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The Impact of Technology Enhanced Learning on Pedagogy: A Case Study

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Walden University
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Abstract

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Dissertation Submitted in Partial Fulfillment

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Abstract

Despite the growing trend of technology-enhanced learning (TEL) tools being integrated into pedagogy, there have been challenges preventing the transformation of pedagogy. This has included limited research on understanding why the increase in TEL integration has not resulted in movement from replacing to transforming pedagogy. The purpose of this qualitative explanatory single case study was to determine why teachers integrating TEL tools and applications have not done so in a way that transforms how teaching and learning occur. The conceptual framework of replacement, amplification, and transformation was used to examine levels of integration in this study. Participants were seven teachers of 7^{th}-12^{th} grades at a school in the Midwest. Data sources included 1-to-1 interviews, a focus group interview, and follow-up interviews. Data analysis included open and axial coding and transforming codes into categories and themes. Findings showed that what impedes movement from replacement to transforming pedagogy include seamless use, compatibility, lack of formal professional development, and a teacher-centered point of view with integrating TEL tools and applications. Findings also showed new ways of collaborating with the integration of TEL tools, including applications. The collaboration exhibited a level of transformation where traditional methods of pedagogy moved from teacher-centered to student-centered practices. This research can contribute to a positive social change by informing teachers and administrators of the challenges that limit the integration of TEL tools and applications.

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Table of Contents

List of Tables vii

List of Figures viii

Chapter 1: Introduction to the Study 1

Introduction 1

Background of the Study 2

Problem Statement 5

Purpose of the Study 6

Research Questions 8

Main Research Question 8

Subquestions 8

Conceptual Framework 8

Nature of the Study 9

Definitions 10

Assumptions 13

Scope and Delimitations 13

Limitations 15

Significance 15

Significance to Practice 16

Significance to Theory 18

Significance to Social Change 18

Summary 19

Chapter 2: Literature Review 21
Introduction 21
Literature Search Strategy 22
Conceptual Framework 23
Technological, Pedagogical, and Content Knowledge 25
Literature Review Related to Key Variables and Concepts 37
Domains of Pedagogy With Digital Technology Integration 37
Effects of Technology-Enhanced Learning Tools on Instruction 38
Effects of Digital Mobile Technology on Learning 44
Effects of Technology-Enhanced Learning Tools on Curriculum Development 49
The Impact of Technology-Enhanced Learning Tools on Professional Development 50
Summary and Conclusions 55
Chapter 3: Research Method 57
Introduction 57
Research Design and Rationale 57
Main Research Question 58
Subquestions 58
Case Study Rationale 59
Other Qualitative Approaches 60
Role of the Researcher 63

Methodology 64
Participant Selection Logic 64
Instrumentation 65
Procedures for Recruitment, Participation, and Data Collection 68
Data Analysis Plan 71
Issues of Trustworthiness 75
Credibility 76
Transferability 77
Dependability 77
Confirmability 78
Ethical Procedures 79
Summary 79
Chapter 4: Results 82
Introduction 82
Main Research Question 82
Subquestions 82
Setting 85
Demographics 85
Data Collection 86
Invitation Letter to Participate 87
Recruitment in the Setting 88
Interview Settings 89

Individual Interviews 90
The Focus Group Interview 91
Follow-up Interview 91
Variation in Data Collection 92
Individual Interviews 95
Focus Group Interview 112
Follow-up Interview 115
Themes From the Data Analysis 116
Evidence of Trustworthiness 119
Credibility 119
Transferability 119
Dependability 120
Confirmability 121
Results 122
Theme 1: The Integration of TEL Tools and Applications Is Teacher-Centered 123
Theme 2: Compatibility and Being Seamless Are Challenges in Raising the Level of TEL Integration 125
Theme 3: TPACK Is Nonexistent With Informal Professional Development 127
Theme 4: Collaboration Impacts Pedagogy Across Students and Teachers With TEL Integration 128

Subquestions 130
Theme 1: Traditional Methods of Presenting Knowledge Are Replaced With TEL Tools and Applications 130
Theme 2: Efficiency Created by the Integration of TEL Tools and Application Into Instruction 132
Theme 3: Instruction Is Accessed in a New Way, Not Necessarily Transformed 134
Theme 1: Traditional Hardcopy Textbooks, Along With Paper Assignments, Are Replaced by Digital Copies 136
Theme 2: Curriculum Is Accessible and Exchanged Beyond the Classroom 137
Theme 3: Access and Enrichment With Curriculum That May Not Be Possible Without TEL Tools and Applications 138
Theme 1: Replacement in Learning 139
Theme 2: Efficiency in Learning 140
Theme 3: Transformation in Learning 140
Summary 141
Chapter 5: Discussion, Conclusion, and Recommendations 144
Introduction 144
The Integration of TEL Tools and Applications Was Teacher-Centered Focused 145
The Integrations to TEL Tools and Applications Were Not Seamless 147
Professional Development Is Limited to Personal Experience 148

The Integration of TEL Tools and Applications Changed How Students Collaborate 149
The Components of the TPACK Apply in Different Ways 150
Limitations of the Study 152
Recommendations 153
Implications 155
Implications for Social Change 155
Implications for the Conceptual Frameworks of SAMR and RAT 156
Implications for Practice 156
Conclusions 157
References 159
Appendix A: Circle of Influence Sample Diagram 173
Appendix B: Data Collection Interview Request 174
Appendix C: Alignment of Research Question to Interview Questions 176
Appendix D: Alignment of Research Question to Focus Group Questions 178

List of Tables

Table 1. Other Types of Research Methodologies 62

Table 2. Instrument Outline 67

Table 3. Replace, Amplify, or Transform Framework Precoding Table 72

Table 4. Summary of Themes That Align With the Research Questions 84

Table 5. Participant Demographics 86

Table 6. Circle of Influence Open Coding, Categories, and Meaning 110

Table 7. Individual Coding, Categories, and Meanings 111

Table 8. Focus Group In Vivo Coding With Meanings 113

Table 9. Follow-up Interview In Vivo Coding With Meanings 116

Table 10. Meanings to Themes 117

Table 11. Participants' Perceptions of Technology-Enhanced Learning Tools Integration as Teacher-Centered 124

Table 12. Perceptions of Professional Development Among Technology Integration Specialists 128

Table 13. Participant Anecdotes Equating Instruction to Replacement 131

List of Figures

Figure 1. Process map of technological pedagogical and content knowledge to replace, amplify, or transform pedagogy 9

Figure 2. Replace, amplify, or transform assessment framework. 36

Figure 3. Digital technology pedagogy. 38

Figure 4. Research design. 80

Figure 5. Teacher A circle of influence map 96

Figure 6. Teacher B circle of influence map 99

Figure 7. Teacher C circle of influence map 101

Figure 8. Teacher D circle of influence map 103

Figure 9. Teacher E circle of influence map 105

Figure 10. Teacher F circle of influence map 106

Figure 11. Teacher G circle of influence map 108

Figure 12. Themes related to the main research question. 122

Figure 13. Themes related to Subquestion 1. 130

Figure 14. Themes related to Subquestion 2. 136

Figure 15. Themes related to Subquestion 3. 139

Chapter 1: Introduction to the Study

Introduction

To prepare students for the technological society of the future, teachers need to foster a learning environment where students have technology experiences that enhance and transform their learning. The integration of technology-enhanced learning (TEL) tools and applications has become ubiquitous throughout all levels of education. The phenomenon of this study is based on the integration of TEL tools and applications into pedagogy. TEL tools may include computers, laptops, smartphones, Chromebooks, and tablets. TEL applications are the different software programs used on TEL tools. According to Hwang, Lai, and Wang (2015); Chen, Cheng, and Chew (2016); and Zhu, Yu, and Riezebos (2016), the increase of TEL tools and applications in the classroom has created a need for new teaching and learning methodologies. The social problem has formed from the increase in integrating TEL tools and applications transforming how learning and instruction occur. The related gap in knowledge is the limited research in understanding why the increase in TEL integration has not resulted in the level of TEL integration moving from replacement to transforming how teaching and learning occur (Gros, 2016; Minshew & Anderson, 2016; Tondeur, Pareja Roblin, van Braak, Voogt, & Prestridge, 2017). The primary goal of this study was to explain why the integration of TEL tools has not moved from a level of replacement to a level of transforming learning and instruction among a group of 7th-12th-grade teachers. The results of this study may inform educators why the level of integration with TEL tools and applications has not led to transforming how teaching and learning occur at the study site school (School X). By

informing educators about integration of TEL tools and applications into pedagogy, there is a potential for positive social change in that future educators may change how TEL tool and application integration occurs.

Chapter 1 covers the background, problem statement, purpose of the study, research questions, and conceptual framework. The background sections briefly summarize the literature related to the integration of TEL tools, the gap in the literature, and why this study is needed. The problem statement section identifies the general problem and focuses on the core of the problem with justification through literature. Following the purpose of the study are the theoretical foundations and conceptual frameworks that support the integration of TEL tools within technologically enhanced learning environments.

Background of the Study

TEL tools such as tablets, laptops, smartphones, and Chromebooks, have become synonymous with innovating pedagogy (Chen et al., 2016; Rogers, 1995). The challenge for educators in technology-mediated learning environments has been how TEL tools have been integrated. The integration of TEL tools has been an ill-guided practice with a lack of research into why the integration has not led to moving from replacement to transforming how teaching and learning occur (Gros, 2016; Minshew & Anderson, 2016; Tondeur et al., 2017).

Two significant background areas identified from reviewing literature related to the integration of TEL tools are pedagogical practices and professional development with technological pedagogical and content knowledge (TPACK). The theme of pedagogical

practices can be further broken down into the subthemes of instruction, student learning, and curriculum development. Each of these subthemes has been affected by the advancement of TEL tools. Even though there has been ill guidance on how to integrate TEL tools to transform pedagogy, there have been changes in how instruction, curriculum, and student learning occurs. Instruction has changed from a formal setting, such as a classroom, to an informal setting where instruction can be delivered anywhere at any time, given the use of TEL tools. Student learning has been enhanced beyond paper and pencil to collaborative online sharing using TEL tools. Publishers have been creating a digital curriculum for TELs that is adaptive and customized for each student.

Cadieux Boulden (2017) posited that one of the reasons for technology-driven integration with pedagogy over the past decade has been to transform pedagogy by increasing student-centered learning to improve student-learning outcomes. Other formats of instruction and learning include *blended* and *flipped* models. The blended model offers students learning opportunities inside and outside the classroom using TEL tools. Learning opportunities may include making or watching video lessons outside the classroom. Participating in classroom discussions outside of the classroom in an online format can also be a part of blended learning. The flipped model may be blended or designed as all instruction through TEL tools outside of class, and class time is used strictly for project-oriented tasks. The use of TEL tools has allowed learning to happen entirely online with the use of a learning management system. Various institutions offering fully online courses have allowed students to take courses that their respective schools may not offer. The use of TEL tools has allowed for new ways of providing

instruction and learning. With changes in how instruction and learning can occur, professional development TEL integration for educators has become essential.

The second major area of research in the integration of TEL tools is the professional development of TPACK. Howard and Thompson (2016) posited that professional development with the integration of technology into pedagogy is a social construct because education is a social system. Di Blas (2016) posited that the professional development of TPACK is a social dynamic due to the nature of TEL tools. Di Blas explained that technology development with pedagogy no longer happens at one computer in isolation, but interactively among many participants. Teachers who integrate TEL tools could learn from multiple sources, including students, colleagues, online videos, and massive online open courses. As the advancement of technology increases, the need for professional development with the integration of TEL tools also increases. Students may already know more than teachers about how to use TEL tools because of access inside and outside of school daily. Di Blas posited that teachers and students could learn from each other through the process of TEL integration. The research into understanding why teachers have been replacing rather than transforming how learning and instruction occur with TEL integration has been limited, which formed a gap in knowledge. There is a need for an explanation into why the integration of TEL tools and applications has not moved from replacing to transforming how learning and instruction occurs.

Problem Statement

The problem that arose from the increase of TEL tools and applications integration has been how the level of integration has impacted instruction and learning. The low level of integration has resulted in replacing traditional pedagogy rather than transforming how learning and instruction occur. According to Tondeur et al. (2017) and Blair, Millard, and Woollard (2017), teachers have been integrating TEL tools to replace or supplement instruction rather than transform pedagogy. The integration of TEL tools has become a panacea in how pedagogy has been reformed to increase learning outcomes. The evolution of mobile technologies for learning has been one of the fastest-growing areas of technology in the education field (Celik, Sahin, & Aydin, 2014). One-to-one TEL integration initiatives, along with access to online education, have become a ubiquitous movement across education (Minshew & Anderson, 2016). Cardullo and Clark (2019) stated that Apple has distributed billions of iPads through grants globally over the past 5 years.

The vast distribution of iPads over the past 5 years has changed the landscape of education, transforming the development of pedagogy (Cardullo & Clark, 2019). Rodriquez Triana, Santos Prieto, Vozniuk, … and Gillet (2017) explored over 40 current studies on TEL and found that most researchers focused on the integration of TEL tools in formal settings to present content. A gap exists in the research on how and at what level TEL tools are integrated into pedagogy. Kirschner (2015) drew a clear distinction between teaching effectiveness and the use of TEL tools changing how teaching occurs. The integration of TEL tools does not equate to effective teaching and has been only a

part of pedagogy. According to Kirschner, a master teacher uses TEL tools as a part of pedagogy. A master teacher has a diverse number of educational tools and artifacts to form instructional methods (Kirschner, 2015). The problem is limited to the scope of integration with TEL tools, as there are many facets to how teachers form pedagogy. According to Tondeur et al. (2017) and Blair et al. (2017), teachers have been integrating TEL tools to replace or supplement instruction rather than transform pedagogy toward student-centered learning. According to Blanchard, LePrevost, Tolin, and Gutierrez (2016), most teachers who received technology-enhanced professional development over three summers integrated technology to create efficient pedagogy, and only a few teachers transformed how they taught. The gap revealed from the literature on TEL integration has been the lack of research into why teachers are not transforming how instruction and learning occur in the classroom (Howard & Thompson, 2016; Minshew & Anderson, 2016). There is a need for investigations into why teachers are not integrating TEL tools and applications to transform how instruction and learning occur rather than replace traditional methods.

Purpose of the Study

The purpose of this qualitative explanatory single case study was to determine why teachers have not moved from a level of integrating TEL tools and applications at replacement to a level of transforming how teaching and learning occur. Understanding why the integration of TEL tools and applications affect pedagogy may help future educators shift from replacing traditional methods to transforming how learning and instruction occurs. Celik, Sahin, and Aydin (2014, p. 1) defined *mobile learning* as

learning from anywhere at any time using TEL tools. For this research, the integration of TEL tools is the central phenomenon and is defined as the use of one-to-one TEL tools, such as iPads or Chromebooks, in instruction, curriculum, and learning. I will investigate the behavior of TEL integration to gain an understanding of why the integration of TEL tools and applications has not moved from a level of replacement to transforming traditional methods of teacher-centered to student-centered pedagogy in seventh–12th-grade education. The following research questions derived from the conceptual framework of using technology to replace, amplify, or transform pedagogy (RAT). Innovation in education was equated to technology use by Rogers (1995). *Innovation* in this study is defined using TEL integration to transform pedagogy from the traditional teacher-centered instruction to student-centered teaching practices. I investigated the integration of TEL tools and applications to find out why this behavior did not transform traditional methods of teacher-centered to student-centered pedagogy in seventh–12th-grade education. Positive social change through the integration of TEL tools occurs in how teachers prepare students in technology use. To prepare students for the technological needs of the 21st century, teachers must integrate technology beyond routine practices and curriculum supplements. This study has added to the current body of knowledge on the integration of TEL tools that may help teachers learn how to integrate TEL tools to transform how teaching and learning occur.

Research Questions

Main Research Question

Why have seventh-12th-grade teachers integrated TEL tools at a level of replacement instead of transforming how teaching and learning occur?

Subquestions

SQ1: How has the integration of TEL tools and applications influenced instruction among seventh-12th-grade teachers at School X?

SQ2: How has the integration of TEL tools and applications affected curriculum among seventh-12th-grade teachers at School X?

SQ3: What are the perceptions among seventh-12th-grade teachers at School X in how the integration of TEL tools and applications has influenced learning?

Conceptual Framework

The central phenomenon of this study is the integration of TEL tools and applications into pedagogy. The level of TEL integration defines the conceptual framework for this phenomenon. The body of research that supports this framework was based on the seminal works of Hughes, Thomas, and Scharber (2006). Hughes et al. defined three ways of integrating TEL tools, including RAT. Hughes et al. defined replacement as using TEL tools and applications to replace traditional methods, such as worksheets or other routine practices. Amplification was defined as integrating TEL tools and applications in a way that made teaching and learning more efficient, such as collecting and disseminating feedback quickly. The transformation was defined as integrating TEL tools and applications in a way that teaching and learning were distinct

and could not employ traditional methods. Barrow, Minshew, and Anderson (2016) posited that RAT was a continuum from lowest at replacement to highest at transformation. Barrow et al. employed the conjunction of TPACK and RAT. Numerous researchers have posited that there is a synergy between the professional development of TPACK and the integration of TEL tools (Barrow et al., 2016; Blanchard et al., 2016; Di Blas, 2016; Minshew & Anderson, 2016; Thomas & Edson, 2017). Thomas and Edson (2017) and Barrow et al. (2016) are just a few of the researchers who examined the implementation of the RAT conceptual framework. Di Blas (2016) submitted that social constructivism was the underlying foundation for teachers developing TPACK, while Barrow et al. (2016) connected TPACK as supporting the integration of TEL tools based on the RAT framework.

Figure 1. Process MAP of TPACK to RAT.

Nature of the Study

In this study, I adopted a qualitative explanatory single case study design and method. Qualitative research is used to find meaning into why a phenomenon has occurred (Merriam & Tisdell, 2015; Stake, 2010; Yin, 2017). A qualitative explanatory case study was chosen because the nature of the problem is focused on finding out why the integration TEL tools has not transformed pedagogy through the lived experiences of

seventh-12th-grade teachers. According to Yin (2017), the purpose of explanatory case studies is to find out why behavior has been occurring from examining a unit of study. I investigated the integration of TEL tools and applications in a one-to-one technology setting with seventh-12th-grade level students. Qualitative case studies can use interviews and observations to collect personal data to make meaning from the lived experience of the central phenomenon (Seidman, 2013; Yin, 2017). I collected data from individual interviews, focus group interviews, and follow-up interviews. According to Seidman (2013), the first step in analyzing data from qualitative research is organizing it by labeling, transcribing, and tracing data into themes through coding. I used computer-assisted qualitative data analysis software to help organize data and profile interviewees. From multiple sources, I triangulated and reached conclusions to help determine why the phenomenon of TEL integration is not moving learning and instruction beyond the level of replacing traditional methods in the context of the case study.

Definitions

The following definitions and terms are in the context of education as a social structure implementing teaching, learning, and curriculum through the integration of technology devices.

Blended learning: Allows the learner to gain knowledge using face-to-face and online resources (Kenney & Newcombe, 2016).

Digital instructional material: Material designed to be used with a digital platform (Thomas & Edson, 2017).

Digital mobile technology (*DMT*): Not a single computer or calculator, but a digital device to allow learners to access knowledge or collaboration from any place at any time. Some DMTs may include smartphones, iPads, laptops, and Chromebooks (Minshew & Anderson, 2016).

Digital technology pedagogy: The actions of combining teaching, learning, and curriculum through digital means (Smirnova, Lazarevic, & Malloy, 2017).

Distributed TPACK: A learning theory that expanded or built on distributed cognition. The process of utilizing and learning how to synergize technology, pedagogy, and content with technology integration is not an isolated task, but a process shared across multiple resources (Di Blas, 2016).

Distribution cognitive: A learning theory that employs the gain of knowledge through multiple sources rather than just a single source. The ability to use cognitive processing to learn a task is not a single occurrence but shared among multiple resources, a synergetic process (Hutchins, 1995).

Flipped classroom: Reverse instruction where the learning starts with the students. Unlike traditional methods, mobile digital technologies allow learners to learn any ware at any time, opening a non-traditional way of teaching and learning (Hwang, Lai, & Wang, 2015).

Formal learning: Learning in a traditional setting of the classroom where desks are in a row of tables lined up, and students are generally in a passive role (Jones & Dexter, 2018).

Gamification: The process of using gaming to learn. Gamification includes games like Playcraft or Minecraft, where students learn and create. Gamification may include games that use leveling and character creation passed on as learning outcomes (Dicheva, Dichev, Agre, & Angelova, 2015).

Informal learning: Learning that happens outside the traditional classroom. The setting may include a field trip or a gathering of students or teachers working within a digital learning environment (Jones & Dexter, 2018).

Learning management system: A digital platform where students access materials, resources, assessments, and feedback (Chen et al., 2016).

Replace, amplify, and transform framework (*RAT*): A conceptual framework that references a level of technology integration starting with the lowest level of replacement and ending at the highest level of transforming (Hughes, Thomas, & Scharber, 2006).

Social constructivism: The formation of knowledge through social means (Vygotsky, 1978).

Technological, pedagogical, and content knowledge (*TPACK*): A conceptual framework built on the framework of pedagogy, content, and knowledge (PCK). As technology had become synonymous with pedagogical innovation in education, technology was added to the framework of PCK. TPACK represents the synergy between technology, pedagogy, and content (Mishra & Koehler, 2006).

Technology-enhanced learning (*TEL*): Defined by the integration of iPads, laptops, smartphones, Chromebooks, and other digital technologies (Chen et al., 2016).

Technology integration: The act of using technology with pedagogy (Minshew, Caprino, Anderson, Justice, & Bolick, 2014).

TPACK Coach: A persons or people who help sustain technology integration with pedagogy and content by using a one-to-one coaching model with teachers (Minshew & Anderson, 2015).

Zone of proximal development (ZPD): The difference in areas of knowledge or ability between learners (Vygotsky, 1978).

Assumptions

Assumptions in conducting this research include participants, future research, and professional development of educational leaders. The first assumption was that participants would answer interview questions openly and honestly. Truthful responses were expected because each voluntary participant would have confidentiality from colleagues and administrators in the initial interviews. The identity of each participant was not shared outside the research setting or with other stakeholders. There was a hope that peer influence during the focus group interview would not be a barrier to honest and open responses. Another assumption was that the results of this study have the potential to guide future professional development in the integration of similar TEL tools into pedagogy within a seventh-12th-grade setting.

Scope and Delimitations

In this qualitative explanatory single case study, I sought to explain why seventh-12th-grade teachers integrating TEL tools are replacing traditional methods and not transforming how teaching and learning occur by examining the real-life experiences of

TEL integration. Establishing boundaries for conducting this single case study has defined the scope of this research. According to Yin (2017), the unit of study, geographic location, the behavior observed, and the sample are factors that bound a case study. The unit of study was a single seventh-12th-grade school within a demographic population of 3,000 who are low to medium for socioeconomic status. The behavior investigated was how the one-to-one integration of TEL tools occurs among eight to 12 seventh-12th-grade teachers. This qualitative explanatory single case study was limited to integration with TEL tools because this behavior has been the medium for the problem of ill guidance in TEL integration. The conceptual work of adoption and diffusion with the use of TEL was not explored or investigated due to the overwhelming research in these areas. The conceptual frameworks of adoption and diffusion of innovation were not part of the problem in the ways that TEL has been integrated.

The central behavior of integration with TEL tools and applications for this qualitative explanatory single case study was based on the conceptual framework of RAT. The intention of this qualitative explanatory single case was to examine how the integration of TEL tools with applications occurring and determine why the level of integration has not gone beyond the replacement of traditional pedagogy. According to Yin (2017), a qualitative explanatory single case study will allow for an in-depth examination of behavior. There is a potential for the results of this study to guide future research into how different TEL tools and applications are being integrated.

Limitations

According to Yin (2017), a single case study does not have a large enough sample to generalize findings to a population. Yin asserts that findings from a case study can generalize a conceptual framework or theory. The conceptual framework of RAT with regard to pedagogy through technology integration does not have enough research to compare to the findings of this study. However, this research will expand on the conceptual framework, and findings may be limited in relating the conceptual framework to the central phenomenon of integration of TEL tools and applications.

Another limitation of this study was having a single researcher. Research bias was a concern and a potential limitation to this study as it is impossible to remove all bias. In Chapter 3, I detail how to limit bias, such as utilizing a reflective journal. Having a sole researcher limits the ability to cross-examine findings with another researcher or subject matter expert. As a single researcher, I conducted all data collection, review, coding, category building, and analysis. However, the benefit of having a sole researcher is saving time and money. Yin (2017) expressed concern with case studies taking too much time and too much data to synthesize findings. Yin suggested limiting the time and scope of data collection in a way that the findings can be synthesized.

Significance

The significance of this study applied to the need to understand why the integration of TEL tools has not evolved pedagogy beyond replacing traditional methods of teaching and learning. Innovation in education was equated to technology use by Rogers (1995). Innovation in this study is defined as using TEL integration to transform

pedagogy from the traditional teacher-centered instruction to student-centered teaching practices. I have investigated the behavior of TEL integration to gain an understanding of why this behavior has not transformed traditional methods of pedagogy in seventh-12th-grade education. A gap in knowledge from current literature has revealed a lack of research into why the integration of TEL does not go beyond replacing traditional methods of pedagogy. The purpose of this section is to address (a) how this study has contributed to advancing the integration of TEL tools into teaching and learning at seventh-12th-grade levels, (b) how this study contributed to filling the gap in the literature in the context of a case study, and (c) how this study may have contributed to positive social change in the context of teaching and learning at the seventh-12th-grade level.

The synergy between these three areas defines the significance of this research. Without attempting to understand why the integration of TEL tools has been replacing traditional methods of teaching and learning rather than transforming pedagogy, it may be difficult to develop methods to advance TEL integration with pedagogy. The development of 21st-century skills with the integration of TEL tools may contribute to future learners having a positive social impact on society.

Significance to Practice

The integration of TEL tools has become ubiquitous in education, creating a need for teachers acquire the technological skills to integrate TEL tools into pedagogy (Minshew et al., 2014; Tilton & Hartnett, 2016). New teachers coming into the field of education should experience technology integration as students and teachers (McKnight

et al., 2016). The integration of TEL tools, such as iPads and Chromebooks, has transformed pedagogy. According to Minshew and Anderson (2016), the iPad has given teachers opportunities to create new ways of teaching and learning. However, Minshew and Anderson (2016) and Tondeur et al. (2017) contend that teachers are not using TEL to create new learning opportunities but to replace old methods of pedagogy.

This explanatory single case study contributed to developing a better understanding of why TEL integration has been replacing traditional methods of pedagogy rather than creating new opportunities to teach and learn. Schools and classrooms built decades ago were not designed with the intention of using technology that had not been invented yet. A traditional curriculum that has been revised over decades has not been designed for technology that was not invented yet. Pedagogy has not been designed for TEL integration over the past decades. TEL integration has been injected into existing practices with traditional curriculum and classroom settings. Chen et al. (2016) suggested that traditional environments should be transformed into smart learning environments. Chen et al. posited that traditional classrooms should be remodeled to use interactive whiteboards, TVs, and mobile devices. Glover, Hepplestone, Parkin, Rodger, and Irwin (2016) and Minshew et al. posited that the integration of TEL tools is necessary to increase learning outcomes for 21st-century skills. The results of this explanatory single case study may support and advance the practice of TEL integration in the seventh-12th-grade education.

Significance to Theory

Over the past two decades, school districts had allocated funds to implement TEL tools (Howard & Thompson, 2016). However, increased integration of TEL tools has not to led to the creation of new teaching strategies or the transformation of pedagogy (Howard & Thompson, 2016; Minsew & Anderson, 2016; Tondeur et al., 2017). Instead, teachers lacking guidance on TEL integration have fallen back on past practices or traditional methods of pedagogy (Howard & Thompson, 2016). The integration of TEL tools is a complex social system in education with a need for guidance and understanding for teachers to create new teaching and learning strategies (Howard & Thompson, 2016). The results of this explanatory single case study may contribute to creating guidance and professional development where teachers at the seventh-12th-grade levels create new ways of teaching and learning through the integration of TEL tools. Education is a complex social system where social interaction drives change. This research can identify some reasons teachers may be at different levels of TEL integration, including replacement, amplifying (enhancement), and transformation (student-centered strategies). This qualitative explanatory single case study has advanced the research into TEL integration among the seventh-12th-grade levels.

