors to their communities (Business Roundtable, 2013; Dintersmith, 2019; Johnson, 2009; Sixt, 2020).
REFERENCES


https://stemeducationguide.com/stem-education-statistics/#STEM_Workforce_Statistics


https://eric.ed.gov/?id=EJ1308218


[https://doi.org/10.1080/10494820.2018.1486785](https://doi.org/10.1080/10494820.2018.1486785)

[https://files.eric.ed.gov/fulltext/EJ1118367.pdf](https://files.eric.ed.gov/fulltext/EJ1118367.pdf)


[https://digitalcommons.unomaha.edu/cgi/viewcontent.cgi?article=1014&context=tedfacproc](https://digitalcommons.unomaha.edu/cgi/viewcontent.cgi?article=1014&context=tedfacproc)


Kruger, N. (2019). Preparing students for jobs that don’t exist [Web article]. https://www.iste.org/explore/ISTE-blog/Preparing-students-for-jobs-that-don%27t-exist


https://www.jstor.org/stable/jeductechsoci.19.3.72?seq=1#metadata_info_tab_contents


https://doi.org/10.19173/irrodl.v20i4.4224


https://eric.ed.gov/?id=ED204262


McKenzie, L. (2018, December 12). Shifting focus of publishers signals tough times for textbook authors [Web article].


http://dx.doi.org/10.1177/074171367802800202

https://doi.org/10.1177/074171369204200309


https://doi.org/10.33499/edren.v8i1.117


http://dx.doi.org/10.1108/10748120110424816


http://dx.doi.org/10.15388/infedu.2014.06


231


APPENDIX A

TPACK SELF-ASSESSMENT SURVEY (Schmidt et al., 2009)*

Technology is a broad concept that can mean a lot of different things. For this questionnaire, technology is referring to digital technology/technologies. That is, the digital tools we use such as computers, laptops, iPods, handhelds, interactive whiteboards, software programs, etc. Please answer all the questions, and if you are uncertain of or neutral about your response you may always select “Neither Agree or Disagree.”

Table A.1

TPACK Self-Assessment Survey

<table>
<thead>
<tr>
<th>TK (Technology Knowledge)</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree or Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I know how to solve my own technical problems.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I can learn technology easily.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I keep up with important new technologies.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I frequently play around with technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree or Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>----------</td>
<td>--------------------------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>5. I know about a lot of different technologies.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I have the technical skills I need to use technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CK (Content Knowledge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I have sufficient knowledge about mathematics.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I can use a mathematical way of thinking.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I have various ways and strategies of developing my understanding of mathematics.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Social Studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I have sufficient knowledge about social studies.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I can use a historical way of thinking.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I have various ways and strategies of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree or Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
<td>----------</td>
<td>---------------------------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td>developing my understanding of social studies.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Science</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>I have sufficient knowledge about science.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>I can use a scientific way of thinking.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>I have various ways and strategies of developing my understanding of science.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Literacy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>I have sufficient knowledge about literacy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>I can use a literary way of thinking.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>I have various ways and strategies of developing my understanding of literacy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PK (Pedagogical Knowledge)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>I know how to assess student performance in a classroom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>I can adapt my teaching based upon what students</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree or Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
<td>----------</td>
<td>---------------------------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>21.</td>
<td>I can adapt my teaching style to different learners.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>I can assess student learning in multiple ways.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>I can use a wide range of teaching approaches in a classroom setting.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>I am familiar with common student understandings and misconceptions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>I know how to organize and maintain classroom management.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PCK (Pedagogical Content Knowledge)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>26.</td>
<td>I can select effective teaching approaches to guide student thinking and learning in mathematics.</td>
</tr>
<tr>
<td>27.</td>
<td>I can select effective teaching approaches to guide student thinking and learning in literacy.</td>
</tr>
<tr>
<td></td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
</tr>
<tr>
<td>28.</td>
<td>I can select effective teaching approaches to guide student thinking and learning in science.</td>
</tr>
<tr>
<td>29.</td>
<td>I can select effective teaching approaches to guide student thinking and learning in social studies.</td>
</tr>
<tr>
<td><strong>TCK (Technological Content Knowledge)</strong></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>I know about technologies that I can use for understanding and doing mathematics.</td>
</tr>
<tr>
<td>31.</td>
<td>I know about technologies that I can use for understanding and doing literacy.</td>
</tr>
<tr>
<td>32.</td>
<td>I know about technologies that I can use for understanding and doing science.</td>
</tr>
<tr>
<td>33.</td>
<td>I know about technologies that I can use for understanding and doing social studies.</td>
</tr>
<tr>
<td><strong>TPK (Technological Pedagogical Knowledge)</strong></td>
<td></td>
</tr>
</tbody>
</table>
34. I can choose technologies that enhance the teaching approaches for a lesson.