Significance to Social Change

Seventh-12th-grade students need to acquire 21st-century skills through TEL integration so they might contribute to society and lead to positive change (Chen et al., 2016). The workforce of the future has been changing to include 21st-century technology skills. Chen et al. (2016) asserted that there is a need to transform traditional classrooms

into smart learning environments and shift the pedagogical mindset from traditional to technology enhanced. This qualitative explanatory single case study will contribute to future teachers and educational leaders shifting pedagogical reasoning.

Summary

In Chapter 1, I provided the background information with the problem statement, the purpose of the study, and the research questions that supported the need for this qualitative explanatory single case study. The background of the study included a summary of technology integration in education with a focus on TEL tools. The problem statement outlined that the level of integration with TEL tools has been at the replacement level or traditional teaching methods. The gap in research has been the lack of knowledge with the level of integrating TEL tools and applications beyond replacement. The research question with subquestions outlined and addressed the problem of integration with TEL tools. The definitions, assumptions, scope, and delimitations, and limitations were also included in this chapter. Lastly, in Chapter 1, I also outlined the significance of integration with TEL tools in practice, theory, and positive social change. There has been a significant need for the integration of TEL tools to provide opportunities for teachers to teach in new ways. There is potential for positive social change in professional development with the integration of TEL tools as a result of this study. There is potential for positive social change because the results of this study may contribute to students being exposed to new ways of learning.

The next chapter provides the theoretical and conceptual foundations in the way technology integration has occurred. Chapter 2 begins with major theoretical foundations

that support conceptual frameworks of TPACK with RAT pedagogy through the integration of TEL tools (Mishra & Koehler, 2006). Chapter 2 delineates how the integration of tools has changed pedagogy. Chapter 2 provides a literature background on the domains of digital technology integration and a background on the impact of integration of TEL tools on the professional development of TPACK as a shared practice.

Chapter 2: Literature Review

Introduction

Teaching and learning have evolved with the integration of TEL tools, such as one-to-one devices and smart boards. With the integration of TEL tools, students have new ways to engage in learning. There has been a need to understand how the integration of TEL tools affects teaching and learning. The transformation of curriculum, pedagogy, and professional development with the integration of TEL tools has lacked clear guidance (Howard & Thompson, 2016; Hutchison & Woodward, 2014; Minshew & Anderson, 2016). A gap in the literature exists regarding knowledge why the integration of TEL tools has not transformed how teaching and learning occur. By understanding how the integration of TEL tools and applications affects pedagogy, future educators can transform how learning and instruction occur. Elmendorf and Song (2015) posited that the advances and increased access to digital technologies have created a need to examine how the integration of TEL tools impacts pedagogy. Although technology integration has become ubiquitous in education, research indicates that teachers have been using the integration of TEL tools for traditional instructional practices rather than transforming pedagogy (Lee & Hannafin, 2016; Minshew & Anderson, 2016; Tondeur et al., 2017; Zinger, Naranjo, Amador, Gilbertson, & Warschauer, 2017).

Chapter 2 begins with a literature strategy followed by the theoretical foundations of social constructivism and distributed cognition. Social constructivism is the primary theoretical foundation underpinning this research into how the integration of TEL tools has affected teaching and learning. Social constructivism and distributed cognition

support how the professional development of pedagogy intersects with the integration of TEL tools in the context of TPACK (Di Blas & Paolini, 2017; Mishra & Koehler, 2006). Following the section on the theoretical foundation is a section on the background of conceptual frameworks, including TPACK with RAT (Minshew & Anderson, 2016). The core of the literature review covers two themes: the integration of TEL tools and professional development. Chapter 2 concludes with a summary of the major themes developed, what is known and not known about the integration of TEL tools, and how the gap in the literature substantiated the need for research in TEL integration with the potential for positive social change in how teaching and learning occur.

Literature Search Strategy

The literature search began with a broad scope of how one-to-one technology has shaped educational practices; all selected databases included only peer-reviewed journals. Originally, searches began with keywords of *one-to-one technology* and *technology integration* using the Walden Library databases of Academic Search Complete, ERIC and Education Source Combined Search, ProQuest Central, TechLib, and Teacher Reference Center. After prospecting multiple articles, specific keywords revealed a path toward identifying and developing a gap in the literature in the context of integration with TEL tools. Keywords, along with their combinations, were revealed during the search included *21st-century skills, bring your own device (BYOD), technology adoption, TPACK, technology integration, mobile devices, educational change, technology-enhanced learning,* and *digital devices.* Each of these keywords directed the research into different paths. One of the main ideas that showed up across all research was the increase in the

use of TEL tools in teaching and learning. This central idea scoped the research into mobile technology integration using the following keyword combinations: *mobile devices, one-to-one mobile learning, mobile technology integration,* and *digital technology integration*. I revised the literature search to include combinations of keywords that were defined in the context of teaching and learning with digital technologies: *digital technologies, digital technology integration, smart learning environments, TPACK, professional development in technology integration, distributed cognition, transform pedagogy with technology, and self-efficacy with digital technology integration.* The gap in knowledge with the increase in the integration of TEL tools and applications is why the integration has not moved from replacing traditional methods to transform how teaching and learning occur.

Conceptual Framework

The central phenomenon of this study is how TEL tools have been integrated into pedagogy. The conceptual framework for this phenomenon is defined by the level of TEL integration based on how the integration models have been employed in educational research over the past decades (Kimmons & Hall, 2018). Kimmons and Hall cited technology integration frameworks that included the technology integration model; TPACK; RAT; technology acceptance model; technology integration planning; and substitute, augment, modify, and redefinition (SAMR). Researchers have employed the SAMR framework to explore the ways TEL tool and applications have impacted pedagogy (Geer, White, Zeegers, Au, & Barnes, 2017; Hilton, 2016; Kihoza, Zlotnikova, Bada, & Kalegele, 2016). Similar findings on the impact of technology integration on

pedagogy were the level of integration being of substitution. The framework of RAT and SAMR are similar in substitution and augmentation being the same as a replacement. Also, modification and amplification being similar.

Redefinition and transformation are similar in transforming established teacher-centered pedagogy to student-centered pedagogy (Zhai, Zhang, Li, & Zhang, 2019). The body of research that supports the use of technology to RAT established teaching and learning practices framework was based on the seminal works of Hughes, Thomas, and Scharber (2006). Hughes, Thomas, and Scharber defined replacement as using TEL tools to replace traditional methods, such as worksheets or other routine practices. Amplification was defined as integrating TEL tools in a way that made teaching and learning more efficient, such as collecting and disseminating feedback quickly. The transformation with TEL tools and applications was defined as integrating TEL tools in the ways that teaching and learning were distinct and could not employ traditional methods of teacher-centered practices. TEL-based pedagogy examples include flipped instruction, fully online courses, global collaboration, and particular applications like robotics or coding. Barrow, Minshew, and Anderson (2016) posited that RAT was a continuum of levels from the lowest level at replacement to the highest-level at transformation. However, Hilton (2016) and Kimmons and Hall (2018) posited that teachers did not view SAMR or RAT as a continuum from low to high levels of effective integration but as circular in that each part of the SAMR or RAT framework was used to fit a particular need.

Technological, Pedagogical, and Content Knowledge

TPACK is a framework in how teachers develop knowledge with and between technology, pedagogy, and content. Schulman (1986) founded the conceptual reasoning in how teachers develop knowledge in combining pedagogy and content to form teaching methods. Schulman (1986) was most concerned with PCK. Schulman (1986) posited that the synergy between pedagogy and content was central to developing methods of teaching. Schulman (1986) stated that the knowledge base for teaching was not permanent but will be redefined, newly discovered, and describe new ways of teaching. Teaching requires "transformation and reflection" to develop and change with new educational trends (Schulman, 1986, p. 13). This conceptual description relates to the changes in how teachers learn to use technology with pedagogy through the integration of TEL tools.

The integration of technology has increased in the K–12 setting, changing how teaching and learning occur. Koehler and Mishra (2009) concurred with Schulman that teaching was a shifting, dynamic mix of new teaching methods and changing learning environments. Digital technologies have influenced how teachers develop their instruction with pedagogy and content. Koehler and Mishra (2009) posited that older techniques, like a pencil, calculator, ruler, or microscope, were used in only one way. In contrast, digital technologies have complicated how teaching practices have developed because of the many ways digitals technologies can be utilized in the classroom. Koehler and Mishra (2009, p. 62) stated that the development of technology integration had been a "one size fits all approach" that has not worked because of the variation in content and

pedagogy. The variation in how content and pedagogy have been used with the integration of TEL tools and applications calls for changes in how professional development. With the increasing use of technology for teaching and learning, Mishra and Koehler built upon the work of Schulman and added TPACK. With TPACK framework three areas of synergy were formed from the intersections of technology, content, and pedagogy and included technological content knowledge (TCK), technological pedagogical knowledge (TPK), and pedagogical content knowledge. The TPK framework was a lens into examining how secondary teachers integrate TEL technologies, Mishra and Koehler defined TPK pedagogy as methods of teaching and learning that change with the integration of technologies. Teachers must be able to move from traditional methods to new, creative methods of teaching with technology integration to progress student learning. For teachers to be flexible and open to creating new ways of teaching with the use of TEL tools and applications, they must utilize multiple sources. The following section expands on the framework of Distributed TPACK or D-TPACK.

Distributed Technology, Pedagogy, and Content Knowledge. Digital technologies have become so advanced in being intuitive and adaptive that teachers do not necessarily have the technical skills to utilize Technology-enhanced learning tools. However, moving beyond utilizing TEL tools as add-ons to a curriculum or one-time projects requires teachers to have some degree of TPK. Because of technology continually changing in the educational applications, teachers must look beyond themselves to develop TPK. Di Blas (2016) posited that TPACK was dynamic and

continuously evolving with changes in TEL tools. TEL tools are advancing, offering new opportunities for teachers to use these technology tools to change how teaching and learning occur. With the advancement of TEL tools, teachers have depended on multiple resources beyond their expertise to develop TPK. Di Blas (2016) built upon the concept of Hutchins (1995) distributed cognition by applying it to TPACK. Di Blas posited that the development of TPACK socially was distributed and not dependent on just what one person. Di Blas did a case study on the distributed nature of TPACK and found that when integrating digital technologies, teachers depended on students, the internet, colleagues, relatives, and local experts. One of the implications of the study Di Blas discovered was that teachers did not need expertise in technical knowledge as much as they needed professional development in how to combine technology and pedagogy. Jones and Dexter (2018) performed a mixed-methods study on how four teachers experienced technology integration in coordination with professional development. Jones and Dexter found that formal learning opportunities (professional development) offered by the district and school did not support the learning needs to integrate technology effectively. As a result of this gap in support, the teachers employed an informal or social constructivist approach to learning how to integrate technology more effectively by sharing resources and learning from each other. As technology integration increased with the adoption of new technology devices across education, the need for teachers to learn how to use the new technology in instruction also increased (Alqurashi, Gokbel, & Carbonara, 2017). Hughes, Thomas, and Scharber (2006) recognized this need and created the framework RAT to help k-12 teachers assess their level of technology integration into the classroom.

Learning theories that support the integration of TEL tools and applications. The foundational theories include pragmatism, social constructivism, and distributed cognition. These theoretical foundations support how secondary teachers form knowledge in developing pedagogy around TEL integration. Dewey (1938) proposed that pragmatism was the construction of knowledge that occurred through lived experiences. Dewey (1938) believed in learners constructing their knowledge by using their minds and hands. Dewey's (1938) pragmatism was the beginning of the constructivist approach to teaching and learning. Vygotsky (1978) posited that social constructivism was the formation of knowledge through social means. Vygotsky (1978) posited that learners constructed initial knowledge from experiences, and there was the proximity of moving from spontaneous to a scientific or logical understanding of knowledge. Social constructivism applies to TEL integration because users of TEL tools can move from lower levels to higher levels of integration through social interaction. Hutchins (1995) built upon social constructivism by establishing the learning theory of distributed cognition. Hutchins proposed that distributed cognition is the cognitive process that helped learners form the knowledge to complete a task from multiple sources, including social means—the theoretical foundations of pragmatism, social constructivism, and distributed cognition support how pedagogy has evolved.

Constructivism with technology enhanced learning integration. Dewey (1938), along with Bruner (1960), posited that the construction of knowledge occurs through lived experiences. He believed that one must test and revise new knowledge through a hands-on approach. Dewey (1938) believed that meaningful education

translated to learners being active in hand-on experiences, not passive learners sitting and watching. Dewey (1938) viewed the teacher as a facilitator in a learner-centered environment where learners constructed their understanding of knowledge. In the context of TEL integration, constructivism means teachers form knowledge in TEL integration by using the technology with students daily, not just for a one-time project.

Knezek and Christensen (2016) built on the will, skill, and tool model of technology integration by adding pedagogy as a construct (WSTP). The WSTP model has been a constructive approach to integrating technology. They will construct represent the instructors' propensity to use technology. The skill construct represents the ability for instructors to integrate TEL tools into pedagogy. The tool construct represents the availability of TEL tools. An instructor may have the will and skill, but without TEL tools, integration cannot occur (Knezek & Christensen, 2016). The addition of the pedagogy constructs the style in which an instructor integrates TEL tools. Style can represent how TEL tools are integrated, such as blended, flipped, or single activities added on to curriculum as some examples.

The one to one TEL environment allows for experimental, differential, and hands-on experiences. Cadieux Boulden posited that research on technology initiatives has shown that pedagogy has changed to reflect learners being active in constructing knowledge rather than observes of guided instruction. Dooley, Lewis Ellison, Welch, Allen, and Bauer (2016) posited that students should act as active participants when digital technologies are integrated into pedagogy. Dooley et al. explained that students should not be in a passive role where the instruction is presented through digital

technologies. The student should interact with the curriculum when interacting with digital technologies to gain a deeper understanding of content (Dooley et al., 2016). The one to one environment allows for different resource access for learners. Dewey would have supported access to multiple resources to enhance and individualize each participant's learning experience. Cadieux Boulden gave an example of science, where learners using one to one laptop can choose to experiment in virtual labs, use web-ware tools, do simulations, or use software to analyze data sets. This use of one to one technology-mediated learning environment aligns with the constructivist approach where students are at the center of the experiences and constructing new knowledge. Cadieux Boulden points out that Dewey may have been critical of the lack of social learning experiences in the one to one technology model. Dewey believed that schools should be a community where students are working together to experiment and play with hands-on tools. Social learning would prepare them for an industrialized society that required people to work together on projects (Cadieux Boulden, 2017). Cadieux Boulden recommended one to one technology integration as collaborative practices because it reflects the adult world, where knowledge has been shared and new ideas formulated across social groups. Di Blas (2016) framed shared knowledge as distributed cognition across a social system. Di Blas thought of distributed cognition as the ability to learn from others, and people did not have to depend on their knowledge to learn. Distributed cognition was supported by the seminal work of social construction, which Vygotsky (1978) described as learning through social means. Di Blas posited that the professional development of TEL integration had occurred through social constructivism.

Social constructivism with professional development of technology integration. Social constructivism is a learning theory that describes learning through social means. Vygotsky (1978) posited that learning occurs through a community and can be proximity. Vygotsky described proximal as a space between the initial interpretation and a logical, well-developed understanding. Vygotsky posited that proximal gaps could be reduced by interacting with someone else who has the knowledge they do not or at a more in-depth understanding. Teachers have access to multiple resources to help close the proximal gap in how to integrate TEL tools. In the context of an educational setting, teachers as the learners interact with multiple resources to gain new knowledge in TEL integration. Multiple resources may include students, teachers, administrators, community experts, and one-way communications, such as video resources. Teachers may have social interactions with students, colleagues, online webinars, and professional learning communities as part of their TPACK development (Di Blas, 2016; Schulman, 1986). These resources form the community in which teachers pull knowledge.

Current literature on social constructivism indicates that professional development with the integration of TEL tools is a shared practice. Moore, Robinson, Sheffield, and Phillips (2017), along with Di Blas (2016), posited that social constructivism was appropriate for developing the integration of TEL tools through social interactions and hands-on use. Moore et al. (2017) pointed out that a problem in the professional development of learning how to integrate TEL tools were teachers being in a passive role instead of actively participating. Social Constructivism has been an essential concept for teachers to interact with multiple human resources to gain understanding and build

TPACK knowledge. Di Blas envisioned social constructivism with TPACK as distributed cognition or Distributed TPACK, where the integration of technology tools was a shared process of learning from all participants. Distributed cognition was the foundational learning theory that supported distributed TPACK (Di Blas & Paolini, 2017). Hutchins (1995) was the original theorist to outline or define the distributed cognition theory. Hutchins based distributed cognition as a revision or modern version of social constructivism. Di Blas and Paolini were important in building on the work of social constructivism in the context of TEL integration. Di Blas and Paolini used the theory of social constructivism to develop the learning theory of distributed cognition, where those who integrate TEL tools learn through social means.

Distributed cognition in learning technology integration. Distributed cognition is a learning theory that proposes one's cognitive ability to increasing through social means (Di Blas, 2016). Di Blas (2016) explained that a teacher learning how to integrate new technology tools would learn from students just as the students would learn from the teacher. The teacher does not have to depend on their knowledge of TPACK to integrate new technology tools and can utilize multiple sources to develop that knowledge and experience. Di Blas posited that technology integration is not within a single user but distributed across what the user utilizes as resources. Resources can include students, colleagues, or educational media outlets on the web, such as Teacher Tube. Hutchins (1995) learning theory employed social constructivism, where distributed cognition was described as a group of people within an organization who depend on each other to learn how to use artifacts. An essential part of the cognitive distribution that Hutchins (1995)

described as the ability for members of an organization to be flexible in their understanding or knowledge of available resources.

In the context of teaching and learning, current literature outlines distributed cognition to raise cognitive processes to integrate technology tools through interactions with a multitude of different resources (Di Blas & Paolini, 2017). Di Blas posited that the use of technology to teach was not solely based on the teacher, but the knowledge may reside in other resources. Di Blas posited that knowledge to integrate technology resides in students, the technology tool, the teacher, and other available resources. In grounding the theory of distributed cognition, Di Blas did a study on the use of interactive technology integration and found that among the three types of knowledge, technology, content, and pedagogy, teachers depended on the most on the integration of technology with content. Social constructivism has been a foundation for how teachers construct knowledge of technology integration. Clark, Zhang, and Strudler (2015) posited that TEL tools must go beyond presentation and allow for students to interact with knowledge. The interaction between student to student and student to teacher builds on social constructivism.

Social change in a case study with social constructivism. In a case study on integrating laptops in a one to one technology setting, two teachers worked as a team with students. The two teachers were part of a four yearlong study by Downes and Bishop, (2015), who examined how one to one implementation of laptops affected middle school instruction and learning. They found that a positive impact was made, as some students who did not engage under traditional settings were now engaging. The two teachers

expressed the growth in TPACK through social means and the practice of integrating mobile laptops. The two teachers, along with Downes, Bishop, and Vermont, indicated that the fourth year had the most significant change as students became more engaged with using technology to personalize learning. In this study, students and teachers learned different needs from each other in how to integrate mobile technology through social constructivism. Social change as a result of expanding research on the effects of TEL integration could have positive implications for innovating or transforming how teaching and learning occur through social constructivism.

Replace, amplify, and transform pedagogy through technology use. Digital technology tools for learning and teaching can be integrated at different levels. The integration of technology-enhanced learning tools could be used for a one-time project, exchange assignments, basic practice skills, present content, collaborative projects, daily assessment, and multiple other ways. How teachers integrate TEL tools affects how teaching and learning occur. TEL integration at the high-level results with innovative pedagogy raises student-learning outcomes. Hughes, Thomas, and Scharber (2006) developed an assessment framework that addressed how teachers integrated technology into the K-12 classroom. As a basis for the construction of three broad ways technologies could be integrated, Hughes et al. (2006, p. 2) focused on instructional methods, student learning processes, and curriculum goals. The three broad ways Hughes et al. proposed to measure how K-12 teachers integrate technology includes; technology as replacement, technology as amplification, and technology as transformation (RAT). Hughes et al. defined technology integration as a replacement when no instructional methods, student

learning processes, or curriculum goals were changed while integrating technologies. Technology as amplification focused on technology integration that amplified or increased the efficiency of student learning processes, instructional practices, or content goals.

Technology integration as the transformation was defined by Hughes et al. (2006) as changing how the student learning process occurs, changing curriculum goals because of technology, or applying new instructional methods that cannot be done without technology integration. For example, A STEM teacher could use TEL integration in a one to one setting as a tool for the student to learn how to code (Zhu, Yu, & Riezebos, 2016). In this scenario, the teacher changed instructional goals to use technology, and student-learning processes required technology to perform a student-centered activity. Hughes et al. (2006) intended for RAT as an assessment framework that could be used to see where teachers were from the lowest (replacement) to the highest (transform) point of technology integration. Hughes et al. (2006) concluded that moving from amplification to transformation was the biggest struggle for k-12 teachers. Trepule, Teresevičiene, and Rutkiene (2015, p. 852) posited that TEL integration must be learner-centered to have positive learning results. Trepule et al. explained that the main benefits of TEL integration that increase learner-centered outcomes are the flexibility in where, when, and how content has been accessed. Trepule et al. concluded that instructors' attitudes, skills, and knowledge play a central role in performing effective TEL integration.

Barrow, Minshew, and Anderson (2016) performed a researched-based design study with iterative processes that assessed and reassessed TPACK and RAT. Barrow et

al. viewed the RAT assessment framework as a continuum where Replacement was the lowest level of technology integration, moving up the scale from Amplification to Transformation being the highest level of technology integration. Barrow et al. recommended that professional development for technology integration should be content specific to move teachers up the RAT framework. Figure 2 illustrates the hierarchy from replacing to transform as steps.

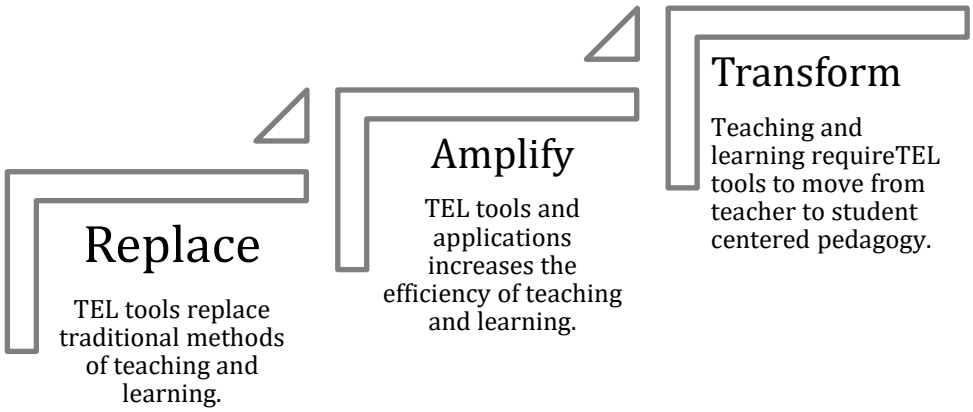

Figure 2. Replace amplify transform assessment framework.

The integration of TEL tools can be operationalized by the RAT framework, measuring the level of integration. Thomas and Edson's (2017) research is vital because they examined the central framework of RAT. Thomas and Edson recently did a study on the level of technology integration with eleven k-8 teachers that incorporated digital instructional materials (DIM) into their curriculum and instruction. Thomas and Edson recommended RAT being used to select DIMs and then evaluate how the DIMs were integrated. Choosing DIMs that are educational and engage students can increase the self-efficacy of students (Perry & Steck, 2015). There has been a lack of research on how professional development with DIMs in TEL integration impact teachers and students

transition from replacement to transformation (Lee & Hannafin, 2016). Kimmons (2015), DeCoito and Richardson (2018), Hilton (2016), with Minshew and Anderson (2015) posited that the professional development of TPACK within specific areas or subjects had been aligned with increasing the efficacy with technology use. Minshew and Anderson (2015); Barrow, Minshew, and Anderson (2016); and Geer, White, Zeegers, Au, and Barnes (2017) contend that the teachers should choose digital applications that are content-based to replace traditional methods of drill and kill practice instead of transforming pedagogy. Minshew and Anderson with Barrow et al. found in their studies that some participants embraced trying to move from replacement to a higher level while some participants were steadfast in holding the technology integration of iPads at the replacement level. After reviewing the literature with the combination of TEL tools and applications, a gap in knowledge was revealed reasons why teachers are not integrating TEL tools at the highest level of RAT as being is ill-guided.

Literature Review Related to Key Variables and Concepts

Domains of Pedagogy with Digital Technology Integration

The constructs that make up the first part of the literature review are domains of pedagogy include instruction, student learning, and curriculum development. The following areas of pedagogy were expanded on in the first part of the literature review: (a) how digital mobile technology integration has affected instruction, (b) how digital mobile technology integration has affected learning, and (c) how digital mobile technology integration has affected curriculum development.

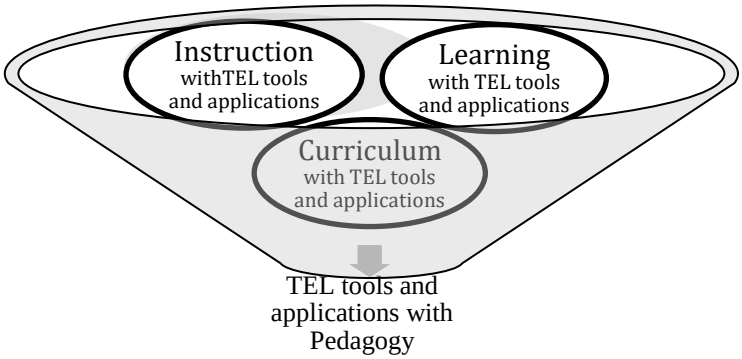

Figure 3. Digital technology pedagogy.

Effects of Technology-Enhanced Learning Tools on Instruction

The use of digital technologies in a one to one setting has shaped a technological learning environment where learners interact with their surroundings in new ways. This section is about how digital technology integration has changed how instruction occurs, reforming the development of pedagogy. Significant changes in teaching with digital technology integration have revolved around transforming where and when learning has occurred. This section explored studies that reveal how TEL environments have changed traditional methods of teaching. TEL environments, such as flipped classrooms and blended learning, can create a transition from conventional teacher-centered to non-traditional student-centered learning environments.

The integration of technology enhanced learning tools transformed pedagogy. The inclusion of TEL tools has changed how teachers experience instruction and access to professional development. Smirnova, Lazarevic, and Malloy (2017) explored how pedagogy has been altered or affected by developing digital technologies. As TEL tools have changed or evolved, teachers have been faced with the challenge of changing how they integrate TEL tools. In reaction to new challenges, Smirnova et al.

conducted exploratory research into how the integration of digital technologies transformed learning and education. Two significant themes developed from their study included the Transformative nature of Experience and Changing Pedagogy from Measured to Engaged Learning (Smirnova et al., 2017, pg. 674). The transformative part showed that as teachers became more proficient with the technology, they increased the use of technology-based activities.

The technology-based activities changed how teachers delivered instruction and how students acquired knowledge. Smirnova et al. (2017) concluded that prior knowledge and professional development were predictors of how successful digital technologies have been integrated. Three traits emerged from the experience of integrating digital web-based technologies. First, the researchers found that professional development could take a lot of time and effort in mastering new digital technologies, not something that happens immediately. Participants were in-service teachers who had many obligations beyond the classroom. The participants experienced the ability to access learning from anywhere at any time. This experience was transformative in that participant's accessed learning and collaboration in an untraditional way. The third experience was the ability to collaborate in an online environment, and digital learning does not mean isolated knowledge. The partnership could be real-time or asynchronous, making collaboration at the convenience of the participant Nguyen and Nguyen (2019) explored collaboration with TEL tools in cultural linguistics learning. The partnership was asynchronous at times, and this allowed for a student to collaborate in informal ways

using TEL tools. The transformation with the integration of TEL tools changed how learning occurred, from formal methods to an informal approach.

The integration of technology tools transforms instruction. The evolution of teaching through the integration of TEL tools has been an emerging theme in the literature. The change in instructional options has not been fully understood by teachers who integrate TEL tools and applications. King, Joy, Foss, Sinclair, and Sitthiworachart (2015) contended the push for digital technology integration was to transform teaching and learning. King et al. claimed that after decades of technology integration in education, there is still no explanation as to why transforming how teaching and learning occur is not happening. Smirnova, Lazarevic, and Malloy (2017) found that participants using a digital classroom did not understand how the instructional goals were different from traditional teaching practices. The participants were used to a behavioral style of instruction that included rote memorization and standardized exams. However, in the digital classroom, the goal was based on social constructivism, where participants were asked to create and engage in interactive lessons, putting the students at the center of learning. Smirnova et al. found that the integration of digital technologies transformed learning and instruction in that teachers and students shared equal participation in using digital technologies. Alshahrani and Ally (2016), along with Delgado, Wardlow, McKnight, and O'Malley (2015), outlined transformative practices with TEL integration that included blended, flipped, situated learning, mobile learning, Massive Open Online Courses, and smart classrooms. All the transformative teaching practices that Alshahrani

and Ally composited into one book represent some of how TEL integration has changed how learning occurs.

The limitation of technology tools with noncontent specific applications. The integration of TEL tools and applications has been used in traditional ways with universal applications, such as Google slides, Prezi, and other presentation tools that are not content-specific. Murthy, Iyer, and Warriem (2015), along with Alqurashi, Gokbel, and Carbonara (2017), argued that technology integration used in traditional ways does not transform instruction. Kersaint et al. posited that technology integration was successful in improving cognitive thinking when it was used for specific content tasks. Kersaint et al. contended that digital technology tools should have a content-specific focus. In a study on a group of 631 Science Technology Engineering and Math (STEM) middle and high school teachers who participated in a yearlong project of professional development on technology integration into math and science courses. In the research, it was revealed that middle and high school science teachers perceived content-specific digital technology tools as more critical than generic ones (Keynote, Google Slides, and Prezi). Despite a yearlong professional development of digital technology integration with math teachers, technology integration into instruction was very limited. Kersaint et al. posited that the professional development of integrating digital technologies should focus more on content-specific applications over generic applications to increase use. Alqurashi et al. did a similar study as Kersaint et al. and found that STEM teachers utilized TEL integration, but the barriers were composed of infrastructure issues. Content-specific

applications of TEL integration may move pedagogy from traditional to new ways of teaching and learning.

Blended and flipped instruction. Parks, Oliver, and Carson (2016), along with Minshew, Caprino, Anderson, Justice, and Bolick (2014), indicated that there had been an emerging theme that secondary teachers have perceived successful technology integration into instruction differently than what has happened in the classroom environment. What happens in the classroom does not always align with what teachers think happened. Minshew et al. (2014) examined one to one tablet integration among middle school teachers implementing flipped instruction. Minshew et al. discovered that what teachers presented in the interviews as instructional use of technology was not the same as what was observed by the researchers. Participants referenced using specific content sites for their content area, but when observed, generic software and websites such as Quizlet, YouTube, and QR codes were not utilized in the classroom. Minshew et al. posited that teachers are not familiar with what technology applications transform instruction into authentic learning.

According to Parks et al. (2016), the increase of TEL tools has made it easier to create new ways of delivering instruction beyond the traditional methods of delivery. In a study to examine the impact of professional development for 366 secondary public-school teachers on blended learning, Parks et al. discovered that what the participants perceive as effective blended pedagogy was different than what was happened in practice. The perceptions of the teachers were technology transforming teaching practice, but with direct observation, the technology was replacing traditional methods. There was

a gap between what teachers perceived as being transformative and what they did with the integration of TEL tools in practice. Parks et al. and Minshew et al. suggested that there was ill guidance with the integration of TEL tools, and there was a need to provide teachers with professional development.

The flipped classroom. TEL integration has changed how instruction can occur. According to Lane-Kelso (2015), the flipped classroom is *reverse instruction*, where the learning starts with the students. Unlike traditional methods, mobile digital technologies allow learners to learn any ware at any time, opening a non-traditional way of teaching and learning, changed pedagogy from teacher to student-centered learning. Hwang, Lai, and Wang (2015) posited that the flipped instruction model had been supported by Blooms Taxonomy of Educational Objectives, where the learner starts at a low level in recalling facts and moves into higher-order thinking skills of apply, analyze, evaluate, and create during the face-to-face time. Students use web resources and videos to be learning content outside of class and then practice what they learned in class. This reverse pedagogy removes the teacher from being the center of direct instruction in the classroom to the role of a guiding facilitator, helping students filling in the gaps in understanding as to the student's practice what they learned. Traditionally, level one and level two thinking skills start with the guiding examples during direct instruction in a face-to-face brick and mortar setting. With reversed or flipped instruction, the level one and two thinking skills happen outside of the classroom and with the student individually versus as a group. There is an assumption that students come back to class ready to move into the higher level of Apply, Analyze, Evaluate, and Create thinking skills with in-class projects or

group work. Hwang et al. examined the process of reversed or flipped pedagogy and found there is a shift in learning that moves students from direct instruction in the classroom to inquiry and problem-based instruction. Hwang et al. posited that the benefit of the flipped model was increased one-to-one contact time. The challenge in the flipped model had the time for teachers to plan and develop instruction for the flipped model. For the flipped model to be successful, the technology integration had to use friendly, and each student needed the technology tools and access outside of the classroom (Kenney & Newcombe, 2016). The above research has conveyed how TEL integration has been used but has not revealed why new technologies are being used in traditional ways rather than non-traditional ways.

Effects of Digital Mobile Technology on Learning

Blended learning. Student learning is not locked to one location or classroom because TEL tools have given students the ability to learn anywhere at any time. Kenney and Newcombe (2016), with Pandit (2018), posited that blended learning allows the learner to gain knowledge with face-to-face and online resources. Kennya and Newcombe's work was important for showing how TEL integration can transform pedagogy from teacher-centered tradition to student-centered methods of learning—integrating TEL tools in a way that allows the learning to learn and construct knowledge outside of the classroom blends informal and formal learning.

With TEL tools, there has been an opportunity for students to learn anywhere at any time. A common type of blended learning suggested by Kenney and Newcombe (2016) with Hwang, Lai, and Wang (2015) the flipped method where students do online

activities outside of school, in an informal setting, and then the students' complete projects in a traditional or face-to-face setting. Hwang et al. referred to this style of learning as being self-regulated learning, where students regulate their pace and style of learning. As part of an action research study, Kenney and Newcombe wanted to know what student perceptions were on the flipped style of learning. From student feedback, the most significant barrier was time management in doing work outside of class in preparation for in-class projects. Kenny and Newcombe concluded that moving from traditional methods of teaching new ways of teaching with the integration of TEL tools should happen in small steps.

Informal versus formal learning. Informal learning does not always mean learning in nontraditional ways for students. Jones and Dexter (2018), along with Zawawi (2018), applied informal learning to the professional development of teachers. They argued that workshops are a formal way of professional development, and teachers need more informal ways of learning the integration of TEL tools. Dexter and Jones defined informal learning for teachers by experimenting, revising teaching practices, use others to learn, and learn by doing. Zawawi applied informal learning with instructional design students. The instructional design students used TEL tools and applications to acquire knowledge outside of the formal setting of a classroom. This informal learning approach follows Dewey's (1938) constructivism by experimenting and Vygotsky's (1978) social constructivism by learning from others. Following a mixed-methods study, Jones and Dexter recommended schools to incentivize informal professional development in

conjunction with formal opportunities. Informal learning can apply to all types of learners.

Traditionally learning has been in a classroom and formalized through a procedure of students absorbing new information from a teacher and then being assessed on that information to see if they retain it. Digital technologies have changed how knowledge can be accessed and how learners interact with new knowledge. According to Chen et al. (2016) posited that digital mobile technologies had created new opportunities for informal learning. Chen et al. argue that the ration of informal to formal learning has been increasing. Access to informal learning mediums like Massive Open Online Courses and games-based learning has been increasing. Blended and flipped instruction has reshaped formal learning into informal learning through learning management systems or knowledge-based video resources, such as Khan Academy. Students in Flipped and Blended learning models acquire new knowledge through a Learning Management System or knowledge-based videos outside of class and then participate in authentic tasks within the classroom, applying their new knowledge. Chen et al. posited that technology-mediated learning environments have revolutionized how learning occurs by creating synergy between formal and informal learning where smart classrooms lead the learning revolution.

Gamification of learning. Digital technologies set outside of learning have transformed how children and adults interact with each other, play games, and many other behaviors. In the context of games, TEL tools have redefined how people interact. Board games are traditional ways of gaming, and with the evolution of digital

technologies, people have changed how they interact with gaming. TEL integration has allowed gaming to be utilized as a tool for learning. Well-designed games for learning purposes allow learners to move across a spectrum of their zone of proximal development, trying to reach a higher level that challenges them. Games that were designed for student learning should allow opportunities for the learner to adjust their thinking and adapt to changes in the gameplay, the building on cognitive skills. Clark, Tanner-Smith, and Killingsworth (2016) did use a systematic review of the literature review as a meta-analysis. He found that gaming environments enhanced student learning environments more than non-game or traditional learning environments. Minecraft Education was designed for students to collectively work and build open worlds based on math and reading skills. Students constructed their meaning from experiencing the role of being a creator of a world that their peers could add to and test. This style of gaming was designed with social constructivism as players explore and test each other's created worlds. Holmes and Gee (2016) posited that multiplayer games require players to work together to meet a common goal, promoting cooperation and social constructivism. Educational digital games can assess and give the learner personalized feedback immediately, unlike traditional learning. Professional development in training teachers in how to integrate gaming has been through self-interest and not part of the reform for 21st-century skills in secondary education. The non-traditional part of gaming has been the change in focus from the teacher being the primary source of information, assessment, engagement, and feedback to the game is the primary learning source.

Smart learning environment. The introduction of TEL tools has transformed some traditional learning environments. Pace and Dipace (2014), along with Spector (2016), described the process a developed a smart, social, innovative learning environment where the integration of TEL tools has played a vital role in changing how teaching and learning occurred. Chen et al. (2016) posited that changes in digital technologies have reshaped teaching and learning in education. Zhu, Yu, and Riezebos (2016) examined the current form of the teaching-learning process and called for educational reform in transforming existing learning environments into Smart Learning Environments. As a new educational reform takes shape, Smart Learning Environments utilize TEL tools and adaptive technology systems that address the different levels of understanding (Hutchison & Woodward, 2014). The conceptual understanding of how to integrate TEL tools into pedagogy starts with constructing knowledge and forming a knowledge base (Li, Kong, & Chen, 2015). Chen et al. posited that TEL tools had transitioned traditional teaching from teacher-centered to learner-centered environments. However, Zhu et al. posited that despite advances in technology, there had been little change from traditional teacher-centered to learner-centered practices. Zhu et al. explained that traditional teaching practices the primary source of information comes from the teacher, where students stay in one place, answer the same questions, take the same assessments, and participate in the same activities. Zhu et al. (2016) posited that an active learning environment should meet the needs of all students and address the different levels of understanding. Li et al. contended that there should be an effort to reform traditional learning environments into smart learning environments because of the

advancements in digital technologies. Li et al. considered smart classrooms to be learning environments that integrated TEL tools. Classrooms of Tomorrow were designed with TEL tools, so teaching and learning could happen in new, non-traditional ways.

Effects of Technology-Enhanced Learning Tools on Curriculum Development

The following section encompasses three main characteristics of curriculum development with digital technologies. The first characteristic has been defined as the development of digital technologies outpacing curriculum development (Minshew & Anderson, 2016). That is, the curriculum has not been evolving in secondary education in a way that includes a transition from traditional to non-traditional learning through digital technology integration. The third characteristic outlined in this section includes the development of a digital curriculum across the globe. The digital curriculum allows learners to explore, assess, and apply digital networks and technologies within a real-world setting.

Digitizing curriculum. Changing the curriculum from a century of traditional teaching practice to fit the digital age of education takes time to develop, train, and provide resources for teachers. On a global scale, from the seminal work on changing curriculum, Vivian, Falkner, and Falkner (2014) explained that England and Australia had introduced new learning areas and curriculum based on computer science and digital technologies beginning the first year of school. As a curriculum has been developed to include digital and computing technologies, professional development has been behind in preparing teachers for this new curriculum in Australia. There was a challenge to deliver professional development for teachers across Australia to help them prepare for

integrating digital and computer technologies. Vivian, Falkner, and Falkner (2014) took part in developing a massive open online course the addressed the teacher's needs in the context of implementing the digital curriculum. Once the course was entirely designed and tested, the researchers opened the course for enrollment. The design of the course was to create a digital sandbox for students to explore and create personal, educational artifacts through an array of applications. The digital sandbox transformed traditional teacher-centered pedagogy to non-traditional student-centered pedagogy.

The Impact of Technology-Enhanced Learning Tools on Professional Development

Educators need professional development to help them keep up with changes in how teaching and learning occur. As TEL tools change, the curriculum should be revised to allow for easy integration. Montrieux, Vanderlinde, and Schellens, and De Marez (2015) posited that the increase in uses of technology in society had created the need with the intention to use technology in education. Glover et al. (2016) posited that technology integration must be driven by curriculum rather than having a trying to use a curriculum that does not have synergy with technology use. When curriculum and technology are disconnected, then the technology integration becomes ineffective and used as a replacement at the lowest level of RAT.

Attitudes toward professional development. Menon, Chandrasekhar, Kosztin, and Steinhoff (2017) performed a pre and post technology self-efficacy survey with 34 preservice elementary teachers that received professional development in the use of integration with TEL tools. Menon, Chandrasekhar, Kosztin, and Steinhoff wanted to know what kind of changes occurred in technology self-efficacy because of the

preservice teachers going through a course that used TEL tools. From the qualitative part of the data results, participants felt positive about using this technology over the pencil to paper because of the high degree of hands-on interactivity. Three main themes that positively affected self-efficacy with the integration of TEL tools emerged as an enhanced understanding of topics, a high degree of interactivity and engagement, and instructor modeling of technology use (Menon et al., 2017).

Moving teachers from lower to higher levels of integration with TEL tools requires a sustained effort in providing professional development beyond one-time technology seminars to continuous or ongoing development that aligns with the evolution of digital technology integration (Keser, Karaoglan Yilmaz, & Yilmaz, 2015; Uslu, 2018;). This section applies to my study by outlining the efforts in improving learning outcomes for students through the integration of TEL tools and applications. The significance in exploring how self-efficacy of teachers germane to digital technology integration affect pedagogy may guide future professional development in how self-efficacy can drive innovation teaching and learning

TPACK development as a shared practice. TPACK development has played a vital role in transforming how learning occurs with the integration of TEL tools into pedagogy. This section addressed the importance of TPACK based on recent studies. More importantly, this section elaborated on TPACK as a shared practice across multiple resources, not a single teacher or professional development TPACK expert. Secondary educators have a responsibility to improve, expand, and evolve pedagogy as the needs of society change. Minshew and Anderson (2015) posited that there had been a lack of

research and professional development in creating interactive learning environments with digital technologies. Minshew and Anderson proposed research in creating a collaborative workplace where innovation in instructional practices can be fostered with TEL tools. With TPACK professional development as the primary driver, Minshew and Anderson utilized designed based research to evaluate how TPACK coaching would affect the integration of digital mobile technologies. Results showed that TPACK coaches helped secondary teachers raise the level of digital mobile technology integration through multiple resources. This type of embedded professional development helped teachers reduce the gap between low levels to higher levels of TEL integration. The zone of proximal development (ZDP) was unique for each teacher as they were all at different levels of TEL experience and knowledge.

Zone of proximal development. ZDP can apply to the development of TPACK characteristics as it is applied to the integration of digital technologies. Traditionally teachers are isolated to their respective rooms during the practice of applying TPACK to TEL integration. However, being isolated to a room does not mean that the professional development of TPACK is restricted in the same way. Di Blas (2016) argued that the development of TPACK with digital technology integration has not been isolated to one person or resource, but has been a shared practice among multiple resources, including TPACK coaching and students. Student perception and efficacy can help teachers integrate TEL tools and reduce the level of ZDP between teachers and students TEL knowledge (Liton, 2015) ZDP can be defined with TPACK by comparing levels of TPACK self-efficacy and levels of TEL integration. The levels of TPACK self-efficacy

can be affected by the resources available. Di Blas discovered that teachers who integrate TEL tools daily had a higher TPACK self-efficacy. Schnitman and Forgerini (2018) found in a study that teachers who increase the use of technology integration also see a growth in comfortability and confidence. Di Blas posited that by integrating digital technologies daily within one to one setting the ZDP between lower and higher levels of understating in how TPACK works with digital technology, integration became smaller. However, because of the advancement in technological applications are constantly changing a need for sustained support in technology integration, such as a TPACK coach or someone who specializes in technology integration has grown.

Sustainable professional development through coaching. One-time workshops do not always result in effective professional development. Having a long-term investment, such as a TEL integration coach, may result in sustained professional development. Keppell, Suddaby, and Hard (2015) argued that the traditional method of one-time workshops has not led to higher levels of integration that resulted in transforming teaching and learning. Teachers may have needed sustained support from a technology integrationist or coach. Due to the lack of research and information on the role of technology, integrationist Keppell et al. wanted to gain a better understanding of what was occurring and creating guidelines for future use in school districts. Some of the guidelines included being adaptable, innovative in finding solutions, obsessed with technology, and being a good listener. Parks, Oliver, and Carson (2016) did a quantitative study compared self-assessments before and after teachers went through the professional development of using TEL integration with blended learning. They found that teachers

needed more one to one professional development in real-time to be effective when using integration with TEL tools to implement blended learning instruction.

Replacement, amplification, and transformation. Minshew and Anderson (2016) posited that sharing and building on technology integration with pedagogy advances the level of growth with the integration of TEL tools into instructional practices. Utilizing the RAT framework, Minshew and Anderson wanted to know in what ways middle school teachers were integrating TEL tools. Through the iterative process with designed based professional research development with the integration of TEL tools were employed among teachers. Minshew and Anderson examined to see if there were changes in the level of integration with TEL tools and in what instruction changed based on the RAT framework. One of the implications from the study was teachers focusing on test scores so much that they did not utilize the integration of TEL tools to move from replacement level of RAT to transformation, the highest level. Teachers did not have the time to amplify or transform teaching practices. Transformation of pedagogy included utilizing TEL tools to move from direct instruction to inquiry-based teaching practices. Other examples of the transformation of pedagogy through TEL integration includes differentiating instruction, dynamic and interactive lessons, and student-centered practices (Thomas & Edson, 2017). Alqurashi, Gokbel, and Carbonara (2017) found that TEL integration had a direct positive impact on moving from a teacher to student-centered pedagogy within a STEAM (Science, Technology, Engineering, Art, and Math) course. Following an intensive professional development workshop, teachers' level of

TEL integration within the STEAM courses increased and transformed pedagogy. However, sustained development was a need as TEL tools and applications evolved.

Minshew and Anderson (2015) found that with TPACK coaches, some middle school teachers-built lessons around digital mobile technologies and, with each iteration of the research, found that these teachers began to move from replacement level toward transforming how teaching and learning occurred unite classroom. Minshew and Anderson, along with Di Blas (2016), posited that teachers need collaborative time, sustained professional development, and different levels of support to improve pedagogical and technological teaching practices.

Summary and Conclusions

Chapter 2 outlined significant themes in the literature based on the professional development and practice of integrating TEL tools into Pedagogy. The theoretical foundations support the hands-on approach to integrating technology tools. Di Blas and Paolini (2017) outlined the professional development of integration with TEL tools as a shared practiced that is based on social cognitive distribution. The first major theme was based on how pedagogy has synergy with the integration of TEL tools. Subthemes of the integration with TEL tools into pedagogy connected the conceptual frameworks RAT and TPACK conceptual frameworks to the foundation's social constructivism. Subthemes were identified based on the integration of TEL tools with different instructional methods. The role of professional development was a second major theme with subthemes that were identified with TPACK.

The reasons why teachers are not moving from traditional methods of instruction to transforming how learning and teaching occur through the integration of TEL tools has been understudied (Minshew et al., 2014; Celik et al., 2014; & Smirnova et al., 2017). Minshew et al. did research that built upon and showed how traditional methods of pedagogy had been transformed with TEL integration. This study addressed the gap in the literature through an explanatory single case study. The purpose of this research was to explain how the phenomenon of integration with TEL tools in the context of real-world teaching practices in one school is occurring (Yin, 2017). Innovation in education was equated to technology use by Rogers (1995). Innovation in this study is defined using TEL integration to transform pedagogy from the traditional teacher-centered instruction to student-centered teaching practices. I have investigated the behavior of TEL integration to gain an understanding of why this behavior has not transformed traditional methods of teacher-centered to student-centered pedagogy in 7th -12th-grade education. The literature supported a qualitative explanatory case study as the problem and research questions align with *how* and *why* the integration of TEL tools has not transformed traditional teaching practices (Yin, 2017). Chapter three outlined an explanatory case study approach.

Chapter 3: Research Method

Introduction

There is a need for explanation and understanding into how the integration of TEL tools and applications affect pedagogy so future educators can transform how learning and instruction occurs. In Chapter 3, I will outline the rationale for the case study research design, explain the role of the researcher, and describe the methodological approach in detail. I discuss participant selection, instrumentation, and procedures for recruitment, participation, and data collection. Ways to manage issues of trustworthiness will be outlined with credibility, transferability, dependability, confirmability, and ethical procedures. In the final section of this chapter, I review the significant points and outline the plan for data analysis.

Research Design and Rationale

A qualitative explanatory single case study allowed for an in-depth investigation of the integration of TEL tools and applications. The results of this study could lead to an understanding of how teachers are experiencing the integration of mobile technologies into instruction and learning. The single case study encompassed an explanatory approach following the exploration of the phenomenon. According to Merriam and Tisdell (2015), a case study can be a combination of phenomenological and explanatory research to explore and explain the existence of a behavior. Gaining an understanding of the perceptions, personal experiences, and frame of reference held by secondary teachers who integrate mobile technologies into instruction and learning could contribute to positive changes in the development of researched-based teaching methods (Stake, 2010).

In this section, I restate the research questions, identify the central phenomenon, identify the research tradition, and provide a rationale for the chosen research tradition.

The central phenomenon of this study is the integration of TEL tools into teaching and learning. The goal of this study was to describe how TEL tools are being integrated and determine why this behavior has not led to transforming teaching and learning practices. The following research question addresses the transformation of pedagogy from teacher-centered to student-centered learning. The subquestions address the RAT framework in moving from a level of replacement to a level of transforming instruction.

Main Research Question

Why have seventh-12th-grade teachers integrated TEL tools at a level of replacement instead of transforming how teaching and learning occur?

Subquestions

SQ1: How has the integration of TEL tools and applications influenced instruction among seventh-12th-grade teachers at School X?

SQ2: How has the integration of TEL tools and applications affected curriculum among seventh-12th-grade teachers at School X?

SQ3: What are the perceptions among seventh-12th-grade teachers at School X in how the integration of TEL tools and applications has influenced learning?

SQ4: What are the perceptions of seventh-12th-grade teachers at School X in how TEL tools and applications have been integrated?

Case Study Rationale

According to Yin (2017), research questions that use *why* and *how* identify with qualitative single explanatory case studies. The traditional approach to researching the above questions follows a qualitative explanatory case study. The specific case is defined by investigating the integration of TEL tools among seventh-12th-grade teachers in a single school site to find out how the integration of TEL tools has changed pedagogy.

Case studies are often used in the social science of education because educators are people being studied within a natural setting with lived experiences of phenomena (Stake, 2010). A quantitative approach was not chosen because I am not employing an experimental design. Based on the research question developed from the gap in the literature, a quantitative approach would not be appropriate. A case study has allowed for a particularistic, descriptive, and heuristic focus of the phenomenon (Merriam, 1998). According to Merriam, particularistic means that the case study focuses on a specific phenomenon or unique unit of study, which is the integration of TEL tools within a school site. Descriptive means that the case study should allow for a detailed, thick description of the phenomenon (Merriam, 1998). The heuristic quality, according to Merriam, of the case study, should bring meaning to the phenomenon and may show a new understanding or causal relationship not previously known. In this research, the heuristic quality of investigating aligns with the explanatory case study. The results should not only give a good description of the phenomenon but also convey a better understanding of why the integration of TEL tools has not been more effective in transforming how teaching and learning occur. According to Merriam and Yin, case

studies should be bounded by place or time. This explanatory case study was bounded with a seventh–12th-grade school as the unit of study. The phenomenon of integration with TEL tools and applications was studied in depth within the unit of analysis or school site (Merriam & Tisdell, 2015). The unit of study was a seventh-12th-grade school that employs TEL tools, where technology integration has been embedded throughout instruction and the school environment. The case study allows for an in-depth description of the phenomenon from firsthand experiences in a real-life context. There has been a need for explanation and understanding into how the integration of TEL tools and applications affect pedagogy so future educators can transform how learning and instruction occurs. This qualitative single explanatory case study allowed the researcher to capture a description of the phenomenon in practice and share an understanding as to how and why the problem of transforming teaching and learning through the integration of TEL tools has not been more effective. The results from this study may inform other schools, districts, and educational leaders about possible ways that integration of TEL tools has been occurring and what factors influence the degree to which TEL tool integration transforms teaching and learning.

Other Qualitative Approaches

Yin (2017) suggested three types of case study research designs: exploratory, descriptive, and explanatory. An exploratory case study was not chosen because I am not trying to identify research questions or procedures that could be used for a future research study (Yin, 2017). According to Yin, an exploratory case study is also useful in exploring a case where an intervention has occurred with no clear set of outcomes. A descriptive

case study could be used to describe the phenomenon as it is happening in real-life context but does not capture why behavior has been occurring. The purpose of this study was to gain an understanding as to why the integration of TEL tools and applications has not transformed teaching and learning. Based on a research gap that the integration of TEL tools has not been well understood in the context of transforming teaching and learning, a qualitative single explanatory case study was appropriate in identifying possible causal relationships (Yin, 2017).

According to Yin (2017) and Merriam (1998), case study research can create a holistic view where data from multiple sources, including the experiences of participants, generate a whole picture view of the phenomenon. An explanatory case study design may create a holistic view of the perceptions among seventh-12th-grade teachers with the integration of TEL tools in the context of changing how teaching and learning occur. A case study research design is appropriate for conducting this methodology because the unit of study was unique (Yin, 2017). The case study design may provide information relevant to why there has been a lack of transforming teaching and learning through TEL tools integration. The study results may provide educators with information about how the integration of TEL tools can enhance or change the way teaching and learning occur. Table 1 shows the other research methodologies with explanations why they were not appropriate for this study.

Table 1

Other Types of Research Methodologies

Type	Purpose	Reason
Quantitative	To evaluate or hypothesize on imposed changes in a setting, such as an intervention within social science.	A quantitative study is not appropriate for this study because a behavior is not being controlled. The behavior will be investigated in a natural state. The research problem is aligned with human behavior as it is happening in a real-life context with no interference.
Qualitative exploratory	To explore a behavior to form research questions for future studies.	The gap in the literature, along with the problem, is known. In this study, the research questions have been derived from the gap in literature along with the known problem.
Qualitative phenomenological	To examine a situation to define a behavior that is occurring within an environment, such as the social sciences.	Given the problem and gap in the literature, the behavior is well understood. The integration of digital technology tools has been well researched, and the behavior has defined.
Qualitative multiple case study	To gain a more considerable holistic understanding from more than one unit of study.	It would be a benefit to investigate the behavior of digital technology integration in more than one school. However, due to time, money, and resources, this would not be feasible for a single researcher.

Role of the Researcher

In this research, I am the only collector of data and served as an instrument in collecting data through multiple methods. I collected, transcribed, and reported the data. I conducted the initial focus group and follow-up interviews. I am not a participant because I did not share my own experiences with the phenomenon. I was not an observer-participant because I was not part of the school that is the unit of study nor did I have any personal or professional relationship with the participants. I do not work in or participate in any professional development or have a relationship with any participants in School X. I identified participants based on the criteria that the integration of TEL tools and applications is used on a weekly or daily basis. I was the only person conducting interviews, collecting interview data, and transcribing all data. According to Stake (2010), member checking is the process of giving participants copies of an interview or observations so they may make any needed corrections. Reflective journaling is a process where a researcher reflects after each observation and interview in a journal (Stake, 2010). By keeping a reflective journal, I was able to look back and read my interpretations, which allowed me to remove any subjectivity and personal opinions. I have employed a reflective journal as a guide to minimizing my own bias against the integration of TEL tools. Because I am a secondary teacher who has experienced the given phenomenon, I have not escaped bias entirely as I have empathized with the experiences of the participants. However, this commonality may be beneficial in capturing fuller, more descriptive data from participants (Yin, 2017).