35. I can choose technologies that enhance students’ learning for a lesson.

36. My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.

37. I am thinking critically about how to use technology in my classroom.

38. I can adapt the use of the technologies that I am learning about to different teaching activities.

39. I can select technologies to use in my classroom that enhance what I teach, how I
<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree or Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>I can use strategies that combine content, technologies and teaching approaches that I learned about in my coursework in my classroom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>I can choose technologies that enhance the content for a lesson.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>I can write lessons that appropriately combine mathematics, technologies and teaching approaches.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>I can write lessons that appropriately combine literacy, technologies and teaching approaches.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
45. I can write lessons that appropriately combine science, technologies and teaching approaches.

46. I can write lessons that appropriately combine social studies, technologies and teaching approaches.

*Note: Only questions 1–46 were used, at the recommendation of the researcher. Note that Questions 43–46 were altered to serve this study’s participants. See Table A.2 for changes to the original survey questions.

**Table A.2**

*Revised Questions on TPACK Self-Assessment Survey*

<table>
<thead>
<tr>
<th>Original survey question</th>
<th>Revised Survey Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. I frequently play around the technology.</td>
<td>4. I frequently play around with technology.</td>
</tr>
<tr>
<td>43. I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.</td>
<td>43. I can write lessons that appropriately combine mathematics, technologies and teaching approaches.</td>
</tr>
<tr>
<td>44. I can teach lessons that appropriately combine literacy, technologies and teaching approaches.</td>
<td>44. I can write lessons that appropriately combine literacy, technologies and teaching approaches.</td>
</tr>
<tr>
<td>Original survey question</td>
<td>Revised Survey Question</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>45. I can teach lessons that appropriately combine science, technologies and teaching approaches.</td>
<td>45. I can write lessons that  appropriately combine science, technologies and teaching approaches.</td>
</tr>
<tr>
<td>46. I can teach lessons that appropriately combine social studies, technologies and teaching approaches.</td>
<td>46. I can write lessons that  appropriately combine social studies, technologies and teaching approaches.</td>
</tr>
</tbody>
</table>
APPENDIX B

TECHNOLOGY INTEGRATION ASSESSMENT RUBRIC

Table B.1

*Technology Integration Assessment Rubric (Harris et al., 2010)*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Goals &amp; Technologies</strong></td>
<td>Technologies selected for use in the instructional plan are <strong>strongly aligned</strong> with one or more curriculum goals.</td>
<td>Technologies selected for use in the instructional plan are <strong>aligned</strong> with one or more curriculum goals.</td>
<td>Technologies selected for use in the instructional plan are <strong>partially aligned</strong> with one or more curriculum goals.</td>
<td>Technologies selected for use in the instructional plan are <strong>not aligned</strong> with any curriculum goals.</td>
</tr>
<tr>
<td><strong>Instructional Strategies &amp; Technologies</strong></td>
<td>Technology selection(s) are <strong>exemplary</strong>, given curriculum goal(s) and instructional strategies.</td>
<td>Technology selection(s) are <strong>appropriate</strong>, but not <strong>exemplary</strong>, given curriculum goal(s) and instructional strategies.</td>
<td>Technology selection(s) are <strong>marginally appropriate</strong>, given curriculum goal(s) and instructional strategies.</td>
<td>Technology selection(s) are <strong>inappropriate</strong>, given curriculum goal(s) and instructional strategies.</td>
</tr>
<tr>
<td>(Using technology in teaching/learning)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technology Selection(s)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Compatibility with curriculum goals &amp; instructional strategies)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