Methodology

Participant Selection Logic

The unit of study was a traditional school site that implements one to one integration of TEL tools. The participant pool included 7th-12th grade level teachers at School X. Select seventh -12th-grade teachers that have used an integration with TEL tools on a daily or weekly basis within the unit of the study were identified. In this case study, the school was a place where the seventh-12th-grade teachers have been integrating TEL tools in one to one technology settings (Chen et al., 2016). The number of participants was between seven seventh-12th-grade teachers from a pool of 58 teachers that included three technology integration specialist who works at School X. Similar case studies on technology studies reached a point of saturation within ten participants (Beschorner & Kruse, 2016; Cober, Tan, Slotta, So, & Könings, 2015; Hsu, 2016). Merriam and Tisdell (2015) suggested that sampling size is based on reaching several participants where a point of saturation or redundancy is reached. The purposeful sample may also have network sampling in that a few early key participants may be used to identify other participants who meet the same criteria. Merriam and Tisdell (2015) suggest that a convenience sample is not used solely for sample selection as it may produce insufficient evidence of the behavior. Beginning with the principal, I have employed networking to recruit the first participant via email. Within each individual interview, I have asked the participant for other potential candidates that fit the selection criteria. Time and accessibility affected accessing six to 10 seventh-12th grade teachers,

and I asked to expand the area of recruitment to the middle school grade level of teachers for 5th and 6th grade.

The criteria for a unit of study and participant selection was be based on a school site that has been active in utilizing one to one technology integration. Full adoption and acceptance are vital to the purpose of the study because the integration of TEL tools must be non-obtrusive to teaching and learning. The following criteria were used in identifying participants to create a purposeful sample:

1. Employed at a School X as a teacher who supports the integration of TEL tools among sewventh-12th grade teachers.
2. Work in a school that has adopted a 1-1TEL tool integration.
3. The participant does not have adoption barriers and does not view the integration of TEL tools and applications as intrusive to instruction and learning.
4. The participant integrates TEL tools and applications on a daily or weekly basis.

Instrumentation

The instruments for data collection included semistructured interviews, one focus group interview, and follow-up interviews (Merriam & Tisdell, 2015; Stake, 2010; Yin, 2017). Initial interviews in Table 2 below outlines the type of data instrument with the purpose, research question alignment, and who it is for. efficient, transparent, and concise data collection of factual data on the influence of TEL tools and applications participants utilize in their instruction (Minshew & Anderson, 2015).

Initial interviews. Semi-structured interviews would allow for in-depth descriptions of how the integration of TEL tools has impacted curriculum, instruction,

and learning. Part of the initial semi-structured interviews will include a circle of influence (CoI) based on think out-loud protocol. The CoI will be used verbal with initial interview questions one and two. The CoI allowed each participant to create a visual map using Inspiration Maps iPad application. Appendix B is an example of what the CoI visual map will encompass. The closer a TEL tool or given application is to the CoI, the more significant impact it has on pedagogy. Minshew and Anderson (2015) used the CoI during individual interviews as a tool to capture perceptions of participants on the use of TEL tools and applications. The questions listed in Appendix F guided the initial interviews with a focus on the conceptual framework and research questions.

Questions three through five relate to SQ1-SQ4 I in how the integration of TEL tools and applications has impacted learning, instruction, and curriculum. Question six was used to probe for transformation as to how the integration of TEL tools and applications affected the dynamics between teacher and student-centered pedagogy.

Focus group interview. The purpose of the focus group is to have a time when there is peer influence affecting responses and to probe deeper based on previous responses from individual interviews (Yin, 2017). The focus group interview captured the perceptions of the integration of the TEL tool and applications from a holistic point of view. Peer influence allows for more precise, diverse, and more in-depth feedback. The focus group interview questions were different from individual interviews because the questions were not directed to any particular participant or subject area. During the focus group interview, I investigated teacher perspectives on what the level of integration means to them. Questions 1-4 were intended to capture data related to SQ1-SQ4.

Questions 1-4 are the reverse of the questions from the individual interview questions in that they investigate what pedagogy would look like if there were no integration of TEL tools or applications. Focus group questions 5-7 related to the MRQ and capture data related to the replacement level of TEL integration. Focus group questions 8 focuses on the amplification of TEL integration. Focus group question 9 aligns with the transformation of TEL integration. These focus group questions are written to capture meaningful data that allowed me to probe deeper and gain meaningful data related to the conceptual framework and research questions. The focus group interview questions alignment table can be found in Appendix D.

Follow-up interviews. The follow-up interviews were used as another data source. The purpose of the follow-up interview is to allow for: (a) further questions after a time of reflection, (b) questions from the interviewee after a time of reflection, and (c) verify member data for accuracy.

Table 2

Instrument Outline

Type	Research questions	Purpose	Who	Time frame
Interview	MQR SQ1 SQ2 SQ3 SQ4	To capture how teachers are integrating TEL tools.	Six to 10 seventh-12th-grade teachers who integrate TEL tools at least weekly. An integration specialist if this position exists in the district.	2 weeks

Follow-up interview	Gather data from probing questions. Review responses to add/delete/modify data for accuracy in triangulation	Allow teachers to remove, add, or change responses following a time to reflect. Gather further data from probing questions based on previous interviews.	Six to 10 seventh-12th-grade teachers who integrate TEL tools at least weekly. An integration specialist if this position exists in the district.	1 week
Focus group interview	MRQ SQ1 SQ2 SQ3 SQ4	To capture teacher perceptions of TEL tool integration as a whole unit. The peer influence will affect responses resulting in different results than 1:1 separate interviews (Yin, 2017).	Four-six seventh-12th-grade teachers who integrate TEL tools at least weekly.	1 week

Procedures for Recruitment, Participation, and Data Collection

Recruitment procedures. Initial and follow-up recruitment procedures followed the snowball process of using participants to find other participants. Criteria followed participants who unobtrusively use TEL tools daily or weekly in the classroom. Following Walden's Institutional Review Board approval of this research, I contacted participants via email based on recommendations of other participants. They know the criteria for using TEL tools and applications daily or weekly is verifiable.

Participation. Procedures to participate included a consent form sent via email. The principal was the first person to begin suggestions on which participant fits the participant selection criteria. The initial recruitment with the assistance of the principal at School X began the snowball procedure in finding more participants.

Data collection procedure. The questions listed in Appendix F guided the initial interviews, while the questions in Appendix G guided the focus group questions. Questions that guided the initial interviews and the focus group interviews were based on the conceptual framework with the research questions. The following list shows the order in which I recruited and collected data.

1. Contact the Principal to obtain consent to use School X as the unit of study.
2. After obtaining IRB approval and consent to use School X, I began recruitment, starting with asking the principal for a participant who fits the purposeful sampling selection criteria.
3. I contacted each participant via email using the data collection interview request found in Appendix D. I included the selection criteria, so the participant knows if they fit the purposeful sample or not. Following the first interview, I went on foot to recruit more participants based on recommendations.
4. For the participant volunteers that responded to the email I sent an l to follow up via email with an attached consent form, they can agree to via email or at the time of the interview. I asked for a good time and place to meet via email. The data collection request form includes the criteria for having a private, quiet space for the interview as well as the length of time. I went over the consent form with

participants face to face before the start of each interview. All interviews were face to face.

5. At the end of each interview, I asked the participant if they would volunteer in a focus group interview once all the initial interviews are done. I also asked each participant at the end of the interview if I can contact them for a follow-up interview after I have conducted the focus-group interview.
6. The focus group interview was conducted after all initial interviews were completed, and I have had a chance to transcribe data. I contacted those individuals via email with some options for a place a time to meet as a group.
7. The follow-up interviews took place after the focus group interview was completed.
8. My role in the data collection was to guide participants through the interview process, ensuring the conversations stay on topic and to probe deeper with questions as participant feedback develops. The frequency of the data collection plan is as follows:
    - 1-2 initial interviews per day unless time and availability allowed for more interviews per day.
    - One day for the focus group interview.
    - 1-2 follow up interviews per day was based on the availability.

Exit procedure. After the data collection, each participant received a thank you note for the voluntary participation. Participants were informed of the next step in the research process and received a summary of their responses. Within a time of two weeks

from the initial interviews, the participants were allowed to adjust, clarify responses, or add additional thoughts through member checking. The member checking served as a procedure of the data collection process. Participants had the option of receiving a full copy of the dissertation at the completion.

Data Analysis Plan

Initial interview and focus group interview data analysis. The qualitative data analysis employed an iterative process of reviewing, coding, and interpreting interview data. A constant comparative method was employed, where I went back and forth between emerging and existing data looking for patterns. Data from the initial interviews were used in cross comparing individual interviews. Constant cross-comparison allowed for creating similar and contrasting themes among participant feedback data related to the research questions.

Coding. I did all the coding from transcriptions. MAXQDA qualitative analysis software was used to store all transcriptions. I employed cyclic coding, where the first cycle is open coding. In the second cycle, I used axial coding, where I combined open codes into categories (Merriam & Tisdell, 2015). A cyclic, line by line coding was used to compare data looking for differences and similarities always. The cyclic method of constant comparison limited my ability to reach any pre-conceived conclusion before building and interpreting emerging themes. The outcome of coding for each data source is shown in tables 5 and 6. Saldaña (2015) explained that there are types of patterns, which include similarities, common differences, frequencies, sequences, correspondence, and causation. However, Saldaña posited that looking for patterns is not the only way of

analyzing data. Looking for meaning, idiosyncrasies or traits, ambiguities, and paradoxes are other ways to interpret data. The primary predictor of coding and interpreting as analyzing the data will start with the type of questions asked. Due to the nature of the research design being qualitative and explanatory, the questions asked were derived from questions that describe and reconstruct the way integration of TEL tools and applications affect learning and instruction. The following table outlines a CoI pre-coding table related to the research questions.

Table 3

RAT Framework Precoding Table

Component of pedagogy: Curriculum learning instruction	Participant In Vivo code	Meaning	Level of influence in CoI	Replace, amplify, and transform
Learning				
Instruction				
Curriculum				

***Instruction*.** Coding for instruction was based on how participants deliver ed knowledge. Throughout the data collected, I identified what instructional method was used and how it changed based on TEL integration.

***Learning*.** Coding for learning was based on participants (seventh-12th-grade teachers) perceptions of how students interact with TEL tools and applications. I identified interview data that relates to how students obtain, transfer, and show evidence

of learning. This data was analyzed through the perceptions of the severnth-12th-grade participants, not the students.

***Tools*.** Coding for the tool (iPad, tablet, Chromebook, smartboard, etc.) was identified within interview data and the visual map with the interactive circle of influence. Each participant in the individual interviews interacted with the circle of influence to create data that shows which TEL tools influence the pedagogy within that subject area based on the distance the tool is from the center of the map. Participants will have an opportunity to change this map during the follow-up interview. The opportunity for participants to revise previous responses will result in data that is more has higher accuracy.

Applications. Coding for applications (websites, LMS, or any other specific application used with a tool) was employed throughout the interview data. The data from the circle of influence was a visual map of tools and applications integrated based on each participant's response. The data for applications was used to identify emerging themes as well as comparing data from individual participants. This data is part of an alignment table that shows the categories, subcategories, and level of integration based on RAT.

***RAT*.** With the assistance of MAXQDA qualitative analysis software, I coded data with instruction, learning, tools, and applications with a level of integration based on replacement, amplification, and transformation. Replacement coding was based on integrating TEL tools to replace traditional methods of pedagogy. Amplify coding was based on integrating TEL tools to make pedagogy efficient. Transform coding was based

on integrating TEL tools where pedagogy depends on those tools or applications that move pedagogy from a teacher to a student-centered learning environment. RAT was part of the results that showed a level of integration with parts of pedagogy and TEL integration within the case of School X.

Theme building. Themes based on data collection revolved around the integration of TEL tools and applications with pedagogy. I developed emerging themes from coding data from individual interviews, single focus group interviews, and follow-up interviews. The outcomes in identifying emerging themes contributed to developing interpretations and conclusions about why the integration of TEL tools and applications have not moved from a level of replacement to transformation.

Qualitative data analysis tool. The qualitative data analysis software tool that I used is MAXQDA. A few reasons for choosing MAXQDA is the training, support, and different functionality that is offered. I used MAXQDA to assist in coding, organizing, and building themes from interview data. I also used MAXQDA to create visual concept maps of the data. I organized data into groups, sets, categories, and subcategories. I used MAXQDA with an iPad to transcribe audio, visualize data, and create concept maps.

Interview data. According to Merriam and Tisdell (2015), the unstructured interview is appropriate when a behavior is not well understood and is being explored. In this explanatory case study, the behavior of integration with TEL tools has been professionally researched and understood as a behavior. It would not be appropriate to conduct unstructured interviews in this study. The cyclic act of coding with the data from the interviews will be an overarching procedure in synthesizing the data to identify

Themes. Saldaña (2015, p. 17) explained that codifying happens when the researcher "applies and reapplies codes to qualitative data." Saldaña explained that it is rare that coding is done the right the first time, and because qualitative data is interpretive, there was recoding as wells as re-categorizing. The focus group interview entailed probing, where some questions were generated from coding and categorizing data from the one-to-one interviews. The data from the focus group interview was coded and categorized. The initial procedure for coding interviews was based on a hierarchical method and connected to the conceptual framework being employed in the research questions, Replace, Amplify, and Transform (RAT) teaching and learning through the integration of TEL tools. The overarching theme is the integration of TEL tools; that is, how it is occurring, and to what degree does the integration of TEL tools change how instruction, learning, and curriculum occur.

Treatment of discrepant cases. Diversity in responses allows for triangulation from multiple data sources (Saldaña, 2015). If all the responses were identical, then there would be no need to triangulate and form a holistic picture as it would already be given. Diversity in responses emerged as a factor in identifying themes and contributing to the perceptions of behavior for the integration of TEL tools.

Issues of Trustworthiness

This section has addressed issues around the trustworthiness of the study. Subsections included credibility, transferability, dependability, confirmability, and ethical procedures. These issues deal with data saturation, managing personal bias, a single researcher collecting, transcribing, and analyzing data, transferability of information, and

ethical concerns for the protection of participants. Trustworthiness and following ethical procedures are expected by the community of scholars, including the IRB.

Credibility

The biggest threat to internal validity in an explanatory case study is inaccurate interpretations (Yin, 2017). Because this research design used an explanatory case study with how and why to the effects of integration with TEL tools and applications on teaching and learning, there is the possibility that interpretations could be misconstrued. Yin recommended four fundamental principles to construct validity. These four principles will be utilized to increase confidence and validity in the findings and conclusions. The first principle will be using multiple sources of evidence. Multiple sources of data include more than one interview: multiple documents and direct observations with following a focus group interview or questionnaire. Yin posits that the strength of doing a case study is using multiple diverse sources of evidence. Using multiple and different resources will allow for triangulation as a strategy for increasing internal validity. Yin (2017, p. 128) referred to doing data triangulation as a data analysis method to create "convergent evidence," increasing the creditability of the findings.

The second principle is creating a database for the case study. Creating a database for the study allows for organization and a more accessible analysis of the data. I will use MAXQDA qualitative data analysis software tool to organize and analyze data from multiple sources. The third principle that will be used is the chain of evidence. Yin explained that evidence gathered during the data collection process should be traced back to the research questions and overarching theme. The last principle explained by Yin was

using social media as our social websites as sources of data. Yin cautioned against these types of sources and cross-checking them for validity or credibility. However, social media sources will not be used in this study. Merriam and Tisdell (2015), along with Stake (2010), suggested member checking as one way to create respondent validity. I employed a member checking with each participant.

Transferability

According to Merriam and Tisdell (2015), single case studies are particularistic and not transferrable to generalities. Transferability was particular to the seventhth-12th-grade school site that employs the integration of TEL tools with similar resources and backgrounds. Merriam and Tisdell noted that qualitative studies are not entirely transferable because human behavior changes across time and change in environments. Variation in participant strategy was to be employed, given that there was be multiple data sources, and more than one person being interviewed. With variation in participant selection, there was diversity in the experiences of integration with TEL tools, increasing external validity, or the ability to apply the findings from this study to other studies. Another strategy that was being used, as suggested by Merriam and Tisdell (2015, p. 255) as a "*thick description"* of the site and findings. With detailed descriptions of the school site (the case) and the findings, there is an increased transferability for others to replicate my study.

Dependability

According to Merriam and Tisdell (2015), there are some strategies to establish reliability or dependability and include triangulation, peer examination, researcher's

position, and an audit trail. Strategies that were used in this study to establish dependability were creating an audit trail and developing a database through MAXQDA qualitative data analysis software tool (Yin, 2017; Merriam & Tisdell, 2015). Cutcliffe and McKenna (2004) explained that an audit trail is a record of steps taken from the beginning of the research study to the development of findings and conclusions. I employed categories to create an audit trail that included raw data records, data reduction and analysis, data reconstruction with categories and meanings, notes on methods and issues of trustworthiness, and reflexive notes in reducing bias in findings. Merriam and Tisdell noted that reflective journaling reduces bias because the researcher has a chance to reflect on their disposition during the data collection.

Confirmability

Patton (1980) posited that qualitative research done in the most naturalistic setting possible with well-designed research methods raises confirmability and objectivity. The inclusion of anecdotal evidence from participants in Chapter 4 is one strategy that can raise confirmability in this study. Reflexivity is another strategy that will be utilized. Reflexive journaling will involve recording my views following interviews. Going through and reading reflective helped reduce subject interpretations when concluding the findings. Patton suggested that low reactivity to opinions helps maintain an objective stance. It was essential to maintain objectivity by not injecting my opinions or views, but also being empathetic can help create a comfortable rapport and may induce more in-depth descriptions in responses.

Ethical Procedures

Ethical standards were used and approved by Walden IRB (approval # 08-27-19-040856) before any data collection begins. All participants are voluntarily and may withdraw at any time during the study. An informed consent form was outlined with ethical standards and the purpose, procedures for data collections, and the participant's roles in the research. The risks and benefits were outlined in the consent form, reviewed, and signed by participants before any data collection begins. Participants' names and locations were not published and remain confidential except for mandatory reporting or court trial if that should arise. To reduce vulnerability, data based on participant responses were confidential and not shared with school administrators or other educational staff. Part 7 conveys that for persons less than 18 (children), consent is required from a parental guardian. However, in this study, children were participants.

Summary

Chapter three outlined an overview of the research design, participant selections, and a brief explanation of the instrumentation with the data plan and analysis. Following the explanation of the research design, an outline was given to define the participant selection, school site criteria for the unit of study along with the procedure for recruitment, identifications, and participation. An outline that defines the intention and purpose of instruments, data plan, and data analysis concluded the methodology section.

The research design was qualitative because of questions with *how* and *why* were addressed in the experiences of TEL integration among secondary teachers. To capture in-depth, lived experiences within a real-life context, a case study would be appropriate

(Yin, 2017; Stake, 2010; Merriam & Tisdell, 2015). The type of case study was explanatory because there is an intention to gain an understanding of why the integration with TEL tools has not led from replacing to transforming how teaching and learning occur. The figure below diagrams the research design.

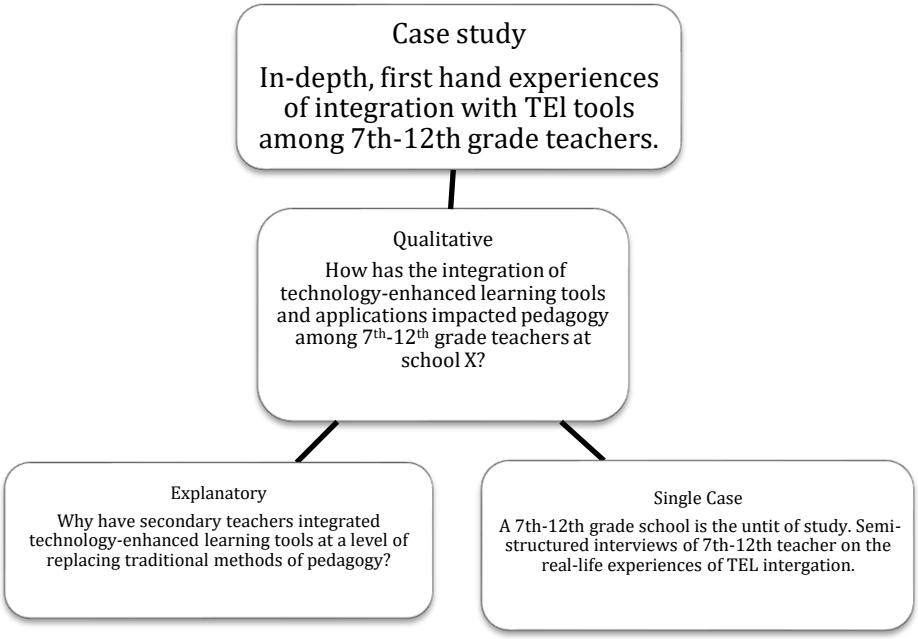

Figure 4. Research design.

Chapter 3 also presented the rationale for the explanatory single case study approach. The role of the researcher and the logic behind sampling and selecting a case was discussed. The unit of study will be a seventh-12th-grade school, where the integration of TEL tools has been occurring on a daily or weekly basis. The role of the researcher was to examine and investigate the behavior of TEL integration through interviews, direct observations, and analysis of educational artifacts. A detailed description of the population and school site was included in chapter three. Instruments, data collection procedures, and data analysis plans were outlined in this chapter. There

was an emphasis on using multiple resources and an audit trail to deal with issues of trustworthiness, including internal validity, dependability, transferability, and creditworthiness. Many studies have involved the integration of different digital technologies, but few have investigated why the integration of TEL tools has not been more effective in transforming teaching and learning. In chapter 4, there was emerging evidence that helps gain an understanding of why there has been a lack of transforming pedagogy through TEL integration. In chapter 4, I included a description of the research setting in detail, along with the demographics of the population. In chapter 4, I discussed the data collection and procedures that were proposed in chapter 3.

Chapter 4: Results

Introduction

The purpose of this qualitative explanatory case study was to find explanations into why the integration of TEL tools and applications among seventh-12th-grade teachers has been at a level of replacing established pedagogical practices instead of transforming pedagogy. In Chapter 4, I present the data results from the individual, focus group, and follow-up interviews. Chapter 4 includes the research setting, demographics, data collection and analysis, evidence of trustworthiness, and study results based on the research questions. Table 4 shows the themes that emerged for the main research question and subquestions. Table 4 shows which themes fit the conceptual framework, professional development, and unexpected outcomes that elicited explanations to the research questions.

Main Research Question

Why have seventh-12th-grade teachers integrated TEL tools at a level of replacement instead of transforming how teaching and learning occur?

Subquestions

SQ1: How has the integration of TEL tools and applications influenced instruction among seventh-12th-grade teachers at School X?

SQ2: How has the integration of TEL tools and applications affected curriculum among seventh-12th-grade teachers at School X?

SQ3: What are the perceptions among seventh-12th-grade teachers at School X in how the integration of TEL tools and applications has influenced learning?

Table 4 shows the themes that emerged for the main research question and subquestions. Themes were developed based on the coding, categories, and meanings from the data analysis. Themes are discussed in further detail in the results section of this chapter.

Table 4

Summary of Themes That Align With the Research Questions

Research questions	Theme 1	Theme 2	Theme 3	Theme 4
MRQ	Teacher centered: Teacher integrates TEL tools and applications	Seamless: The integration of TEL tools and applications can be limited by compatibility, user-friendliness	TPACK is nonexistent with distributed informal professional development	Collaboration has an impact across platforms, teachers, and students.
SQ1	Replacement: Ttraditional methods of presenting knowledge are replaced with TEL tools and applications.	Efficiency: Grading, assessing, and delivery of assignments save time with TEL tools and applications.	Transform: Instruction is accessed in a new way, not necessarily transformed.	
SQ2	Replacement: Traditional hardcopy textbooks, along with paper assignments, are replaced by digital copies.	Efficiency: Curriculum is accessible and exchanged beyond the classroom.	Transform: Access and enrichment with a curriculum that may not be possible without TEL tools and applications	
SQ3	Replacement: Students access assignments and textbooks digitally.	Efficiency: Student accesses all resources and assignments in one place, and it is organized automatically.	Transform: Students engage and collaborate in new ways that are outside of the traditional learning environment	

Setting

This study took place in a seventh-12th grade building with 58 teachers. The urban school is in a city with a population of 12,000 where most of the students who attend live in the city. About 1,000 students attend School X with a graduation rate of around 89%. The student-to-teacher ratio was around 18:1, with an 11% minority population. The one-to-one iPad initiative was rolled out in 2011for the primary grades. Students in grades seventh-12th received iPads in 2014. Teachers and students at School X have been integrating TEL tools and applications since 2014. The halls are organized by subject area. This organization made it easy to recruit by subject area and locate participants for the interviews. The special education areas were located on the first two floors to reduce the amount of movement for students with disabilities who were not fully inclusive.

Demographics

The seventh-12th-grade building has 58 teaching staff. I interviewed seven of those teaching staff, which included three technology integration specialists. Based on the initial interview, I contacted a fourth technology integration specialist, but he was reluctant to participate due to time constraints. Three of the four technology integration specialists participated in this study. The three integration specialists had dual roles as teachers and technology integration specialists. Initially, one of the three started as a full-time integration specialist helping teachers integrate TEL tools and applications at the start of the one-to-one technology initiative. This participant worked solely as a technology integration specialist. According to participants, by 2014, the 1:1 iPad

initiative moved to the seventh-12th-grade building, and two more technology integration specialists were added. By 2018, there were four technology integration specialists. At the time of this study, two technology integration specialists were active. The original technology integration specialist decided not to take on the role this school year and moved back to teaching full time. Another technology integration specialist moved into a new position and was not taking on this role any longer, leaving two active technology integration specialists. The two active integration specialists also teach full-time. Table 5 shows participant demographics. Categories for the participant demographic table include gender, years of teaching, individual and focus group interviews, special versus general education, and technology integration specialists.

Table 5

Participant Demographics

Participant	Gender	Years teaching	Individual interview	Focus group interview	Special or general education	Technology integration specialist
TA	M	7–12	Yes	No	General	No
TB	F	15–20	Yes	Yes	Special	No
TC	M	15–20	Yes	Yes	General	Yes
TD	M	7–12	Yes	No	General	No
TE	M	2–7	Yes	No	General	No
TF	F	12–17	Yes	No	General	Yes
TG	F	12–17	Yes	Yes	General	Yes

Data Collection

The data collection process began with inviting possible participants based on purposeful sampling. Participants who made up the purposeful sample met the selection criteria written out in the invitation letter. Following the recruitment process, the next phase in the data collection process was setting up individual interviews. Recruitment

was a continuous process that occurred as I collected data from individual interviews. Following the individual interviews, a focus group interview was conducted based on willing participants. The last part of the data collection process was the follow-up interviews. For the follow-up interviews, each participant was sent three probing questions based on the themes developed from the data analysis process via a confidential email. Each participant was asked to review the transcription of their interviews and add, modify, or delete any information. All data collected and transcribed have been stored in a secure password-protected online storage area.

Invitation Letter to Participate

The initial invitation letter to participate included the data collection methods and the participant selection criteria. Three data collection methods used were individual interviews followed by a focus group and interviews, and lastly, follow-up interviews. The participant selection has these characteristics:

1. Employed at a School X as a teacher who supports the integration of TEL tools among 7th-12th grade teachers.
2. Work in a school that has adopted a 1:1 TEL tool integration.
3. The participant does not have adoption barriers and does not view the integration of TEL tools and applications as intrusive to instruction and learning.
4. The participant integrates TEL tools and applications daily or weekly.

The collection of this data was sent via email to a seventhth-12th grade teacher over a week. Only two responses were returned to teachers who fit the selection criteria. The following week I went to the two teachers who responded for a meet and greet. The

face to face meeting allowed me to introduce the study to the initial participants and ask the initial participants what other teachers fit the selection criteria. This snowball effect allowed me to walk around the seventh-12th grade building and begin to recruit participants that were recommended by previous participants. I went back over the selection criteria as I met new teachers to make sure they fit those characteristics. The whole process of collecting selection criteria information that fit recruits were over three weeks. Each week included some individual interviews and recruiting new participants.

Recruitment in the Setting

The initial contact was helpful because the first participant helped in initiating the snowball recruitment by providing names of potential participants. Snowball recruitment resulted in seven participants from the seventhth-12th grade building and one participant from the third-sixth grade building. Most of the time was spent recruiting at the seventh-12th grade level, where the integration specialists worked. The single interview at the third-sixth grade building was not in the original sample pool. The single third-sixth interview was incomplete and did not result in full data collection. Changes to the interview schedule were made, and the teacher had to interview in the hall. Within 15 minutes, the area went from being quiet to people passing, and I had to stop the interview from protecting confidentiality. Due to the data collection being incomplete, it was used in the data analysis. The interview was a discrepant case in the data collection, which has been further discussed under the variations in the data collection section.