243
<table>
<thead>
<tr>
<th>Criteria</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Fit&quot; (Content, instructional strategies and technology fit together)</td>
<td>Content, instructional strategies and technology <strong>fit together strongly</strong> within the instructional plan.</td>
<td>Content, instructional strategies and technology <strong>fit together within</strong> the instructional plan.</td>
<td>Content, instructional strategies and technology <strong>fit together somewhat</strong> within the instructional plan.</td>
<td>Content, instructional strategies and technology <strong>do not fit together within</strong> the instructional plan.</td>
</tr>
</tbody>
</table>
APPENDIX C

FOCUS GROUP PROTOCOL

Purpose Statement

The purpose of this focus group is to gather qualitative data to compare participants’ perceptions of technology integration before and after professional development in technology integration to discern changes in perception because of collaboration. All focus group protocol questions align with Research Question 3, “How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?” Variables measured include professional development, perceptions, and technology integration.

Focus Group Protocol and Script

Introductory Script

Thank you all for being willing to meet with me today and for working together in the professional development course. As a follow-up to that course, I will be asking you all a series of questions regarding your feelings, thoughts, and perspectives on integrating technology into educational products from both before and after the professional development course regarding collaboration. I plan to take notes during this interview as well as record this interview. I expect this focus group to take no longer than a half hour.
You are not obligated to participate and may withdraw at any time. Do I have your consent to participate in and record this interview? Do you have any questions for me? (Answer questions as needed.) Are you ready to begin?

Let’s dive in.

**Table C.1**

*Research Questions and Interview Questions Alignment*

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Interview Questions</th>
</tr>
</thead>
</table>
| RQ 3 How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework? | 1. Did collaborating with the Educational Technology Specialists change your perceptions of technology integration (Harris & Hofer, 2009)?  
  
  1A. What barriers to technology integration did collaborating with the Educational Technology Specialist remove for you?  
  1B. How did collaborating with the Educational Technology Specialist affect the difficulty of technology integration?  
  1C. How did collaborating with the Educational Technology Specialist affect your confidence in technology integration?  
  1D. How did collaborating with the Educational Technology Specialist affect your ability to enjoy integrating technology? |
|                   | 2. Did collaborating with other writers change your perceptions of technology integration (Harris & Hofer, 2009)? If so, how?  
  
  2A. What barriers to technology integration did collaborating with other writers remove for you?  
  2B. How did collaborating with other writers affect the difficulty of technology integration?  
  2C. How did collaborating with other writers affect your confidence in technology integration?  
  2D. How did collaborating with other writers affect your ability to enjoy integrating technology? |
<p>|                   | 3. Did your educational beliefs change because of the professional development and collaboration (Heintink et al., 2016; Mezirow, 1994)? If so, how? |</p>
<table>
<thead>
<tr>
<th>Research Question</th>
<th>Interview Questions</th>
</tr>
</thead>
</table>
| 3A. Describe what experience began the change in your educational beliefs.  
3B. Describe how your educational beliefs changed. |

4. Will you approach lesson design differently because of collaboration in this professional development course? If so, how? (An & Reigeluth, 2011; Harris & Hofer, 2009, 2010; Rosenberg & An, 2019)?

5. What suggestions do you have to improve the course to affect others’ perceptions of technology integration?

5A. Were the opportunities for collaboration in the course appropriate for affecting perception? Why or why not?

5B. How did collaborating with other writers affect your perception of technology integration?

**Conclusion Script**

The questions I asked you today are based on research on educational technology integration. I will use the information you gave me today to evaluate how your perceptions of technology integration changed because of the professional development course you took. In summary, you reported that you felt/thought_____ before professional development, and afterward you reported that you felt/thought_____. Is this an accurate summary of your feedback? Is there anything else you would like to share or discuss? Thanks for giving me this information. I hope this research study will benefit writers, our company, teachers, and their students. Do you have any further questions? If you think of questions or ideas to share later, feel free to stop in my office or send an email or chat. Do I have your permission to do the same for you? Thank you for being a part of this focus group!
APPENDIX D

INTERVIEW PROTOCOL

Purpose Statement

The purpose of this interview is to gather qualitative data to compare participants’ perceptions of technology integration before and after professional development in technology integration to discern changes in perception. All interview protocol questions align with Research Question 3, “How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework? Variables measured include professional development, perceptions, and technology integration.

Interview Protocol and Script

Introductory Script

Thank you for being willing to meet with me today and for your hard work in the professional development course. As a follow-up to that course, I will be asking you a series of questions regarding your feelings, thoughts, and perspectives on integrating technology into our company’s educational products from both before and after the professional development course. I will not be asking you for any identifying information in this interview for purposes of privacy, though I will collect some demographic information. I plan to take notes during this interview as well as record this interview. I expect this interview to take no longer than an hour.
You are not obligated to participate and may withdraw at any time. Do I have your consent to participate in and record this interview? Do you have any questions for me? (Answer questions as needed.) Are you ready to begin?

Let’s dive in.

First, let me ask you a few questions about your background.

• How long have you been writing at our company? (Inan & Lowther, 2010)
• How long did you teach before writing at our company? (Inan & Lowther, 2010)
• What is your educational background?

Table D.1

Research Questions and Interview Questions Alignment

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Interview Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ 3 How do participants’ perceptions of technology integration change with the completion of professional development using the TPACK framework?</td>
<td>Before Professional Development</td>
</tr>
<tr>
<td></td>
<td>1. Describe your experiences integrating technology integration before the TPACK professional development course (Ertmer, 2011).</td>
</tr>
<tr>
<td></td>
<td>1A. What is one of your most memorable experiences (for good or bad) in integrating technology before the TPACK professional development course?</td>
</tr>
<tr>
<td></td>
<td>1B. How did others respond to this effort in technology integration?</td>
</tr>
<tr>
<td></td>
<td>1C. Are there any other instances of technology integration that stand out in your mind? Describe them for me.</td>
</tr>
<tr>
<td></td>
<td>2. Describe your readiness and confidence in integrating technology integration before the TPACK professional development course (Inan &amp; Lowther, 2010).</td>
</tr>
<tr>
<td></td>
<td>2A. How did your teaching experience prepare you to integrate technology before the TPACK professional development course?</td>
</tr>
<tr>
<td></td>
<td>2B. Describe a time you tried to help someone else integrate technology before the TPACK professional development.</td>
</tr>
<tr>
<td>Research Question</td>
<td>Interview Questions</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>3. Did you feel you had difficulties integrating technology before the professional development (Mouza, 2011)?</td>
<td>What difficulties did you experience?</td>
</tr>
<tr>
<td>After Professional Development</td>
<td></td>
</tr>
</tbody>
</table>
| 4. Did the TPACK professional development course change your perceptions of technology integration (Mezirow, 1994)? If so, how? Was the change negative or positive? | 4A. What barriers to technology integration did the course remove for you?  
4B. How did the course affect the difficulty of technology integration?  
4C. How did the course affect your confidence in technology integration?  
4D. How did the course affect your ability to enjoy integrating technology? |
| 5. Did your educational beliefs change because of the professional development (Heintink et al., 2016; Mezirow, 1994)? If so, how? | 5A. Describe what experience began the change in your educational beliefs.  
5B. Describe how your educational beliefs changed. |
| 6. Will you approach lesson design differently because of this professional development course? If so, how? (An & Reigeluth, 2011; Harris & Hofer, 2009, 2010; Rosenberg & An, 2019)? | |
| 7. What suggestions do you have to improve the course to affect others' perceptions of technology integration? | 7A. Was the length of the course appropriate for affecting perceptions? Why or why not?  
7B. Were the activities of the course appropriate for affecting perception? Why or why not? |

**Conclusion Script**

The questions I asked you today are based on research on educational technology integration. I will use the information you gave me today to evaluate how your perceptions of technology integration changed because of the professional development course you took. In summary, you reported that you felt/thought_____
before professional development, and afterward you reported that you
felt/thought_____. Is this an accurate summary of your feedback? Is there anything else
you would like to share or discuss? Thanks for giving me this information. I hope this
research study will benefit writers, our company, teachers, and their students. Do you
have any further questions? If you think of questions or ideas to share later, feel free to
stop in my office or send an email or chat. Do I have your permission to do the same for
you? Thank you for participating in this interview!