Interview Settings

Individual interviews took place within each participant's classroom during their preparation hour. The door was closed to block out noise and create a private space for the interview. Being in the classroom allowed the participant to share some of the TEL tools and applications they use. Participants shared the use of TEL tools like the iPad, Eno Board, Desktop, and other TEL tools used solely within the special education room. The individual interview settings allowed me to hear and see how TEL tools and applications were being integrated. The focus group interview took place after school in the teachers' lounge. For privacy, we seated ourselves in an area that was more secluded within the lounge.

The lounge was a central area and was a quiet area with no traffic after school. There were a couple of interruptions during the process of interviewing. During one of the individual interviews, two student helpers came in to clean. At this point, the audio recording was paused, and the participant asked the two students to come back the next day. During the focus group interview, a staff member came in to get a beverage from the vending machine. The distance from us was far enough that it was not an interruption as we were in a different section of the lounge. Those were the only two interruptions that occurred. After receiving permission from the IRB to expand the purposeful sample to third-sixth teachers, I set up an interview with a sixth-grade teacher. Due to last-minute changes, the teacher had students and wanted to interview in the hallway. The setting was not private, and with a passing staff, I had to cut off the interview from being complete. This unusual circumstance did not allow me to capture the full interview, and this was not

used as part of this case study. This case study setting remained bounded to the seventhth-12th building and participants. The follow-up interviews took place via email.

Individual Interviews

The whole process of recruiting and conducting individual interviews took 4 weeks. The first week included using selection criteria and snowball recruiting to build a pool of participants. Individual interviews occurred in the following 3 weeks. Following the first week of recruitment, two interviews were set up. The second week of data collection included two interviews and three more interviews set up for the third week. The third week of data collection included three more interviews and two more interviews, along with the focus group interview set up for week four. During week four, I collected data from two more individual interviews and conducted the focus group interview. By week four, seven individual interviews and a focus group interview were complete.

The location of each individual interview took place in the classroom for each teacher during their prep hour. The classroom door was closed, and the duration of each interview was uninterruptedly lasting about 30-45 minutes. Being in the teachers' respective classroom allowed the participant to share hands-on examples in the different ways technology-enhanced tools and applications were being integrated. Data for each individual interview was collected in two ways. The first way of collecting data was using Inspiration Maps application on an iPad to create a circle of influence map that showed what technology-enhanced tools and applications were being integrated and to what degree each influenced pedagogy based on the frequency of integration. The second

type of data was based on the research questions and was collected through an audio recording application using MAXQDA. The individual audio data were transcribed and coded for data analysis.

The Focus Group Interview

The focus group interview took 60 minutes to complete and followed the completion of individual interviews. Three seventh-12th grade teachers were able to participate in the focus group interview. One of the three participants was previously a full-time technology integration specialist and now is solely in the teacher role. Data based on the focus group questions were collected through audio recording with the MAXQDA.

Follow-up Interview

Follow-up interviews were used to probe more profound questions after building categories from open and descriptive coding. Follow up interviews were sent via email using Google Forms. Three of the seven responded. Participants were asked the following three questions:

1. How have you and your students' used technology-enhanced learning tools to collaborate?
2. In what ways has the integration of technology-enhanced learning tools worked seamlessly? If not, describe some examples that you would envision it working seamlessly.
3. What do you think of when you hear that technology-enhanced learning tools are user-friendly?

All data were stored in a password protected storage device that only I could access.

Variation in Data Collection

Reluctance to participate. A reluctance to participate was one of the unexpected issues that arose. There was previously an incident of a student recording a teacher during class and then making it public on Facebook. This incident took place at the end of the previous school year. In reaction to this incident, the principal and teachers put in place rules regarding the use of technology in the classroom. Some teachers went as far as not using any digital technology in the classroom. Because of this incident, the process of recruiting participants was influenced negatively, where teachers were apprehensive about integrating digital technology, which was a part of the selection criteria in building a pool of participants. Contacting the number of teachers resulted in a reluctance to participate as a result of lowering or removing digital technology-enhanced learning in their classroom after the incident from the previous school year.

A discrepancy in sampling. A change in sampling was another issue in the data collection process. I was concerned that I might not reach saturation in data early in the data collection process. I applied to expand the pool that I would sample to 3rd-6th grade teachers at a different building within the district. Two issues arose with doing this. First, it created a different case as it moves outside the bounds of 7th-12th grade teachers. Secondly, I assumed I would not reach saturation, which I did without the need to expand the sampling pool. I still wanted to access some third-sixth grade to teachers to see if the patterns that showed up in the seventh-12th grade sample was consistent. Only one

teacher was willing to participate. I arrived at the building and found my way to the participant. The participant told me that there was a change in the schedule, and she had class, but wanted to do the interview. At this point, I should have cut off the interview politely. However, we found a quiet spot and began. In the middle of the interview, the bells went off, and the students began coming to our quiet area. At this point, I realized the participant was stressed and felt obligated. The area was no longer private, and the interview was not appropriate. I decided not to use the data I collected as it was not representative of a full interview process.

Revised interview question on the curriculum. A change in the interview question was made due to the responses from the first two individual interviews. The question of how the curriculum would change left the initial participants with confusion. Teacher A paused following the questions and stated, “I don’t think it changed my curriculum. I think it allowed me to add new stuff to what we were working on.” Teacher B gave a similar response. I realized the teachers were not using the integration of TEL tools and applications to change the curriculum. Participants were looking for ways to use TEL tools and applications to access the new curriculum and enhance the current curriculum. Following the second interview, I revised the question to include ways in which the integration of TEL tools and applications added a new curriculum or enhanced current curriculum.

Data Analysis

This section describes the process used to analyze the data. According to Yin (2017), a Five-Phases Cycle can be employed for qualitative data analysis:

1. Compiling Data: Audio data is transcribed by me using Microsoft Word and uploaded to the MAXQDA program organized by each data collection method.
2. Disassembling Data: A process that I used to highlight words and phrases in the interview transcriptions that aligned with the problem and research questions.
3. Reassembling and Arraying Data: A process of looking for patterns in data that I organized into phrases. Each phrase was then put into categories based on the meanings of the phrases.
4. Interpreting Data Results: A process in which I used categories and meanings to build themes.
5. Concluding: A process of creating findings based on the themes that emerged from interpreting the data results.

The first three phases were used to analyze the data. The process of compiling, dissembling, and reassembling data was applied to each data source, including the individual interviews, the focus group interview, and the follow-up interviews. The following sections were divided into individual interviews, focus group interviews, and the follow-up interview. Each section includes the phases of qualitative data analysis, including compiling, dissembling, and reassembling data. According to Yin (2017), compiling data is organizing and placing data into a database. The individual interviews and the focus group interview had audio recordings using MAXQDA audio recording application. The audio data was compiled into transcripts and then organized by me using MAXQDA, where each participant was placed based on the chronological order of when the interviews occurred. The follow-up interviews were compiled using Google Forms.

Yin (2017) described the dissembling of data as a process of chunking data into smaller parts through coding. I employed open and axial coding (Merriam & Tisdell, 2015).

Individual Interviews

The dissembling of data began with open coding during the individual interviews by creating a Circle of Influence Map (CoI) of the TEL tools and applications that influenced each participant's pedagogy. The CoI allowed me to organize, code, and develop probing questions during the interview. I applied derived annotated field notes within each CoI. I applied open coding for each transcript with the assistance of MAXQDA. The CoI maps were the start of compiling, organizing, and analyzing the data within each interview. I also employed In Vivo coding by creating memos of phrases that participants made. The phrases connected to the research questions. Following the open coding, a second code cycle, sometimes called axial coding, was applied to begin building categories (Merriam & Tisdell, 2015). Yin described the reassembling phase as looking for patterns. Using a constant comparative method during the compiling and disassembling of data, I began to see underlying themes emerge. Each data source has an array of reassembled data where codes are combined to create categories and meanings. Table 6 shows the themes formed from each data source.

The following section begins with the data collection for the CoI maps. Each CoI map represents the ways in which participants integrated TEL tools and applications. The arrows visually represent tools, applications, or learning management systems. The bubble shows open coding while the connections are labeled with curriculum, instruction, and learning. Field note descriptors (by some bubbles) were added in different areas as

thoughts I had during the data collection with the CoI maps. Open coding for the CoI maps was done during the interviews. As participants went through their TEL tool and applications, I coded the type and purpose in their CoI map. Open codes were within the areas for the *types of tools, types of applications,* and the *learning management systems.* The categories included *TEL tools, TEL applications with collaborations, instruction, curriculum,* and *learning management systems*. Table 6 shows the movement from open coding to categories to meanings. Table 6 follows the presentation of the CoI maps.

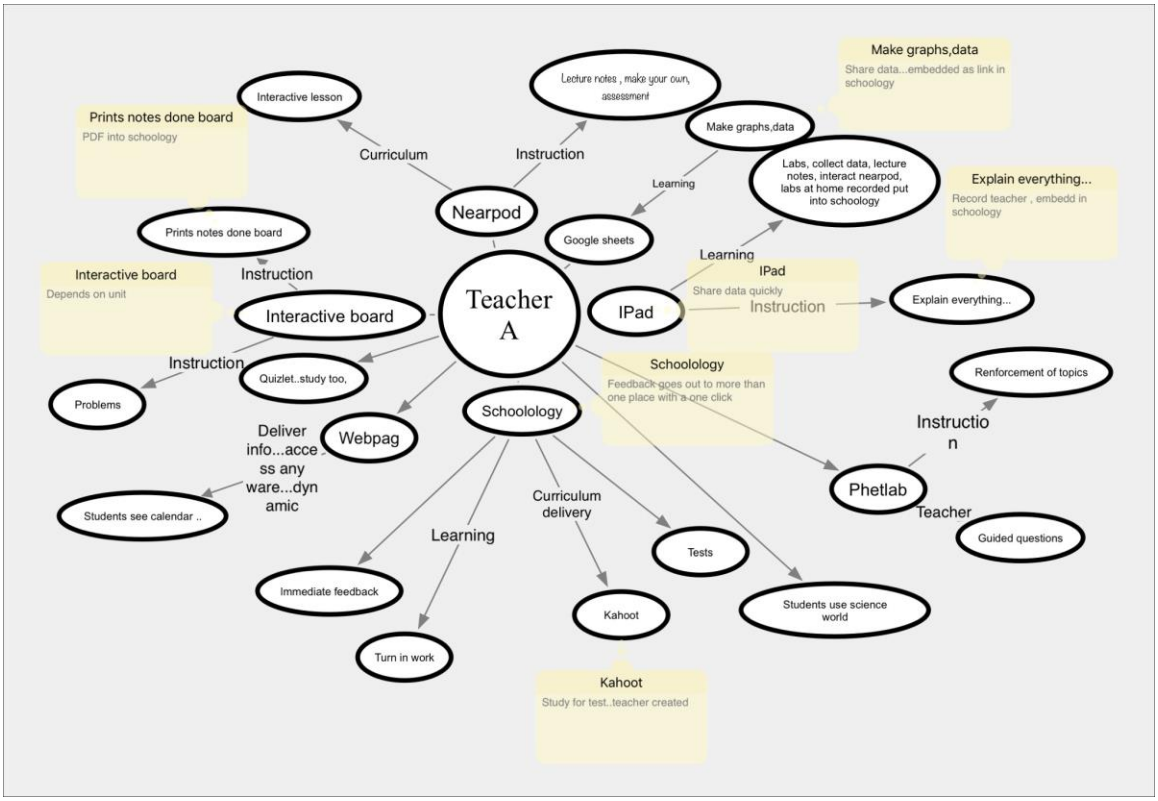

Figure 5. Teacher A circle of influence map.

Figure 5 is a visual that Teacher A created showing all the TEL tools and applications that were integrated into pedagogy and the influence they had. For example, the iPad is a TEL tool, and Schoology is a TEL application that was integrated into her

pedagogy daily. Teacher A had been a technology integration specialist who exhibited enthusiasm for using several different TEL tools and applications. Teacher A remarked:

> This is the magical piece right here. So what I have to do on here and we're doing math problems I go in here and do as problems appear on the board, the cool thing that I can do that afterward if I'm done doing example problems for homework I press file print everything that's up on the board that I just wrote prints off the printer, so any students that need every example problem that I did is right there.

Initially, the vision with the integration of the Eno interactive whiteboards was to increase student-centered learning by having the student use the Eno boards to interact within lessons. The Eno boards became a tool for teachers to diversify the way instruction occurred, becoming teacher-centered.

Teacher A showed frustration in the role as an integration specialist. Embedded professional development had its challenges: "There were those teachers who wanted help, and then there were those teachers that gave up as soon as the first step in using the technology didn't work right away". (Teacher A, pos 14). Technology integration challenges beyond user adaption were identified in interviews.

The Eno interactive whiteboards became obsolete as the company that made them went out of business, and future updates came to a halt. The Eno boards went from interactive to just a traditional whiteboard. The loss of interactive whiteboards became a barrier to raising the level of integration for this TEL tool as well as the end of distributed professional development between the integration specialist and teachers.

Teacher A used the iPad, Schoology LMS, and Kahoot application for instruction and assessment. Teacher A remarked:

> I use Schoology to deliver content mainly and as a place to turn in higher-level assignments and projects. I still do test paper and pencil because of cheating on the iPads. The students are always smarter than us on technology. Even if you think you got it, students will still find a way to cheat.

Schoology was used daily over iPads mainly for a place for students to turn in work and access resources, putting this TEL application at a level of replacement in the context of learning. Schoology became a place for teachers to increase efficiency by having student work and resources organized in one place. Along with TEL tools and applications being integrated to create efficiency for teachers, the idea of cheating was a barrier to integrated TEL tools and applications at a higher level.

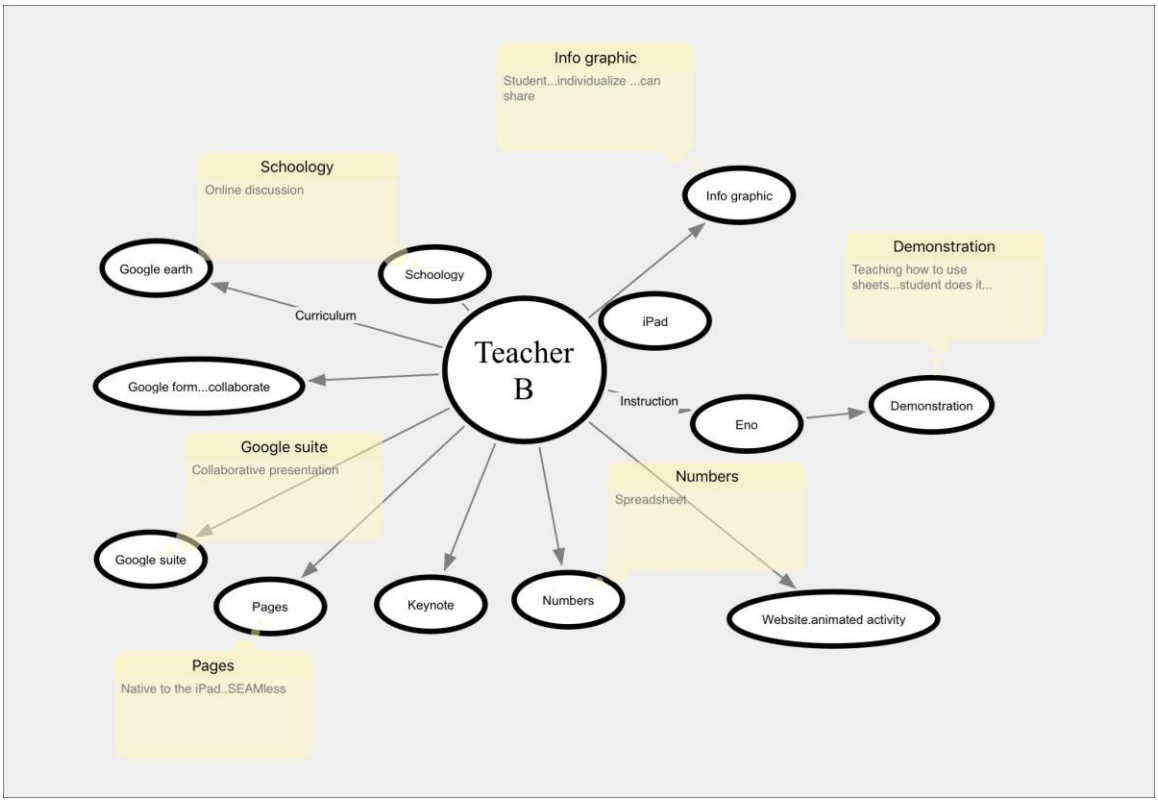

Figure 6. Teacher B circle of influence map.

Like Teacher A, Schoology and the iPad were use the most often with Schoology being an LMS to store resources and a place for students to turn in work. Keynote and Pages were mainly used by Teacher B to place and make presentations. Teacher B remarked:

> I use pages to create content for Keynotes. I use Keynote mainly for instruction. The student does not use Keynote or Pages in my class. I use Pages to make my daily planner. Pages are my planning tool or guide to planning.

For Teacher B saving time in grading and reducing that chances of cheating were two areas that TEL tools applications were used for. Teacher B remarked:

Teaching economics, I looked at the opportunity costs as saving time on grading tests. I take some time to make the tests, but the reduction in grading pays off. Schoology allows me to randomize questions and randomize the answer to the questions, so the chances of students being on the same question are small, and this reduces cheating. I also use the Classroom Apple Application, where I can see what the students are doing on their iPads. I use this application for classroom management. The integration for TEL tools and applications became a way for teachers to create efficiency in grading, organizing, and assessing students. Like Teacher A, Teacher B worried about cheating with the use of TEL tools and applications.

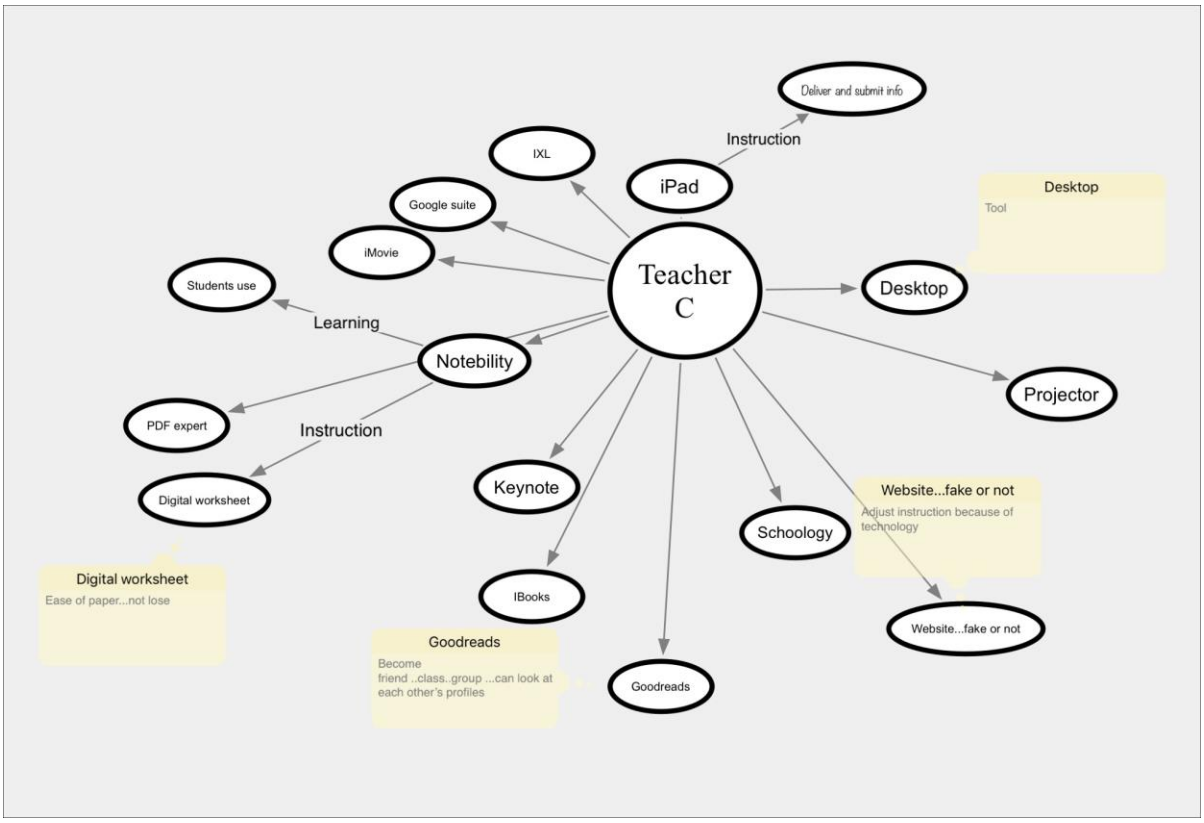

Figure 7. Teacher C circle of influence map.

Teacher C had been an integration specialist. As an integration specialist, teacher C spent time passing on her knowledge in integrating TEL tools and applications to those teachers that were willing to integrate TEL tools and applications. Teacher C remarked:

> It is interesting how I have a lot of questions from a small percentage of staff. First-year we did this, and we had four of us. Budget cuts and schedules, we dropped down to two. This year we have two, and I am one of them. I am seeing a select group of teachers. Some want to use it.

Teacher C found success and roadblocks in applying distributed professional development with the integration of TEL tools and applications. Teacher C noted:

> There is a physical education teacher who had no experience with Schoology. Several Physical education teachers were teaching the same health course. I walked him through using Schoology and in creating a group and course where all three teachers could share the same materials for their health courses. He was terrific and wanted to learn more. I will contradict this with another teacher who got frustrated with Schoology and, at that point, shut down and did not want anything to do with it. As soon as a task becomes tough, the teacher wants to stop using the technology or applications. BY sharing a materials bank in Schoology, it makes it easier and saves time. Efficiency makes things faster and easier. I can grade things faster with the iPad and Schoology.

Teacher C expressed barriers to integration and reasons why integration occurred. The main two points Teacher C expressed were the efficiency and organizing of content. The use of TEL tools and applications was teacher-centered because Participants focused on what made pedagogy easier and faster. Teacher C also expressed the challenge of learning and designing tasks in integrating TEL tools and applications. Teacher C remarked:

> First, I had to take steps to teach the students how to use Google Suite applications. Then I have a student who is writing big papers, and they would type on Google Docs on the iPad, and then they share and submit the essay to me.

Participants in this study were expected to be the designers, creators, and experts in the TEL tools and applications, creating a challenge to raise the level of integration successfully.

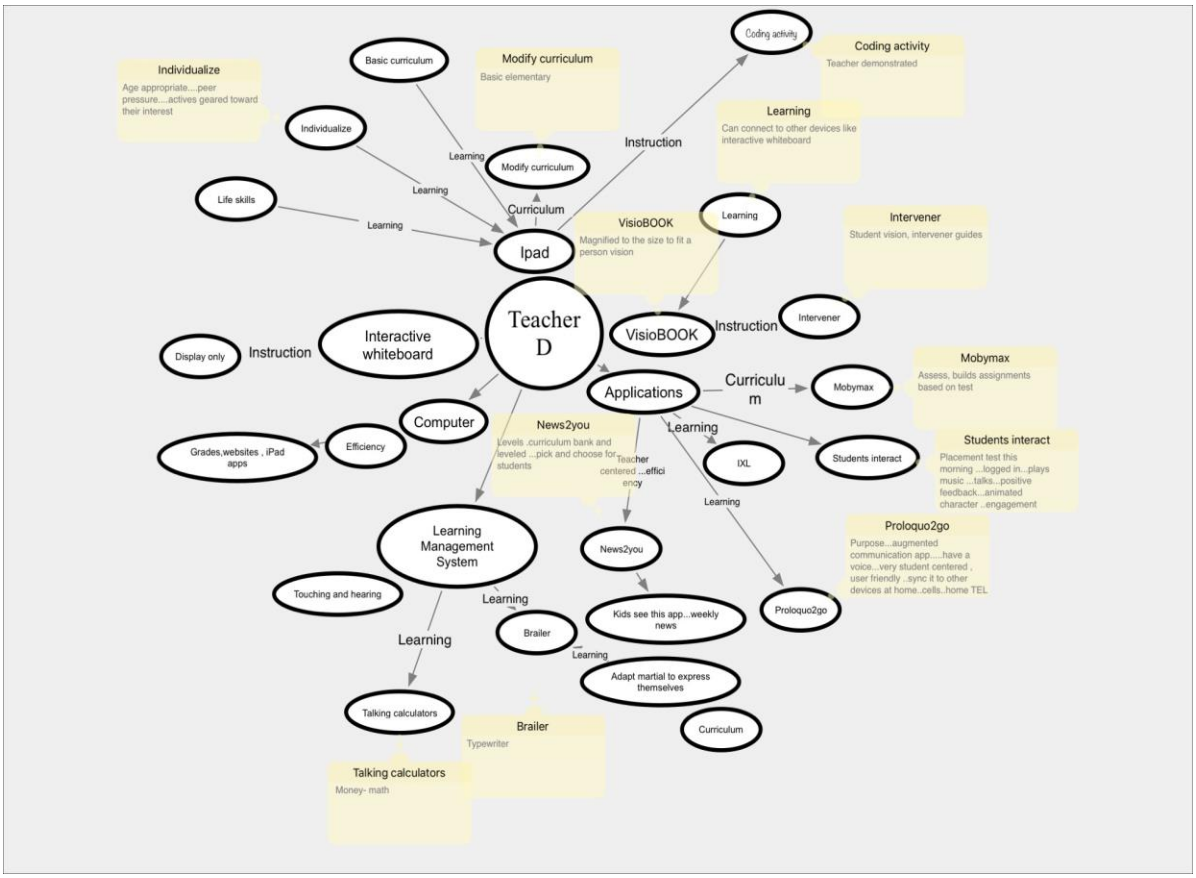

Figure 8. Teacher D circle of influence map.

Teacher D was different from the other participants in that the TEL tools and applications were not all the same because of the students being special needs. Assistive technology was used for a student with special needs. For example, applications of Mobymax and Proloquo2go were used to assist special needs students in interacting with curriculum and communication. Assistive technology and applications were centered around student learning. In one case, a student who was nonverbal due to a disability was able to communicate using Proloquo2go, reaching a level of transformation where communication was limited or not possible without the integration of TEL application.

Teacher D remarked:

> Specially designed for people that cannot use their voice to speak for whatever reason. There are other apps out there that do similar things. Still, this one we have found that it is the most user-friendly, it is easy to set up, once you have it established you could sink that account to a phone, you can sink it to his home iPad, so he could have the same exact screen on his school iPad, on his mom or dads cell phone, or the cell phone he got when he was older, or his home iPad, so they all look the same.

Teacher D explained that there were students at all different grade levels with diverse needs. The integration of TEL tools and applications allowed teacher D to differentiate pedagogy in a way that met the diverse needs of the students. However, the whiteboard was not interactive as it became just a presentation screen due to the lack of updates. The integration of TEL tools and applications fit a student and teacher-centered approach at the same time. Applications were designed to meet the needs of students raised the level of integration from replacement to transformative in communication. This interview was the first interview that the participant introduced the use of Digital Instructional Materials (DIMs). The applications of Mobymax and News2you allowed students to interact with digital materials. The integration of TEL tools and applications allowed the augmentation new curriculum.

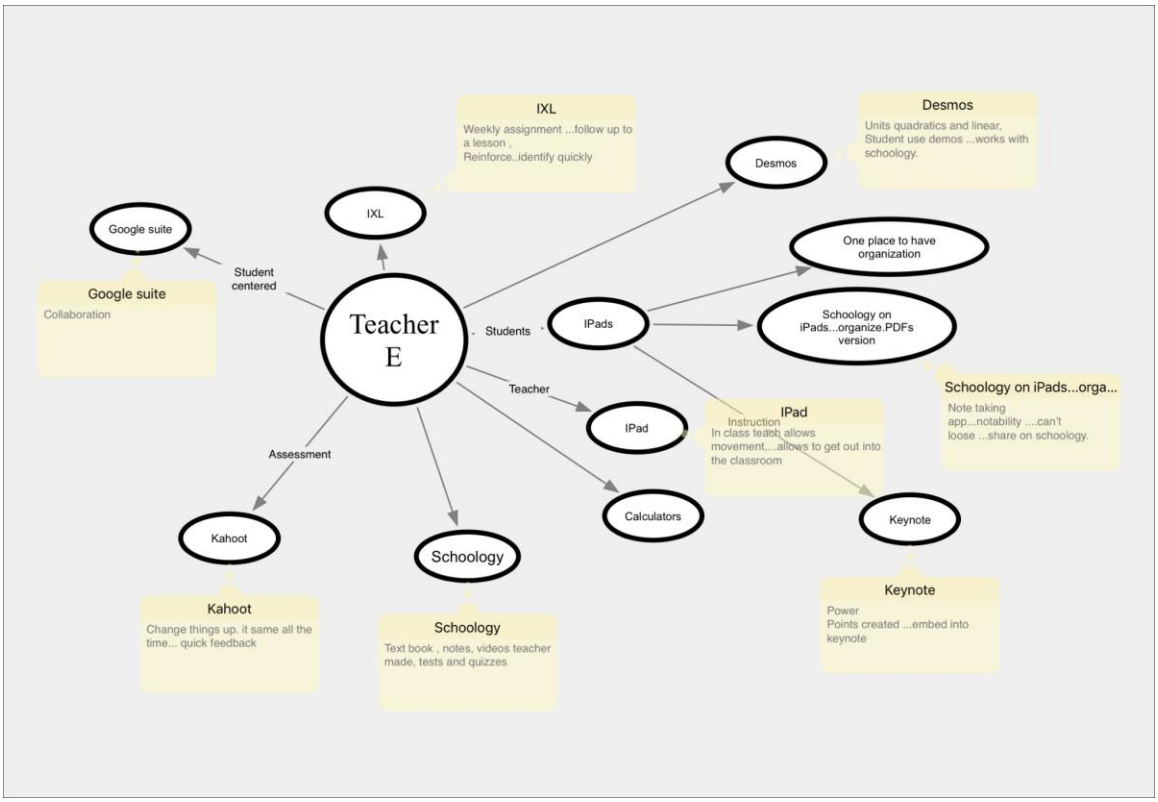

Figure 9. Teacher E circle of influence map.

Teacher E integrated TEL tools and applications at a level of replacement where Schoology was used as a place to organize resources and exchange work with students. Teacher E remarked: “They download the assignment from Schoology into PDF expert or Notability where they can annotate and fill out the assignment. They upload it back into Schoology. I then annotate and assign a grade”. (Teacher E, Pos. 14)

The use of TEL tools and applications followed a similar pattern form the previous interviews with organization and efficiency. Teacher E noted:

> It gives me the freedom to go around the room. Classroom management is a lot easier that way. I am with the students more rather than being at the front of the

room and away from them. I think it is a lot about efficiency. I do not have to erase a bunch of my writing. I move to a new slide and go from there.

The integration for TEL tools and applications was teacher-centered, assisting the teacher in how traditional methods of teaching were made efficient and organized.

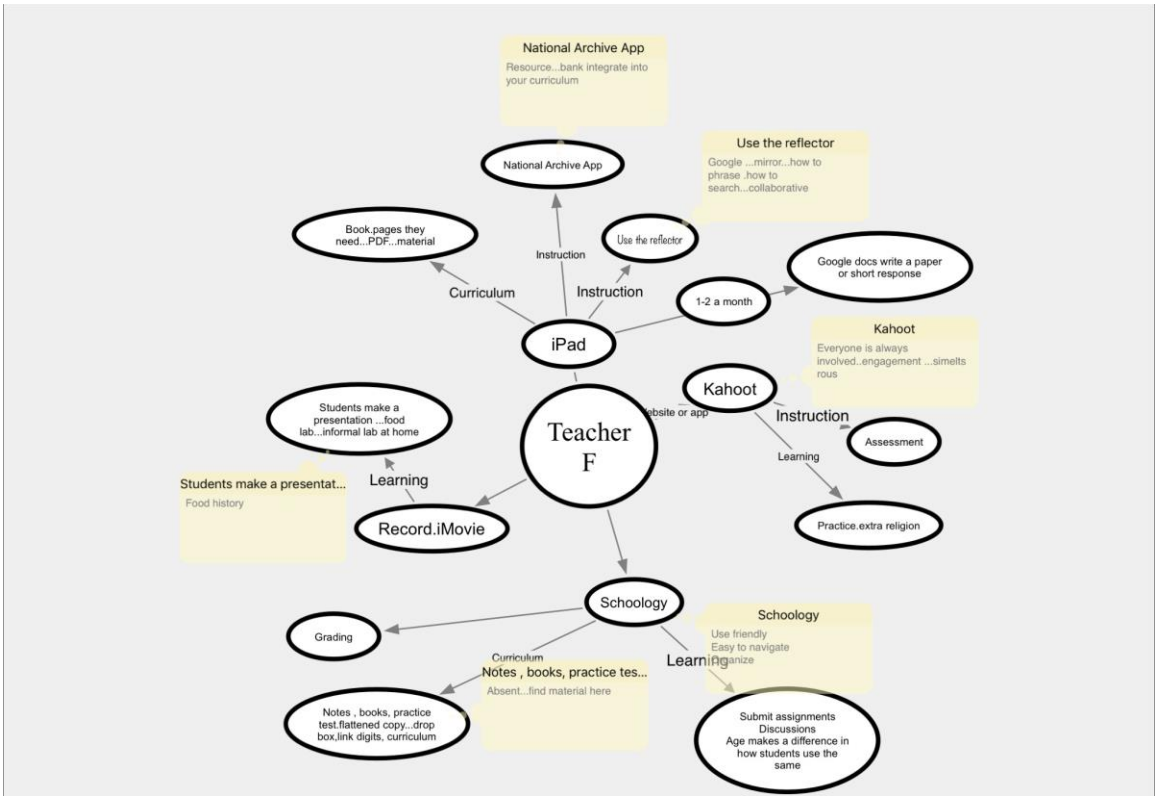

Figure 10. Teacher F circle of influence map.

Teacher F mainly used TEL tools and applications for storing, organizing, and exchanging student work, replacing traditional methods of teaching with paper and pencil work. Teacher F noted:

The integration is usually seamless, but not always. I have not adopted the grading component because it is not always seamless. 99% of my tests and quizzes are paper and pencil. My comments do not get lost on paper. I have done

> this digitally, and my comments with feedback do not always show up. I mainly use Schoology for the student to access the curriculum, usually notes, and the book. Students pull off digitally copies of worksheets and questions from Schoology as a pdf into notability and then write on it and upload it so I can look at it.

Teacher F viewed Schoology as a place for making traditional methods of pedagogy easier to manage. Traditional methods included students accessing curriculum, assignments, and discussions. Teacher F noted that *some students do not always open up in class during discussions, and Schoology allows a place for those students to participate*. This was the first time a participant noted using Schoology in a way that moved from a level of replacement to a level of transforming learning. The use of Schoology was student and teacher centered. Teacher F discussed a similar trait of not trusting students with technology with other previous participants. Teacher F remarked access to the new curriculum.

> I have access to a new curriculum like university archives. I have access to maps and private collections that I could never get without the technology. We cannot go to China to look at pottery, but we can use an interactive application to talk to someone from China on pottery made there.

The access to the new curriculum in the way teacher F described shifts the level of replacement to a level of transformation with an interactive curriculum with a live person in China. Teacher F also noted that the use of Kahoot increased the level of engagement to 100% compared to traditional methods of formal assessments. Based on

the CoI map, teacher F utilized Kahoot daily or weekly. In the context of professional development, Teacher F did not feel confident with integrating more TEL tools and applications due to a lack of professional development. The low efficacy in technology integration was a common trait among participants as well as the participants who had held integration specialist roles. Teacher F explained:

> There is a lot of stuff that I like and look good that students are using in other classrooms, but I do not feel like I have enough training or personal experience to use this in class. There is a loss in translation if I do not know what to do. I will be using Google Docs more this year. Once or twice a month with the older kids.

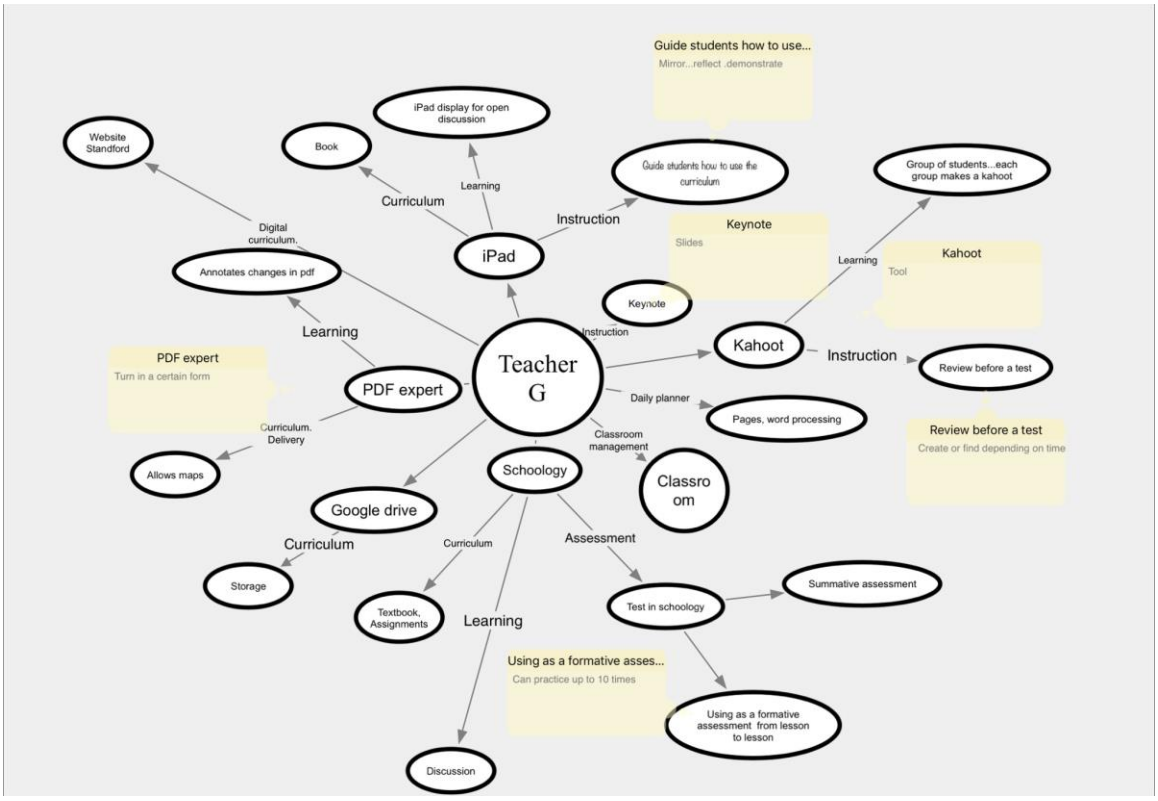

Figure 11. Teacher G circle of influence map.

Teacher G was one of the first integration specialists and recalls the rollout of iPad integration, beginning in the primary grades and then moving into the 7^{th}-12^{th} grade building. Frustrated with the challenges of professional development and issues with the integration of TEL tools and applications being seamless, user-friendly, and adaptable, teacher F decided to work in a single role as a full-time teacher.

Teacher G integrated Schoology daily as a place for storing, assessing, and exchanging work between the teacher and students. Teacher G explained that he trained himself on applications and then trained the students. Teacher G would have students present how to use Excel to the whole class and then fill in any gaps. Teacher F had a student create group quizzes using Kahoot. Teacher G integrated TEL tools and applications in a way that allowed students to be part of the instruction, moving the level of integration from replacement to transforming how students learn. Participants in this study integrated TEL tools and applications in different ways.

The CoI maps were a useful tool in coding, compiling, and organizing data within the individual interviews. Following the completion of the individual interviews, the CoI maps were coded and categorized as part of the individual data analysis. The column on meaning was interpretations of the categories. The meanings were used to build the themes for the main research question along with the sub-questions. Data presented within table 6 was diverse and complied into categories. Each category was analyzed to create meanings related to the conceptual framework as well as the research questions.

Table 6

Circle of Influence Open Coding, Categories, and Meaning

Open codes	Categories	Meaning
iPad Eno board Desktop Projector VisioBook Interactive white board Reflector (Apple TV) Talking calculator	TEL tools	TEL tools used to deliver instruction and exchange work
Schoology News2You MobyMax	Learning management system	Schoology was used at a level of replacement to store material and exchange work. Mobymax and News2You were student-centered due to the adaptability for special needs students. Efficiency in auto-grading turned in work or quizzes.
Google Sheets Google Suites Google Forms	TEL applications–collaboration	Google was a primary application used to inject collaboration into learning. Exceeds a level of replacement, moving from efficiency to transformations.
Quizlet Webpage Keynote Nearpod Phetlab Kahoot Explain Everything Numbers Pages InfoGraphic PDF Expert iMovie Desmos Notability	TEL applications–instruction	These applications were used for a variety of reasons. Deliver instruction. Efficiency in the assessment. Efficiency in complaint work. Efficiency in grading Nearpod raised the level of engagement, depending on how it was integrated. Each application can fit replacement, efficiency, or transformation, depending on how it is integrated.
National archive GoodReads iBook PhetLab Nearpod IXL Google Earth Websites with Animated Activity MobyMax News2You	TEL applications–curriculum	These applications augmented pedagogy be allowing students and teachers to access the new curriculum. Applications like Nearpod and Phetlab enhanced the current curriculum as well as the offered new curriculum that otherwise would not be available. Real-time access to the curriculum was not utilized.

The CoI maps were one part of the individual interview data collection. The second part of analyzing the individual interviews was compiling, transcribing, organizing, and coding the transcribe audio data. Table 7 shows what codes there were and the movement from codes to categories followed with the meanings.

Table 7

Individual Coding, Categories, and Meanings

Codes	Categories	Meaning
Replacement Efficiency Transformation	RAT Framework	Segments from Individual interviews that connected pedagogy to the RAT framework.
Assistive Digital Technology Applications DIM New Curriculum Access	Curriculum	Segments coded the connected TEL tools and applications to Curriculum.
Student-Centered New Curriculum Access Instruction Learning	Pedagogy	Segments coded where TEL tools and applications impacted components of pedagogy.
Distributed PD PD Teacher-Centered	Professional Development	Segments coded that connected the integration of TEL tools and applications with professional development.

Focus Group Interview

Questions for the focus group interview were derived from the research questions and individual interview data. The initial focus group questions formed from the research questions were designed to capture views from participants if TEL tools and applications were removed. Probing questions were formed from analyzing the individual interview data, including the audio recordings, CoI maps, and transcripts. Table 8 below outlines the focus group questions with In Vivo Coding and meanings.

Table 8

Focus Group In Vivo Coding With Meanings

Focus group question	In Vivo coding	Meanings
How would your instruction change if TEL tools and applications were not there to integrate?	"Kids live in their digital world. I bring the digital world in to have engagement." "Kids want to be entertained, and using digital technology helps make content meaningful to them."	What students are exposed to the outside of school affects their motivation and engagement with classroom instruction.
How would curriculum change if TEL tools and applications were not there to integrate?	"Internet gives me access to content that could not normally have due to time, money, availability, and distance." "We got to this point because we can do stuff we could not do without digital technology." "I think it opens the door to utilize it for replacing textbooks." The curriculum is delivered to them in a way that they understand."	The idea that the curriculum is not accessible without TEL tools and applications equates to transforming pedagogy. Textbooks on the iPad and Schoology LMS is a level of replacement. Kids access knowledge through digital technologies, so getting knowledge this way in school makes sense to students.
How would learning change if TEL tools and applications were not there to integrate?	"I think there would be less interaction with more listening." "You're talking time. To make a slide show using posters would take me them a week versus one class period. Efficiency is what I am thinking." "They won't feedback and progress right now. This is the culture they live in": "Access to the world in real-time."	Learning is based on efficiency. Culture plays a significant role in how a student engages with learning. With the advent of instant messaging, videos, and access to a vast array of information, student perception is being molded by TEL tools and applications outside of the classroom.
In what ways has the integration of TEL tools and applications replaced learning, curriculum, and instruction?	"Allowed students to be more student-centered rather than listening to the teacher instruct the whole hour." "Made it easier for me to apply instruction at different levels using Mobymax applications." "The student's pace is not dictated by the pace of the teacher."	Replacement is equated to the integration of TEL tools and applications substituting instruction. Allowance for student-centered activities. Textbooks are now digital copies. A student interacts with a self-guided approach to lessons.
In what ways has the integration of TEL tools and applications created efficiency in learning, curriculum, and instruction?	"Grading is so much more efficient on the iPad." "Management of time." "Doing things by hand."	The integration of TEL tools and applications provided functionality with speed and organization to teachers. Less stress with efficiency.
The collaboration came up across several interviews. What would collaboration look like without any Tech integrations?	"Face to face outside of class would be difficult." "It changed me from not collaborate in doing a lot of collaboration." "Teachers teach each other"	The integration of TEL tools and applications has changed how collaboration works.

Table 8 Focus Group In Vivo Coding With Meanings §continued)

Focus group question	In Vivo coding	Meanings
What is your perception of how PD has contributed to TEL integration?	"We are self-elected." "I never had formal training. I share what I know with others." Once we had four TIS people, we all started sharing and learning from each other."	Teachers are expected to be the creators and designers of TEL integration. Distributed TPACK is shown the number of TIS increases.
Has there been a time when students were surveyed to see what they use or like to use for learning?	"No" "We are dependent on what works in our classroom and resources."	Because teachers are in control of how pedagogy works in the classroom TEL integration becomes dependent on the teacher.
How do you decide as a teacher what to use?	"I take something another teacher is trying" "I test out applications with students." "We are going to do what is comfortable for us." "Every year, new things come out."	Teachers are the designers of how and which TEL tools and applications are integrated.
How does efficiency equate to learning? Is it more learning or faster learning? What does the outcome look like?	"The learning is different." "My mental health is better, with less stress."	The Integration of TEL tools and applications brings relief to the daily stresses of teachers with efficiency. Appears teacher centered.
Describe experiences in instruction that could not occur without technology.	"Communication" "Collaboration in a new way."	Transform does not mean new, but old methods done in a new way.

Follow-up Interview

The follow-up interviews were limited to only three participants out of the seven. Follow-up interview questions were formed from overarching perceptions around collaborations, seamless operation, and user-friendly navigation. Participants reported collaboration as a challenge and, at the same time, transformed learning. The seamless operation was reported as a challenge defined by working across the different platforms of Google, Apple, and Microsoft tools and applications. User-friendly was identified as a challenge defined by how many steps it took to integrate a TEL tool or application. In Vivo Coding includes direct phrases from the follow-up interviews. The specific phrases were chosen based on the questions asked—Table 9 shows In Vivo Coding for each question and participant with meanings.

Table 9

Follow-up Interview In Vivo Coding with Meanings

Questions	In Vivo Coding	Meanings
In what ways have you or your students used TEL tools and applications to collaborate?	"Collaborate with other teachers for curriculum, PLC, and tech integration." "Students use Schoology to share resources."	Distributed TPACK Student-Centered
In what ways has TEL tools and applications worked seamlessly? If not, what are some of the challenges?	"I like tools that are intuitive." "If a user, if easily frustrated, overworked, not supported, not properly trained, or doesn't see the value in the tool, seamless will be less likely to happen." "Compatibility"	TEL tools and applications work without training. The idea of being intuitive in place of no training.
Describe what it means for TEL tools or applications to be user-friendly?	"To share on Google, it is as simple as one person creating a document and "Premium accounts have more options." "Not overly complicated."	Limitations of TEL tools and apps are not in control of the user.

Themes From the Data Analysis

Tables 6,7,8 and 9 show the movement from codes and categories to meanings. The meanings reflect the data interpretations from the codes and categories. Table 10 shows the movement from the meanings that were developed from the codes and categories to themes. The alignment of the themes to the main research question and subquestions is presented in the results section of chapter four, as wells as the beginning of Chapter 4.

Table 10

Meanings to Themes

Data Sources	Meanings	Themes
Meanings from the semi-structured interviews, including the CoI maps.	• TEL tools used to deliver instruction and exchange work. • Schoology was used at a level of replacement to store material and exchange work. Mobymax and News2You were student-centered due to the adaptability for special needs students. Efficiency in auto-grading turned in work or quizzes. • Google was a primary application used to inject collaboration into learning. Compatibility issues. Exceeds a level of replacement, moving from efficiency to transformations. • These applications were used for a variety of reasons. Deliver instruction. Efficiency in the assessment. Efficiency in complaint work. Efficiency in grading Nearpod raised the level of engagement, depending on how it was integrated. Each application can fit replacement, efficiency, or transformation, depending on how it is integrated. • These applications augmented pedagogy be allowing students and teachers to access the new curriculum. Applications like Nearpod and Phetlab enhanced the current curriculum as well as the offered new curriculum that otherwise would not be available. Real-time access to the curriculum was not utilized. • Segments from individual interviews connected pedagogy to the RAT framework. • Segments coded the connected TEL tools and applications to Curriculum. • Segments coded where TEL tools and applications impacted components of pedagogy. • Segments coded that connected the integration of TEL tools and applications with professional development.	• Compatibility and being seamless are challenges in raising the level of TEL integration. • Collaboration impacts pedagogy across students and teachers with TEL integration. • Grading, assessing, and delivery of assignments save time with TEL tools and applications. • The curriculum is accessible and exchanged beyond the classroom. • Access and enrichment with a curriculum that may not be possible without TEL tools and applications. • Instruction is accessed in a new way, not necessarily transformed.
Meanings from the focus group.	• What students are exposed to the outside of school affects their motivation and engagement with classroom instruction. The idea that the curriculum is not accessible without TEL tools and applications equates	• The Integration of TEL tools and applications was teacher-centered.

	to transforming pedagogy. Textbooks on the iPad and Schoology LMS is a level of replacement. Kids access knowledge through digital technologies, so getting knowledge this way in school makes sense to students. • Learning is based on efficiency. Culture plays a significant role in how a student engages with learning. With the advent of instant messaging, videos, and access to a vast array of information, student perception is being molded by TEL tools and applications outside of the classroom. • Replacement is equated to the integration of TEL tools and applications substituting instruction. Allowance for student-centered activities. • Textbooks are now digital copies. • A student interacts with a self-guided approach to lessons. • The integration of TEL tools and applications provided functionality with speed and organization to teachers. Less stress with efficiency. • The integration of TEL tools and applications has changed how collaboration works. • Teachers are the designers of how and which TEL tools and applications are integrated. • Because teachers are in control of how pedagogy works in the classroom TEL integration becomes dependent on the teacher. • Teachers are expected to be the creators and designers of TEL integration. Distributed TPACK is shown the number of TIS increases. • The Integration of TEL tools and applications brings relief to the daily stresses of teachers with efficiency. Appears teacher centered. • Transform does not mean new, but old methods done in a new way.	• Traditional methods of presenting knowledge were replaced with TEL tools and applications. • Digital copies replace traditional hardcopy textbooks along with paper assignments. • Students accessed assignments and textbooks through digital mediums. • Students accessed all resources and assignments in one place, and it is organized automatically.
Meanings from the follow-up interviews.	• Distributed TPACK • Student-Centered • TEL tools and applications work without training. The idea of being intuitive in place of no training. • Limitations of TEL tools and apps are not in control of the user.	• TPACK is nonexistent and distributed with informal professional development but distributed • Students engage and collaborate in new ways that are outside of the traditional learning environment.

Evidence of Trustworthiness

Credibility

The biggest threat to internal validity in an explanatory case study is inaccurate interpretations (Yin, 2017). Because this research design uses an explanatory case study with how and why to the effects of integration with TEL tools and applications on teaching and learning, there is the possibility that interpretations could be misconstrued. Yin recommended four fundamental principles to construct validity. Employing three of the four principals increased the credibility of my study on the integration of TEL tools and applications.

I utilized the first principle of using multiple sources by treating each individual interview as a source, along with the focus group and follow-up interviews. Triangulating data from individual and follow-up interviews, along with the focus group interviews, increased the credibility of the findings (Yin, 2017). I followed the second principal by using MAXQDA to create a database. Utilizing MAXQDA allowed me to organize, code, and begin the data analysis by building categories and themes. The third principle that I adhered to was using a chain of evidence. As I gathered evidence through different interviews, the probing questions derived from the responses to the research questions that were developed from the overarching theme of the impact of TEL integration on pedagogy.

Transferability

According to Merriam and Tisdell (2015), single case studies are particularistic and not transferrable to generalities. Transferability was particular to 7th -12th-grade

school sites that employ the integration of TEL tools with similar resources and background. Merriam and Tisdell noted that qualitative studies are not entirely transferable because human behavior changes across time and change in environments. Variation in participant strategy was employed because multiple data sources, and more than one person was interviewed. There was variation in participant selection in that the integration of TEL tools and applications was implemented in different ways. The integration of TEL tools and applications was not the same across participants. Merriam and Tisdell posited that the variation across participant experiences increase validity and the ability for future researchers to replicate this study. An in-depth description of participant experiences with the integration of TEL tools and application into pedagogy was added to the ability to replicate this study by supporting external validity (Merriam & Tisdell, 2015).

Dependability

According to Merriam and Tisdell (2015), there are some strategies to establish reliability or dependability and include triangulation, peer examination, researcher's position, and an audit trail. Strategies that were employed in this study to establish dependability were creating an audit trail and developing a database through MAXQDA qualitative data analysis software tool (Merriam & Tisdell, 2015; Yin, 2017). Cutcliffe and McKenna (2004) explained that an audit trail is a record of steps taken from the beginning of the research study to the development of findings and conclusions. I used emails, audio recordings of the interviews with dates, and transcribed data to create an audit trail. Merriam and Tisdell noted that reflective journaling reduces bias because the

researcher has a chance to reflect on their disposition during the data collection. I made notes to myself each week of the data collection process to reduce bias. The main issue that arose from my notetaking was removing my words in filling in statements that participants made during the interviews. After I did an extensive literature review, I became relevant to ideas and terminology with the integration of TEL tools or applications. There was a desire to fill in and define behaviors of integration with TEL tools and applications as participants described their experiences. By the third interview, I removed this bias after listening to the audio recording from the first two interviews.

Confirmability

I used several strategies to support confirmability. Patton (1980) posited that qualitative research done in the most naturalistic setting possible with well-designed research methods raises confirmability and objectivity. The inclusion of anecdotal evidence from participants in the study results section raised confirmability in this study. Reflexivity is another strategy that was utilized. Reflexive journaling involved recording my views following interviews. Reflexivity helped me reduce my bias in guiding the participants during interviews. From the first two interviews, I took note of guiding participants by filling in and defining some of the words. During the first two interviews, I would define responses for participants. I would help them complete or express their ideas creating a bias in responses. Through writing down my thoughts and listening to an audio recording of the first two interviews, I removed this bias of guiding participants during the other interviews. I also employed member checking as a way for participants to verify that the responses they gave were correct. Participants were also given the

opportunity during member checking to delete, revise, or add to their responses, raising confirmability and objectivity of the findings and conclusions.

Results

The results of this study are presented in this section, organized by the main research question and sub-questions. Based on the qualitative data analysis, including coding, categories, and meanings, recurring themes emerged that aligned with the research questions. Excerpts from the interview transcripts have provided support for the emerging themes. Each sub-question is broken into themes based on the three areas of RAT, that is the replacement, efficiency, and transformation. The goal of this section is to show how the results of emerging themes align with the research questions. At the end of this section, figure12 has been included to show a summary of the themes that align with the research questions.

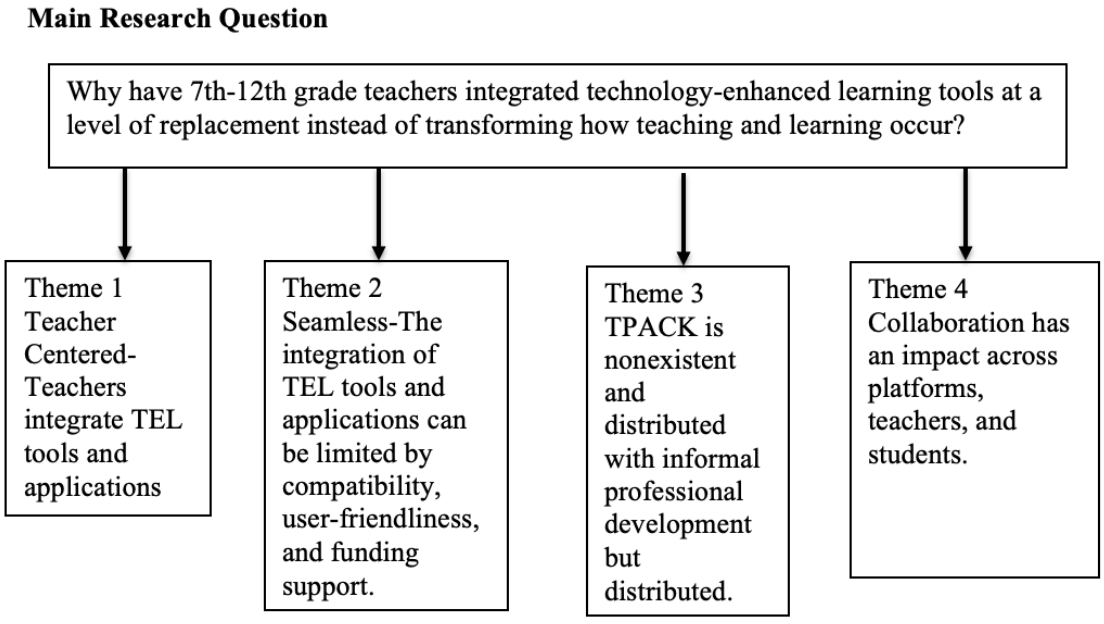

Figure 12. Themes related to the main research question.

A universal message that was conveyed throughout the interviews were ways in which the integration of TEL tool and applications supported teaching practices. Participants answered interview questions aligned with the main research question through the lens of how TEL tools and applications were used to make teaching less stressful, more efficient, and manageable. Four themes emerged that indicated challenges and opportunities in how pedagogy was impacted by the integration of TEL tools and applications. Each theme is discussed below with anecdotal evidence from the interview transcripts.

Theme 1: The Integration of Digital Tools and Applications is Teacher-Centered

The integration of TEL tools and applications at School X was limited to replacement because participants did not assess the needs of students. Participants at School X integrated TEL tools and applications to create efficiency in teaching practices, such as grading, exchange of assignments, and using iPads, a resource bank. Throughout the interviews, a universal message was how the integration of TEL tools and applications made things easier for the teacher. Instant feedback and grading were two areas that created more time for participants to focus on students. Participants reflected on how teaching became less stressful with the integration of TEL tools and applications. Using digital technology to go paperless was also reported as a significant time-saver for preparing content. Participant expressed the ease in opening a document, annotating it, and then uploading the document for student review through Schoology. Being able to organize lessons and student work all in one place was also reported by participants to save time. Table 11 shows some of the perceptions that reflected teacher-centered views

aligned with efficiency—integrating TEL tools and applications created efficiency in pedagogy in a way that resulted in teacher-centered practices. For example, grading is automatic with the student completing the assessment; the scores do not have to be hand-graded, saving time and energy. TEL integration impacted pedagogy by teachers creating efficiency in pedagogy, reducing the stress that comes with traditional methods of teaching practices.

Table 11

Participants' Perceptions of Technology-Enhanced Learning Tool Integration as Teacher-Centered

Participant	Teacher-centered	Efficiency
Teacher A	"I use Explain Everything to record a lecture. Use teacher and student made Quizlets create tests."	"I Use Kahoot to gather instant feedback during the assessment."
Teacher B	Use Pages to create a daily planner. Use the mirror with Apple iPad to project the pdf of the book and model to students how to read the book and point out what is valuable.	Create or use what other teachers have made for Kahoot assessments. Instant feedback and scores are automatically recorded.
Teacher E	They are using the math Grapher application Desmos, so graphs are easy to read. Graphs on paper are usually incomplete and difficult to read. Create a lesson on Keynote and upload them to Schoology LMS.	On the iPad, you can annotate assignments and return them. It is organized and no way to lose assignments.
Teacher G	"Most of the time, the whiteboard is used for projecting from the iPad."	"Real-time feedback. There is no waiting between when the assignment is turned in and the results."

Theme 2: Compatibility and Being Seamless Are Challenges in Raising the Level of Digital Integration

Compatibility and seamless integration were identified as a reoccurring issue across several interviews. The different platforms used for integration included Apple Keynote, Pages, and Numbers, along with Google Slides, Docs, and Sheets. Projects could not be converted between the platforms, which limited the level of integration to replacement. Microsoft has Word, Excel, and PowerPoint applications. Each application offered efficiency differently. Google applications were seamless in collaboration but lacked the high functionality of Microsoft applications. Teacher C stated:

> Google is easy to collaborate, and my students can work on the same document and see the changes in real-time. My kids can work on the same project at their convenience without having to meet in one place at the same time. With my kids collaborating outside of class, I can spend more time in a class focused on content. The other platforms do not have real-time collaboration. Microsoft does not have a collaboration like Google Docs, but it allows my kids to do more with their work. Microsoft just has more bells and whistles.

Apple and Microsoft applications did not have the collaborative capabilities that Google does. Teachers learned to use Apple products because they are native to the iPad, the TEL tool used across the district. Teachers created lessons in Keynote and were not able to convert them to PowerPoint, which demonstrates a lack of compatibility. Teachers used the Apple applications of Keynote, Pages, and Numbers for the management and creation of instructional materials. These applications are native to the iPad, which is the

primary TEL tool used when the 1-1 technology integration was started. Teacher A stated:

> I have used Keynote to create a presentation for the past five years, and there is no way I am going to redo all my lessons in Slides or PowerPoint. When it comes to Google Docs, it is a dumbed-down version of Microsoft. I only use Google Docs or Slides when we do a project, and students need to collaborate outside of school.

Participants tried to work around the issue of incompatibility between platforms, trying to get the most of each platform. Teacher E wanted Google for collaboration and Microsoft for the extensive functionality that offers students more tools to edit and improve their work. Teacher F remarked,

> Where we collect data there, we use a numbers document, a Number spreadsheet. We collect data as a master sheet. But when I collect group data, we use a Google Form. Google forms collect group data by questionnaire or survey, whatever you want to call it. So, I kind of go in both directions with that. They get the numbers from the Google form and then implement it into the Numbers form. Take it from the CSV spreadsheet and put it into Excel.

In this situation, Teacher F is guiding students in moving data between all three platforms. The incapability for projects to be converted between platforms has created a barrier to the level of integration that can transform pedagogy.

Theme 3: Digital Integration Is Nonexistent With Informal Professional Development

The lack of professional development with technology integration limited the integration of TEL tools and applications to a level of replacement. The participants who took on the role of technology integration specialist explained that teachers worked with integrated TEL tools and applications based on personal efficacy. According to the participants who were technology integrationist specialists, teachers with low efficacy in the integration of TEL tools and applications lead to no integration or integration at a level of replacement. The four technology integration specialists took it upon themselves to distribute their knowledge of integration with TEL tools and applications. Each technology integration specialist took the dual role of teaching and providing embedded professional development during non-instructional time. In the first year that iPads were given to elementary teachers, the district hired a participant G to serve solely as an integration specialist. Participant G received formal training from Apple as part of the Apple iPad purchase. After the initial rollout of iPads, the implementation of one-to-one technology moved to the 7^{th}-12^{th} grades. Following the full roll-out of one-to-one technology integration, there was a need for more integration specialists. The participants that were early adopters were asked to take on the dual role of teaching and working as a technology integration specialist. Out of the four-integration specialists, three took part in this study. Participant G went back to teaching full time as the knowledge and background of colleagues were exhausted without formal professional development. Participant A, C, and G took part as integration specialists. They employed their

background and used it with TEL tools and applications to distribute embedded professional development informally to other teachers.

Table 12

Perceptions of Professional Development Among Technology Integration Specialists

Participant/Integration Specialist	Perceptions of professional Development with TEL integrations	Importance
Participant A	"I can't think of a time where I had formal training." "We were the ones who jumped on board with the iPads, so we were like the chosen ones." "I walked him through how to use Schoology." "There was a phy ed teach with experience with Schoology." "At times, I was forcing things together, and that was not always effective."	This shows participant A as a resource for informal training of colleagues. This also shows the lack of formal professional development with the integration of TEL tools and applications.
Participant C	"As soon as I learn something new or how to use something in a new way, I show other teachers who I know would be interested." "I took quite a few classes on the flipped classroom." "Budget cuts and schedules caused the umber to go from four to two of us.:" "Teachers told me I don't have time for training and don't know how to use this."	Participant C conveyed how professional development was done in isolation and out of choice. This is a lack of sustained formal professional development. Participant C is learning on there own and then distributing their knowledge.
Participant G	"I was trained the first year we got iPads in how to use the iPad and some of the applications native to the iPads." "There was only so much I could pass on with my background." "First, I had to take steps in how to use the applications and then teach my students."	Participant G conveys the professional training happened only once and was not sustained. Again, this is an example of isolated professional development.

Theme 4: Collaboration Impacts Pedagogy Across Students and Teachers With Digital Integration

Collaboration with the integration of TEL tools and applications did not limit the level of integration to a replacement but moved pedagogy to a level of transformation. A transformation occurred with students working together and learning from each other through collaboration, independent of the teacher. The integration of TEL tools and

applications allowed teachers and students to collaborate in new ways. Across several interviews, the integration of Google applications making collaboration seamless, was discussed. Teacher C remarked, “The one thing Google Suites does right is collaboration.” Schoology is the one learning management system that was a reoccurring application used collaboratively. Schoology is being used for students to collaborate with discussions. Schoology is also being used for teachers to share curriculum and resources. Teacher D stated, “Schoology is easy to navigate,” while teacher G remarked, “We have lots of discussions in Schoology. Some students are not comfortable with open discussions in the classroom and engage through a medium like Schoology.” Teacher C helped the department get all their resources into Schoology, where the resources could be accessed and organized by class.

The collaboration was limited to the TEL application as Microsoft and Apple did not share the same capabilities as Google. Schoology is intuitive in that it will allow teachers and students to upload from the Apple, Google, or Microsoft platforms. Teacher F noted, “Schoology is intuitive where I can put in all my quizzes and tests with no compatibility issues.” The use of Schoology was integrated differently with some subjects. Teacher E noted, “Schoology will let me upload Desmos graphing application where students can use it right within the Schoology without leaving the applications.” Schoology is a learning management system that was directed by the district to be used. By doing this, it allowed many teachers and students to see the pros and cons of using Schoology.

Subquestions

Each sub-question is broken into replacement, efficiency (amplification), and transformation. During the data analysis, it became apparent that the conceptual framework components of RAT emerged for each sub-question, including learning, curriculum, and instruction. The conceptual framework of RAT is applied differently for each are of pedagogy, which is learning, instruction, and curriculum. Each sub-question is broken into the three areas of the RAT framework. Each sub-question is broken into replacement, efficiency (amplification), and transformation.

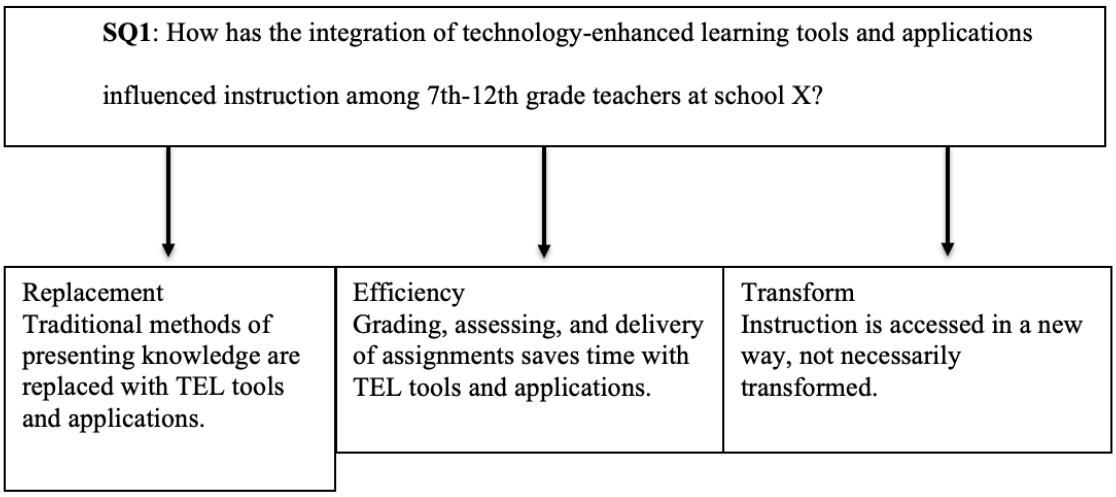

Figure 13. Themes related to Subquestion 1.

Theme 1: Traditional Methods of Presenting Knowledge Are Replaced With Technology Enhanced Learning Tools and Applications

Participant integrated TEL tools and applications with instruction to engage students in new ways by replacing traditional lectures with videos, using the iPad to project content, upload copies of notes as PDFs to Schoology, and use the Kahoot website to do quick formative assessments. Teachers found new ways to deliver content

and assess student knowledge with the integration of TEL tools and applications. New ways of delivering instruction did not always equate to transformation. Instruction with the integration of TEL tools and applications occurred at levels of replacement, efficiency, and transformation. The application Kahoot was used by some participants to replace traditional informal assessments. Kahoot also created efficiency in immediate feedback on scores and weak areas across the class. Below is a table of examples from a participant that equated instruction to replacing traditional practices.

Table 13

Participant Anecdotes Equating Instruction to Replacement

Participant	Replacement	Traditional
Teacher D Teacher F Teacher B	"A lot of teachers have the textbook on an iPad or Schoology." "It is a giant resource bank." "The textbook is on Schoology."	Students have a hard copy of a textbook.
Teacher C	"I have a digital worksheet in Schoology, and students put that into Notability to fill it out and then upload it back to Schoology."	Students have a hard copy of a worksheet that is filled out with a pencil and turned into a turn in basket or box in the classroom.
Teacher A	"I use the Eno Board as a projection tool."	Guided instruction is written out on the board.
Teacher G	"Most of the time, it is a demonstration tool, and we show movies on it."	The demonstration is written on the board, and the movie is shown over a TV.
Teacher E	"It is a key organizer, which younger students need."	Students use folders and a backpack to organize and carry resources.
Teacher F	"I use Kahoot to do an informal assessment."	Students do an exit ticket on paper for an informal assessment.

Theme 2: Efficiency Created by the Integration of Technology Enhanced Learning Tools and Application Into Instruction

Efficiency in instruction through the integration of TEL tools and applications created time for participants to engage with students. Grading can be automated without teacher participants going through one paper at a time. Teacher A remarked, "I also send a Kahoot to the student who needs extra practice through Schoology." In this situation, Teacher A is not making copies and grading work by hand, as Kahoot auto grades it. The students who need the extra practice can choose to do it and see the results immediately. Some instructional practices fit both replacement and efficiency. For example, teacher C noted, "I use Explain Everything. I like to audio record myself as I am doing a problem." This replaces traditional instruction with a flipped model in using application Explain Everything to audio record and save lectures. This use of Explain Everything is also efficient because the student can now access the lecture within Schoology and watch it over and over, saving the teaching time in reinstruction. However, reinstruction can be modified to adapt to a student's needs, a benefit of using traditional teaching methods.

Teacher E used Keynote to create guided lectures on the iPad. Teacher C then projected from the iPad to the Eno Board while he went around the room and paused between slides to interact with students during the lecture. Teacher C explained:

> It gives me the freedom to go around the room. Classroom management is a lot easier that way. I am with the students more rather than being at the front of the room and away from them. I think it is a lot about efficiency. I do not have to erase a bunch of my writing. I move to a new slide and go from there.

Classroom management was efficient by integrating a TEL tool and application with instruction.

Teacher G noted, “That is the culture. They want feedback right now”. This message resonates with the digital world students live in with applications like Snap Chat, texting, Instagram, and other applications that have instant communication between people. Teacher A stated, “There is an efficiency when it makes my world and their world faster. Like Teacher G, Teachers A and C conveyed the same kind of message. Teacher C noted, “They love memes, so I use memes a lot with the instruction.” Teacher C and G have an understanding of how the integration of TEL tools and application relate to students beyond the classroom. Teacher C gave an example of traditional methods in students creating poster boards, taking a week complete versus two days using Google Slides. Teacher G explained:

> They want their work to go fast. Their individual work. Their group work. Just because that is the world we live in. That is the culture. They want feedback and progress right now. They want improvement right now. I think things get so much slower going back to the poster board days.

Teacher G, like Teacher C, can look through the lens of integration with TEL tools and applications from a student-centered approach. The efficiency created from the integration of TEL tools and applications impacted the teaching-learning practices between students and teachers. However, several participants equated efficiency in saving time and costs, exhibiting a teacher-centered approach to integrating TEL tools and applications.

Theme 3: Instruction Is Accessed in a New Way, Not Necessarily Transformed

Transforming instruction means moving from a teacher-centered to a student-centered approach. Instruction among participants remained teacher-centered but shifted in how students were accessing it. There is a certain degree of transformation in that students can access instruction in different ways and with more control of when instruction happens. Teacher C noted, “I am no longer the keeper of all knowledge.” Traditional methods of instruction occurred with a single teacher at a specific place and time each school day. Students had to be at the same place as the teacher, at the same time, to access instruction. The integration of TEL tools and applications created flexibility in what teachers at School X could do with instruction and how students accessed the instruction. In some cases, students took on the role of assessment in instruction. Teacher F described, “The students also make Kahoots. So students make like five or six questions, and then we put them together, and the whole class plays.” Kahoot gives instant feedback and displays scores as well as which questions were answered wrong.

Another aspect of how instruction is impacted by the integration of TEL tools and applications at school X is the interaction of students during a lesson. Teacher A remarked, “The other thing that technology allows is interaction through links.” Digital textbooks allow the students to click links within a lesson to explore or interact with new content. Some participants explained having access to instruction beyond the classroom in real-time with digital technologies. Teacher F discussed how the students went to China to get a lesson in real-time on pottery making in that country. This type of

engagement supports a level of transformation where traditional methods are locked to a classroom. Participants reported Engagement through enhancement and interaction were factors that impacted instruction with the integration of TEL tools and applications. Teacher B noted, “With Kahoot, every student is engaged.” With the enhancement, Teacher G remarked, “It is a cool animated map that shows the flow of the slave ships across the oceans.” Teacher G expressed gratitude and motivation in applying TEL applications to instruction because of the enhancement part of it.

Part of the focus group questions asked was the idea of not having TEL tools and applications. Participants in the focus group expressed the change in instruction without TEL tools and applications included collaboration, engagement, enhancement, interactive lessons, and access to curriculum outside of a textbook. Student-centered learning was discussed by the participants in the focus group as changing based on the integration of TEL tools and applications. Student interaction, as well as adaptability to multiple levels of instruction, were key points discussed by Teachers C, D, and G. Teacher C remarked the shift to being student-centered by stating, “ I think it has allowed us to have classrooms be more student-centered. Instead of us standing in front and lecturing the whole time. The more tools I pull in, the more student-centered it is where they are teaching each other and learning from each other.” There was also an adaptive part of TEL integration, where instruction could be individualized. Teacher D stated:

> I think about my math class, and I have ten of them all in different places. Some of them are at single-digit numbers, and some are multiplying. If I can use something like Moby, they can take an assessment, and it places them where they

need to be. I can help individual students, but having ten of me, I can help them at their rough patches, and they can be learning at their pace.

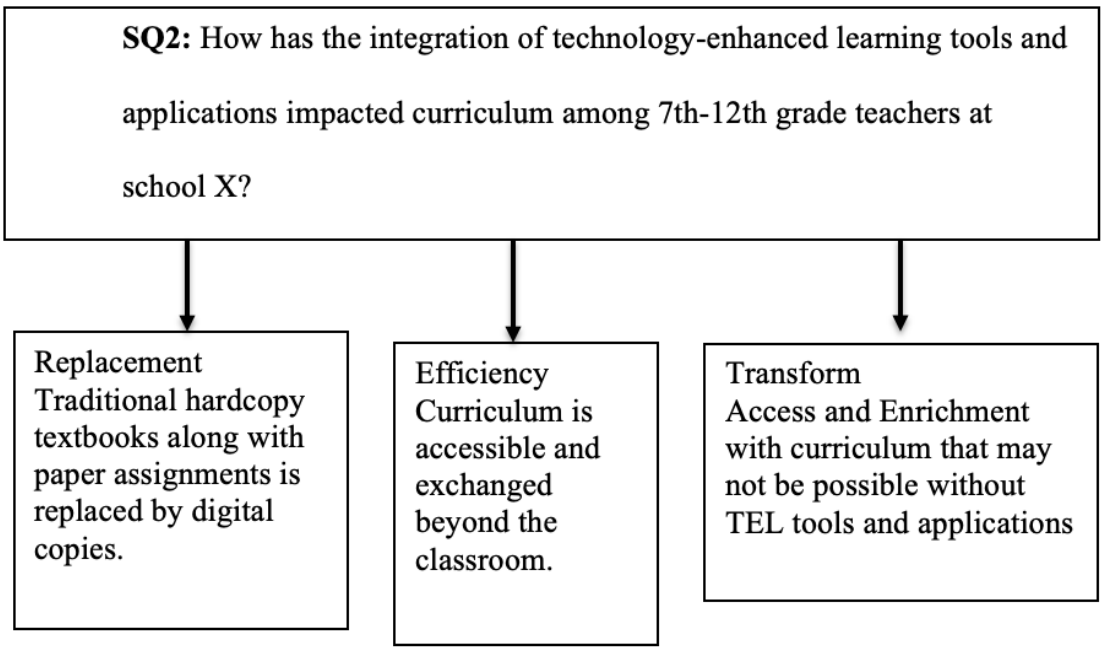

Figure 14. Themes related to Subquestion 2.

Theme 1: Traditional Hardcopy Textbooks, Along With Paper Assignments, Are Replaced by Digital Copies

The integration of TEL tools and applications impacted curriculum in a way that replaced traditional methods for teachers at School X. Schoology became a resource bank for textbooks. Notability is a medium where students download assignments from Schoology, work on them, and then upload them back to Schoology. Teachers are then able to access student work. Teacher B remarked, “A lot of teachers have textbooks on an iPad or Schoology. I think it opens the door to utilize it to replace textbooks.” Schoology became a place for all resources to be stored for those teachers at School X who integrated TEL tools and applications. The exchange of digital worksheets is limited to

the iPad as this is the primary TEL tool integrated at School X. Notability became a primary medium to exchange digital work on the iPad. PDF expert is another application that was used to exchange work between teachers and students. Participant teachers expressed the reason for replacing traditional textbooks and worksheets with a digital copy is for the ability to have all work and resources in one place.

Theme 2: Curriculum Is Accessible and Exchanged Beyond the Classroom

The efficiency with curriculum came with the ability to exchange work and access curriculum at any time from any place. Teacher C remarked,

> By sharing a materials bank in Schoology, it makes it easier and saves time. Efficiency makes things faster and easier. I can grade things faster with the iPad and Schoology. Someone showed me, and the ease of not having paper made things more efficient—no Stacks of papers, just one item, the iPad.

Efficiency in grading, accessing, and exchanging work with the integration of TEL tools and applications became the reason for replacement. According to teacher E,

> I think it has changed how we assess the curriculum. The delivery of the curriculum has changed. The material itself is the same. It gives more of an enhanced vision of the curriculum, such as graphing. Students can visually see content and interact with it. Efficiency is the most significant change.

The amplification of the RAT framework equates to enhancement and efficiency. Teacher E explains how the integration of TEL tools and applications impacts curriculum in a way that allows students to interact with the curriculum. This enhancement and interaction lead to transformation with the integration of TEL tools and applications at

school X. Teacher A noted, “You can zoom in on Schoology and see multiple parts of a diagram. In Schoology, you, the student, can get the results immediately and see which problems were incorrect.” There are enhancement and efficiency apply to the students, not just teachers at Schools X.

Theme 3: Access and Enrichment With Curriculum That May Not Be Possible Without Technology Enhanced Learning Tools and Applications

I had initially asked participants in what ways has the integration of TEL tools and applications changed curriculum. Still, they indicated it had not changed but created new access and enrichment. Following the first two interviews, I changed the questions to include access to a new curriculum. Participants indicated that the curriculum did not necessarily change, but the integration of TEL tools and applications allowed access to a new curriculum along with enrichment through interactive lessons. Teacher F remarked, “I have access to new curriculum like university archives. I have access to maps and private collections that I could never get without the technology.” The transformation looks differently based on the content area. Social studies got access to the new curriculum with Google Earth, National Archives, maps, and live webinars. Mathematics got access to dynamic applications like Desmos, where the student and teachers can make mathematical graphs in detail as well as interact with lesson content. It is not just access to a new curriculum, but transformation through the integration of TEL tools and applications at School X that move traditional teacher-centered practices to the student-centered curriculum. Teacher A explained, “Part of the reason I chose the science world website is that it allows students to change their Lexile score to fit their level of reading.”

The traditional hardcopy of a textbook does not offer the adaptability to transform learning through access to a new curriculum. The interactive part of transforming the curriculum is the use of interactive links within digital textbooks. Teacher A noted, “The other thing that technology allows is interaction through links.” Teacher A discussed how a student could click links from within a digital textbook that would connect them to new content, including videos, articles, images, and interactive tasks.

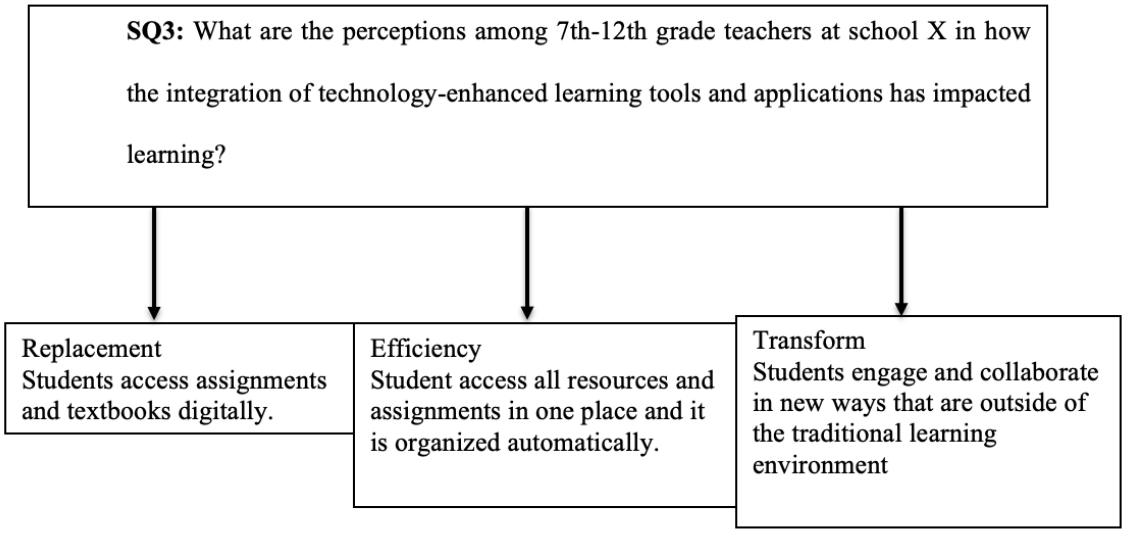

Figure 15. Themes related to Subquestion 3.

Theme 1: Replacement in Learning

With the integration of the Schoology learning management system, teachers utilized this to create a resource bank for students. Schoology became a place to hold textbooks and other subject-specific resources. Teacher B noted, “A lot of teachers have a textbook on an iPad or Schoology. I think it opens the door to utilize it to replace textbooks.” Schoology also became a medium for exchanging work between the teacher and students. This replaced traditional methods of the teacher handing out a hard copy of

an assignment and then the students completing and turning the hard copy back to the teacher. Teacher F remarked, “Students pull off digitally copies of worksheets and questions from Schoology as a pdf into notability and then write on it and upload it so I can look at.” Replacing the traditional method of accessing the curriculum and exchanging work also created efficiency in tracking, locating, and accessing knowledge.

Theme 2: Efficiency in Learning

The Schoology learning management system allowed a student to access curriculum, resources, and assignments beyond the classroom. Accessing lectures, assignments, and curriculum is no longer tethered to the classroom. A couple of examples of how efficiency was used is stated by Teacher A, and G. Teacher A stated, “If they miss it, they can access it in Schoology and watch the lecture.” The wait time to get curriculum and assignments is removed, creating efficiency in how students access resources to learn. Participant G stated, “I no longer spend hours copying papers. I can spend more time focused on content and delivery.”

Theme 3: Transformation in Learning

iPads and Schoology changed how students interact with the curriculum and learning. Collaboration is no longer tethered to the classroom setting as students can work together over an application like Google Slides and Schoology discussions. Students can work on the same document in Google Docs in real-time beyond the classroom. How students work together is transformed by how the iPad and applications are being utilized. Teacher C noted,

> They can do this from anywhere and do not have to meet anywhere. I am going to use Good reads. Students make profiles and become friends with each other. Students list all the books they like in their profile, and then they can see matches on the same books read. I make a class and all the class in one group. Students can now look at each other's profiles and see what they like to read.

This is a new view where teacher C understands how to integrate TEL tools and applications in a student-centered way. Taking student perceptions into account demonstrates a transformation from teacher-centered to the student-centered mindset with integrating TEL tools and applications. Teachers have the primary role in how TEL tools and applications are integrated. How participants used TEL tools and applications affected the level of integration.

Summary

The data analysis with data results presented in chapter four revealed the challenges and opportunities borne out of the impact that the integration of TEL tools and applications had on pedagogy in School X. The reasons why the level of integration was at replacement, efficiency, and transformation was based on how teachers at School X integrated TEL tools and applications. The challenges of raising the level of integration with TEL tools and applications beyond replacement included seamless use, compatibility across different platforms, teacher-centered use, and collaboration.

Seamless integration of TEL tools and applications became the difficulty in how to integrate specific applications due to lack of professional development across School X. With up to four integration specialists, each one distributed their knowledge to other

teachers-based on their use. Teachers at School X became the trainers and designers of the TEL tools and applications they decided to integrate.

Compatibility was a universal message as a challenge in raising the level of integration. The applications that are native to the iPad were not compatible with other platforms. Teachers at School X integrated Google, Apple, and Microsoft based on the purpose of how pedagogy was developed. Google allowed collaboration, while Microsoft offered the most extensive functionality. With the iPad being the primary tool of integration, some teachers integrated the applications native to the iPad that included Keynote, Pages, and Numbers. The level of integration was impacted by the functionality of the different platforms.

The start of the 1-1 technology integration for School X was through the lens of how teachers could change their teaching practices. The universal message among participants was how the integration of TEL tools and applications could create efficiency. This perception developed over time as teachers learned how to integrate different TEL tools and applications. The ability to grade, add curriculum, and save time became a focus on how to move from teacher to student-centered practices.

How students collaborated changed with the integration of TEL tools and applications. A common theme among participants was the integration of TEL applications that allowed a student to collaborate without restrictions of time and being in the classroom. Data analysis based on the sub-questions revealed that each area of pedagogy, including learning, teaching, and curriculum, was impacted in a way that replacement, efficiency, and transformation applied to each area.

The results of this research revealed that different areas of pedagogy were impacted in different ways with the integration of TEL tools and applications. Chapter five discussion and conclusion includes the findings that interpret the results of this study and provide recommendations for future research. Chapter five includes the limitations, implications, social change, and educational impact that the integration with TEL tools and applications had on the pedagogy at School X.

Chapter 5: Discussion, Conclusion, and Recommendations

Introduction

The purpose of this qualitative explanatory case study was to determine why the integration of TEL tools and applications among seventh-12th-grade teachers has been at a level of replacing established pedagogical practices instead of transforming them. After an exhaustive search through current literature on why the integration of TEL tools and applications were at a level of replacement, there was little to no evidence found. There has been extensive research into one-to-one technology integration, but little to no research as to the level of integration, prompting this qualitative explanatory case study. This qualitative explanatory case study, bounded by time and location, relied on interviews with participants chosen through purposeful sampling at School X.

The key findings of this study were:

- The integration of TEL tools and applications was teacher-centered focused.
- Ways in which the integration—Apple, Google, and Microsoft platforms—were integrated for different purposes and are barriers to the level of integration due to compatibility issues.
- The integration to TEL tools and applications was not seamless.
- Professional development is limited to personal experience.
- The integration of TEL tools and applications changed how students collaborate at School X.
- The components of the RAT framework applied in different ways based on learning, instruction, and teaching.

- From the components of the conceptual framework, efficiency was the most reoccurring message throughout the data sources.

Interpretations of the Findings

The Integration of TEL Tools and Applications Was Teacher-Centered Focused

I found that teachers thought about integrating TEL tools and applications in a way that helped them. The organization was a modern approach to integrating TEL tools and applications for teachers at School X. Organization included creating lessons using Keynote, exchanging work over Schoology, and grading work digitally. Teachers explained that the integration of TEL tools and applications saved them time, reduced stress, and gave them greater access to students. There was no reference to how the integration of TEL tools and applications impacted students. The teacher-centered mindset may have been a barrier in moving TEL integration from a level of replacement to transformation.

The mindset of using extensive time and energy to create a student-centered practice is the opposite of what teachers at School X envisioned about integrating TEL tools and applications. According to Lackey (2017), student-centered practices, such as the flipped classroom, takes a lot of upfront time and energy. Teachers at School X who integrated TEL tools and applications focused on ways of reducing time with grading, copying, and developing lesson plans. According to Spalding (2015), teachers need a positive attitude to integrate TEL tools and applications effectively. In this case study at School X, teachers indicated a positive attitude equated to integrating TEL tools and applications in a way that reduced time and stress associated with copying papers and

grading. The integration of TEL tools and applications at School X meant that teachers could change traditional methods of teaching in a way that centered around grading and curriculum delivery.

Apple, Google, and Microsoft platforms are all being integrated for different purposes and are barriers to integration due to compatibility issues. A barrier to shifting traditional teaching-learning practices to student-centered was the ability to convert projects that students or teachers produced between Apple, Google, and Microsoft platforms. With the distribution of iPads, teachers and students used Keynote to create lessons or projects. Keynote does not offer collaboration in real-time as Google Slides does. Teachers and students used Google Slides to create presentations collaboratively but could not convert the work they did to Keynote for presentations. Teachers and students would have to find ways to present Google Slides from Apple products. The English teacher in this case study expressed frustration in how Google Docs allowed collaboration in real-time but did not have a higher level of functionality that Microsoft Word does. Ideally, the students collaborate in real time from any place to create a project in Google Docs. Still, they could not convert that project to Microsoft Word to apply the higher functionally to the project. This lack of converting across different platforms created a barrier to raising the level of integration with TEL tools and applications. Jones and Dexter (2018) posited that teachers in their study on the integration with TEL tools and applications experimented intending to find what fits their curriculum and style of teaching. There was a need for teachers at School X to practice integrating across different platforms to see what works well with their curriculum and

teaching style. Because there was a barrier in converting between platforms, teachers had to experiment independently with their subject areas to see which platforms work the best for any given project (Jones & Dexter, 2018).

The Integrations of Technology Enhanced Learning Tools and Applications Were Not Seamless

The ease of use was an issue at School X. Several participants at School X, who were integration specialists, described their experience with other teachers as frustrating. Most teachers at Schools X did not want to do a lot of work to set up technology integration. Other teachers did not want a complicated process to start the integration of TEL tools and applications. Another barrier was the issue in technology updates as well as the ability to combine grades and curriculum with TEL tools and applications. For some teachers, the idea of moving grades between different TEL tools and applications was enough to deter them from increasing the level of integration beyond the storage of curriculum. The issue of technology being seamless fits within the Rogers (1995) diffusion of innovations dilemma where innovation in education through the integration of TEL tools and applications is limited to the ability of teachers seamlessly being able to integrate technology. Barriers to the integration with teachers at school x were shared with findings from Pan and Conte (2017), where teachers found technology integration to be time-consuming to prepare. Pan and Conte posited that other issues that arose included lack of support by school administration and teachers that were not familiar with how to use TEL tools and applications within their subject area. Pan and Conte also explained that some teachers did not see how the integration of TEL tools and applications would

enhance traditional teaching practices. Participants who were integration specialists expressed this concern the most, where teachers they worked with did not see a benefit in how instruction and learning could change to enhance what was currently in practice. Diffusion with the integration of TEL tools and applications had barriers of being seamless through too much front-end work, not seeing a benefit, and technology not working seamlessly.

Professional Development Is Limited to Personal Experience

In the focus group, there were three integration specialists who all had the same message. *I experiment with tools and applications to see what works and does not work.* Professional development was limited to informal methods of teachers experimenting and then teaching each other how TEL tools and applications were integrated. At School X, distributed professional development of TPACK was occurring without any of the participants knowing about TPACK. Di Blas (2016), along with Di Blas and Paolini (2017), posited that the professional development of how technology is integrated was not isolated to a single person, video, our sources, but a shared effort. At School X, the shared effort came out of a need to develop skills in how technology TEL tools and applications were being integrated. The professional development in a formal way was not committed to and sustained at School X. This became a barrier in raising the level of integration at School X. Professional development with the integration of TEL tools and applications for specific grade levels and subject areas was limited to non-existent. Like School X, Jones, and Dexter (2018) found that most professional development of integration with TEL tools and applications was through informal learning where

teachers helped each other. Unlike Di Blas (2016), the shared effort of professional development was limited to teachers and did not include students. Teachers at School X looked at students knowing more about technology as a way to cheat rather than a constructive view to creating new learning opportunities. This negative view of shared learning created a barrier to increasing the level of integration with TEL tools and applications. An exception to this was one participant who said that having students show how to use an application benefited the other students and the teacher. One participant expressed that the benefit of learning from students raised the level of integration because other students who have the same issues will also learn. The participant said, "If I just show how to use it, then everyone will miss what goes wrong and how to fix it." The participant gave an example of a distributed practice in learning how to integrate TEL tools and applications that included students. Participants who were integration specialists shared stories in distributing their knowledge across several teachers at School X.

The Integration of Technology Enhanced Learning Tools and Applications Changed How Students Collaborate

A typical message during the interviews was the increase in collaboration among students with the integration of TEL tools and applications. The collaboration was an area that showed how the integration of TEL tools and applications transformed the teacher-centered to student-centered practices. The students went from passive learners absorbing knowledge present by the teacher to developing knowledge and sharing it with other students through collaborative group work in Google Slides and Docs. One participant

said that she went around the room, facilitating each group of students as they researched topics and created presentations. Students were able to collaborate in real-time from any place that had access to the Internet. This kind of collaboration allowed students to work on one project without having to be in the same place at the same time. Learning looked different because it was happening in real-time from different places and times. Google Documents and Slides were always live. Chen, Cheng, and Chew (2016) posited that flipped learning was a style of teaching where students used technology in taking knowledge and work with it. Chen et. al. posited that the flipped classroom is one example of shifting from teacher to student-centered practices. Teachers at School X who took advantage of how Google-based applications allowed students to collaborate in new ways flipped traditional practices of teaching and learning. This way of collaborating was one example of raising the level of integration at School X.

The Components of the TPACK Apply in Different Ways

The way teachers at School X integrated TEL tools and applications looked differently depending on the teaching style and subject area. Social studies teachers liked using PDF expert for the ability to read through student work that went with the social studies curriculum. The English teachers liked Microsoft Word for all its in-depth functionality but also liked how the students could collaborate across Google Docs, leaving feedback for each other. Traditionally the teacher leaves feedback and hands back the document to the student. With Google Docs, the students could give each other feedback without exchanging work physically. This type of collaboration puts the student in a teaching role, transforming how learning occurs. However, in social studies, the

integration of PDF expert did not transform how learning occurred. Social study teachers integrated PDF experts to exchange daily work that worked seamlessly with their curriculum. The framework of RAT was applied by participants at different levels and in a different way depending on what the needs of the teacher were with the curriculum. Like School X, Di Blas (2016; 2017) found that teachers use technology in diverse ways depending on their subject area and student needs. One of the Participants at School X is a special education teacher. The special education teacher integrated TEL tools and applications through a lens of adaptive learning. Replacement, Amplification (enhancement), and Transformation looked differently depending on the teacher, subject, and student needs.

From the components of the conceptual framework, efficiency was the most reoccurring message throughout the data sources. A reoccurring theme that emerged throughout the interviews was efficiency in traditional teaching practices as a result of integrating TEL tools and applications. Instead of grading a formative assessment one by one physically, several participants discussed using other digital forms of assessment that auto-graded. They returned feedback immediately—this created time for teachers to focus on feedback and instruction. One participant talked about how the exchange of daily work digitally saved time on copying, collecting, handing back, and organizing work. This reduced stress and created efficiency in daily teaching and learning practices Thomas and Edson (2017) posited that efficiency was part of how K-8 teachers in their study amplified traditional practices through digital assessment, feedback, and daily work. Efficiency emerged as one of the findings where participants integrated TEL tools

and applications to make the assessment, feedback, grading, and daily work quicker with less physical effort.

Limitations of the Study

According to Yin (2017), a single case study does not have a large enough sample to generalize findings to a population. Yin asserts that findings from a case study generalize a conceptual framework. This research expanded on the conceptual framework of RAT and SAMR because the findings related the conceptual frameworks to the integration of TEL tools and applications. Expanding on the conceptual frameworks was limited to this single case study with seven participants that included individual interviews, a focus group, and follow up interviews. Research bias was a concern and a potential limitation to this study as it is impossible to remove all bias. I employed a reflection of my thoughts following each interview. Employing reflection helped me from forming opinions that could affect the following interviews. Having a sole researcher limits the ability to cross-examine findings with another researcher or subject matter expert. As a single researcher, I did all the data collection, review, coding, category building, and analysis. Having a sole researcher may limit what data would have been best for creating inferences and building themes. Yin (2017) expressed concern with case studies taking too much time and too much data to synthesize findings. I did not see the issue Yin raises because the repetitiveness in specific responses became apparent within several interviews. Saturation was reached within seven interviews and three data collection sources. The willingness of participants to share information and maintain openness throughout the interview process was always a concern. One participant limited

information on special education students to the ways in which they integrated TEL tools and applications. This did not affect the outcomes adversely.

Recommendations

In this qualitative explanatory case study, I focused on data from participants in the ways they integrated TEL tools and applications. The goal of my study was to find answers to why the level of integration has been at a level of replacement (Blair, Millard, Woollard, 2017; Tondeur Pareja Roblin, van Braak, Voogt, & Prestridge, 2017). Synthesis of data from participants showed that the integration of TEL tools and applications occurred in daily use as well as for projects. Whether the integration was for daily use or projects, TEL tools and applications were used at all levels, including replacement, amplification (efficiency), and transformation. Results aligned with what Di Blas (2016) described as using technology integration for daily activities or one-time projects depending on the degree of efficacy with Technology, Pedagogy, and Content Knowledge (TPACK). In my study, three participants were integration specialists who had high efficacy with integrating TEL tools and applications. The integration specialists integrated TEL tools and applications daily with a level of integration, moving from replacement to transformation with specific projects. I recommend future case studies like mine to exclude integration specialists and focus on how teachers with lower efficacy in TPACK integrate TEL tools and applications. This recommendation may result in educators gaining an understanding of how teachers with low efficacy in TPACK integrate TEL tools and applications.

Secondly, my study was not exclusive to a specific grade to the subject area. It may be beneficial to study the level of integration within a specific subject area or grade. One of the participants in special education shared experiences with integrating adaptive TEL tools and applications. The examples of how TEL tools and applications were integrated for special needs students had a higher degree of being student-centered compared to the general education classroom. Another recommendation would be employing a multiple case study across several special needs classrooms in the ways adaptive technology impacts pedagogy. Research into adaptive technology integration would expand on my research on how adaptive TEL tools and applications are being integrated. Also, researching with the integration of TEL tools and applications in one grade or subject area may result in educators gaining insight into the challenges that arise with levels of TEL integration for a specific grade or subject area.

One of the focus group interview questions was derived from the individual interview data analysis. During an individual interview, integration specialists described how students used digital technology to communicate and tried to integrate that into the classroom. As I synthesized the individual interview data, this description was unique. During the focus group interview, I asked participants if students were ever surveyed on the use of TEL tools and applications since the start of the one-to-one technology initiative in 2011. One interviewee's face turned red, while another was thinking hard about the question. They looked at each other and said, "No." My study was limited to teacher participants who integrated TEL tools and applications. Another recommendation for future research would be gathering data in the integration of TEL tools and

applications from students based on their experiences. Gathering this type of data may capture new perspectives into why the level of integration with TEL tool and applications has been at a level of replacement.

Implications

The integration of TEL tools and applications has become ubiquitous across education to innovate how teaching and learning occur. Teachers at School X have changed the traditional practices of teaching through the integration of TEL tools and applications. In practice, the integration of TEL tools and applications allowed teachers to create efficiency in grading, assessing, and exchanging student work. The integration of TEL tools and applications at School X allowed teachers to create student-centered ways of learning through collaboration. Teachers at School X augmented curriculum in new ways with the integration of TEL tools and applications. The integration of TEL tools and applications impacted pedagogy at School X in ways that influenced social change, the application of the RAT framework, and teaching practices.

Implications for Social Change

This study contributes to positive social change in how the integration of TEL tools and applications has impacted the development of pedagogy. The results of this study add to the continuous reform of pedagogical practices. The professional development of TPACK has been growing as the integration of TEL tools and applications grows. The potential impact for secondary teachers who are exposed to the findings of this study will be changing their practices from the traditional teacher-centered to student-centered pedagogy. Scholars exploring the integration of TEL tools

and applications across secondary education may build upon the recommendations and findings of this study. Adding research to the development of integration with TEL tools and applications may inform future educators in the ways that teaching, learning, and curriculum impact pedagogy.

Implications for the Conceptual Frameworks

The frameworks of RAT and SAMR are similar in substitution and augmentation, being the same as a replacement. Also, modification and amplification being similar. Redefinition and Transformation are similar in transforming established teacher-centered to student-centered pedagogy (Zhai, Zhang, Li, & Zhang, 2019). Based on the findings of these study participants utilized efficiency in grading, exchanging work with students, and creating lessons. Participants also augmented the curriculum by accessing new resources through the integration of TEL tools and applications. The findings from my case study with School X show that participants integrated areas from the conceptual frameworks of SAMR and RAT through efficiency (amplification) and augmentation. The implications of this show the integration of TEL tools and applications may be used by educators to reduce time to grade, distribute and collect work, and create lessons. The implication of augmenting curriculum with the integration of TEL tools and applications would gain access to a curriculum that could not be accessed in a non-TEL environment.

Implications for Practice

In practice, this study showed that the integration of TEL tools and applications had several implications for teaching and learning. The implications from this study showed that collaboration, efficiency in pedagogy, and access to new curriculum

innovate how teaching and learning occur. The level of integration occurs differently depending on how the TEL tool or application was integrated. This study showed that adaptive technology tools were prevalent in a special needs classroom. The adaptive TEL tools and applications were student-centered, transforming how teaching and learning occurred. However, adaptive TEL tools and applications were not prevalent in the general education classroom at School X. The implication was that TEL tools and applications are not integrated in the same way. Another implication of this study was the efficacy of integrating TEL tools. Those participants that were integration specialists exhibited a high degree of enthusiasm and confidence, which resulted in them taking more risks in trying new ways to integrate TEL tools and applications beyond a level of replacement. Some participants integrated TEL tools and applications at a level of replacement to create efficiency. The implication of this is that TEL tools and applications can be practiced by educators in diverse ways.

Conclusions

In this qualitative explanatory case study, I have attempted to explain why the level of integration with TEL tools and applications has been at a level or replacement versus transformation. The most significant factor that limited integration of TEL tools and applications was the focus of the participant to change their pedagogy without student feedback. The result of integrating TEL tools and applications by participants in this case study had the most significant impact on how students interacted with learning. The focus on efficiency created a barrier to address how students may benefit from integrating TEL tools and applications. In some situations, this is not the case.

In some cases, the integration of TEL tools and applications transformed how learning occurred. Understanding student perspective and use of TEL tools and application would give an additional explanation as to why the level of integration has not been moving from replacement to transformation. Kirschner (2015), along with Tondeur et al. (2017), contended that teachers as designers of integrating TEL tools and applications should be part of pre-service teaching programs. Ultimately, teachers do the best they can with what they know and use. Higher education teacher preparation programs should incorporate more professional development of TEL integration, as there has been an increase of one-to-one technology initiatives. Future research, as well as districts integrating one-to-one TEL integration, should examine and gather student feedback on the integration of TEL tools and applications.

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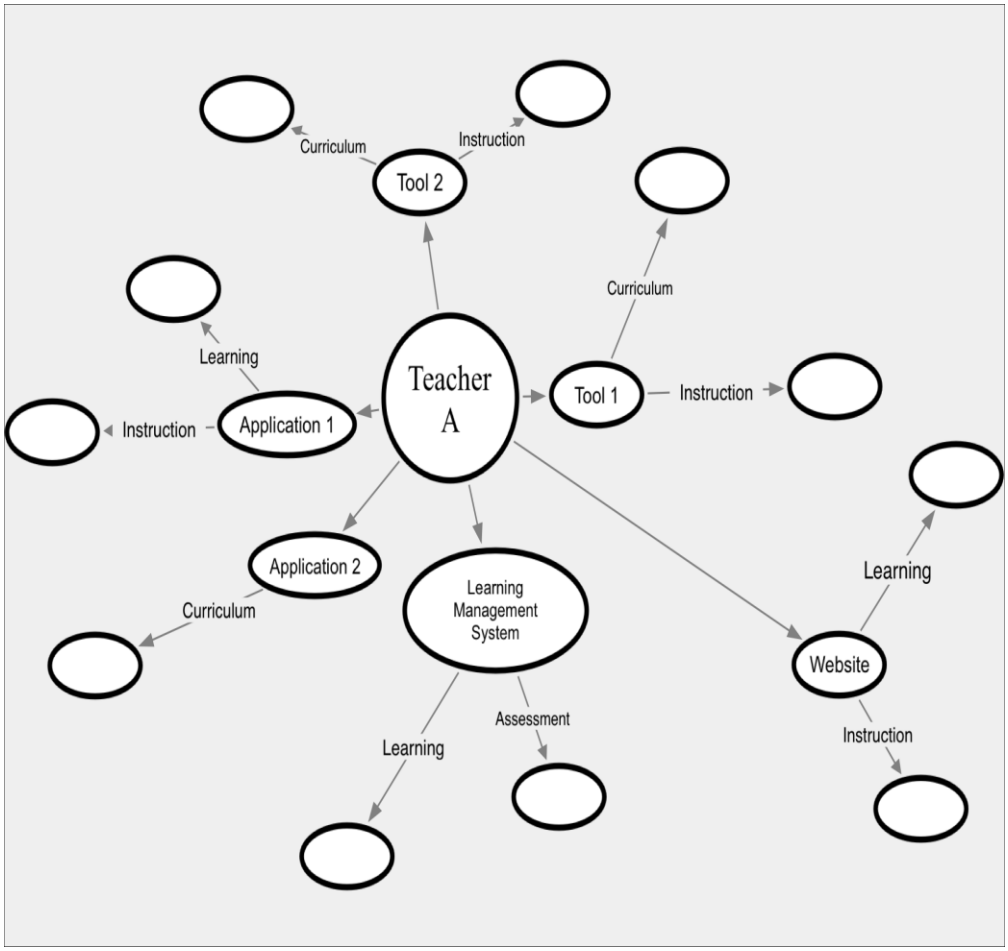
Appendix A: Circle of Influence Sample Diagram

Length of the arrows are the degree of influence on pedagogy for each type of tool and/or application



Appendix B: Data Collection Interview Request

Dear Teacher

I have obtained the principals' support to collect data through interviews for my research project titled The Impact of Technology Enhanced Learning Tools on Pedagogy: A Case Study.

I am inviting you to be part of this study as a voluntary participant. Your name, district, and school will not be revealed in the study. If you decide to be part of this study, you may opt-out for any reason at any time. I will ask if you know of other 7^{th}-12^{th} grade teachers. They integrate technology-enhanced learning tools on a weekly or daily basis that you would confidentially recommend that I could consider for this study.

If you agree to be part of this study, please be prepared to discuss ways in which you integrate technology-enhanced learning tools and applications in the context of instruction, learning, and curriculum. Any anecdotal evidence used in the results section of the study will be with your permission, and your name, not demographics, will not be attached to it. All audio data can be destroyed after it is transcribed. The transcription will be stored for five years in a safe and secure personal drive that is password protected.

I am conducting interviews based on your schedule and availability. The initial interview is one-to-one and about 30-60 minutes in length. The second interview is with a focus group of peers and will go between 45-60 minutes. The final interview will be a follow-up interview, so you have the chance to remove, add, or revise any of your responses after a given time of reflection between the other interviews.

I have attached a set of questions, so you have time to think about and prepare responses.

If you have additional questions or circumstances change, please contact me via email at _____.

You can also contact me via cell phone at_ _ _-_ _ _-_ _ _ _.

Thank you for your consideration. I would be happy to share the results of this study with you if you are interested.

I am requesting your confirmation to document that I have cleared this interview with you. You may either reply to this email with “I agree” or be prepared to sign the attached document at the beginning of our scheduled interview.

Best with appreciation- Seth James Ismil

Printed Name of Teacher Date

Teacher’s Written/Electronic* Signature Researcher’s Signature

_____ _____

Appendix C: Alignment of Research Question to Interview Questions

MRQ: Why have 7th-12th grade teachers integrated technology-enhanced learning tools at a level of replacement instead of transforming how teaching and learning occur?

Sub-Questions

SQ1: How has the integration of technology-enhanced learning tools and applications affected learning and instruction among 7th-12th grade teachers at school X?

SQ2: How has the integration of technology-enhanced learning tools and applications affected curriculum among 7th-12th grade teachers at school X?

SQ3: In what ways has the integration of technology-enhanced learning tools and applications affected instruction among 7th-12th grade teachers at school X?

Research Question in Interviews How has the integration of TEL tools and applications affected pedagogy	Information Collection Tools Research question or probe that targets a part of the research questions
Curriculum-SQ1 as part of pedagogy	(5) In what ways, if any, how technology-enhanced tools and applications have added to or changed the curriculum being used.?
Instruction-SQ2 as part of pedagogy	(4) Describe how the tools and applications have changed your instruction?
Learning-SQ3-as part of Pedagogy	(3) From your perception, describe how the tools and applications have changed how your students learn?
Tools-MRQ level of influence and type of Technology-enhanced learning tools and applications	(2) Using the circle of influence name and describe some tools that you or your student have used? Go ahead and drag the tool close to the center based on how often the tool is used. Pull it farther away if it is rarely used and very close if it used often
Applications MRQ and SQ1-3-Any applications used by some of the tools. These could include a learning management system, specific software applications for your subject area, or	(1) Using the circle of influence name and describe some applications you or your student have used? Go ahead and drag the application close to the center based on how often the application is

any general website or universal application.	used. Pull it farther away if it is rarely used and very close if it used often.
Teacher to student-Centered-MQR	(9) Describe what ways, if any, how pedagogy (learning, instruction, and curriculum) has changed from a student-centered focus with the integration of TEL tools or applications you use?

Appendix D: Alignment of Research Question to Focus Group Questions

MRQ: Why have 7th-12th grade teachers integrated technology-enhanced learning tools at a level of replacement instead of transforming how teaching and learning occur?

Sub-Questions

SQ1: How has the integration of technology-enhanced learning tools and applications affected learning and instruction among 7th-12th grade teachers at school X?
SQ2: How has the integration of technology-enhanced learning tools and applications affected curriculum among 7th-12th grade teachers at school X?
SQ3: In what ways has the integration of technology-enhanced learning tools and applications affected instruction among 7th-12th grade teachers at school X?

Research Question in Interviews How has the integration of TEL tools and applications affected pedagogy…	Information Collection Tools Research question or probe that targets a particular part of the research questions
Curriculum-SQ2 as part of pedagogy	(1) In what ways, if any, would the curriculum change if there were no digital tools or applications currently being integrated?
Instruction-SQ3 as part of pedagogy	(2) How would instruction change if you did not have the tools or applications currently being integrated?
Learning-SQ3-as part of Pedagogy	(3) How would student learning change if you did not have the tools or applications currently being integrated?
Teacher to student-Centered-MRQ	(4) How would pedagogy in the context of being a teacher or student-centered change without the use of technology-enhanced learning tools and applications?
Level of Replacement-RQ	(5) In what ways has the integration of the TEL tools and applications being used replaced instruction?

Level of Replacement-SQ4	(6) In what ways has the integration of the TEL tools and applications being used replaced learning?
Level of Replacement MRQ	(7) In what ways has the integration of the TEL tools and applications being used replaced curriculum?
Level of Replacement MRQ	(8) In what ways has the integration of TEL tools and applications made instruction, learning, or curriculum more efficient?
Level of Replacement MRQ	(9) What are areas of instruction, learning, or curriculum not possible without the integration of TEL tools or applications?