2019

Twenty-First Century Skill Building for Students With Special Needs Through Problem-Based Learning: An Examination Of Homeschool Teacher Blogs

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The Office of the Provost

Walden University
2019

Abstract

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Dissertation Submitted in Partial Fulfillment

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Abstract

Although problem-based learning (PBL) is not a new educational teaching method, little is known about the experiences of homeschool teachers who implement this teaching and learning approach with students with special needs. An increase in the number students with special needs being homeschooled made this study necessary and timely. The purpose of this study was to explore how publicly shared PBL experiences of homeschool teachers of students with special needs reflect 21st-century skills. The study was framed using 3 skill areas from a 21st-century skills framework including communication and collaboration, problem-solving and critical thinking, and cross-disciplinary knowledge. Data were collected from 20 blog sites that were each written by a homeschool teacher of at least 1 student with special needs. The sites had a minimum of 3 blog posts that referenced teaching and learning that aligned with the fundamentals of PBL. Deductive-dominant content analysis was completed on 87 blog posts through 2 levels of coding using both a priori and emergent coding. Key findings showed that the blog posts of homeschool teachers of students with special needs most often described (a) sharing, (b) creating inquiry environments and supports, and (c) cross-discipline content. Because the blog posts of homeschool teachers who use a PBL approach with their students with special needs reflect 21st-century skills, this study may encourage more teachers in the homeschool community to implement a PBL approach. The results from this study may contribute to positive social change by providing insights for homeschool teachers interested in purposefully implementing PBL experiences where students with special needs practice 21st-century skills.

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Dedication

This dissertation is dedicated to my son Phoenix who taught me that teaching someone who learns differently can be a lot of fun and so rewarding.

Acknowledgements

First and foremost, I want to thank God for giving me the wisdom and strength to complete this journey. Without Him it would not have been possible to complete with all the changes our family when through during the last few years. Second, I would like to thank my guys, Mark, Keagan, and Phoenix for all their patience and support over the last few years while I pursued my dream of obtaining this PhD. Thank you guys for the "sacrifice" of spending countless hours at coffee shops, so that I could write but still spend time with my three favorite guys. I would also like to thank my parents, brother, and in-laws for all their support and encouragement along the way.

Dr. Darci J. Harland, I cannot thank you enough for all of your guidance through each step of this process. Thank you for the many hours you spent with me on Skype and for "holding my hand" these last few months while I worked to finish this doctoral journey.

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Chapter 1: Introduction to the Study

Introduction

According to Russell (2017), over the past 10 years the number of homeschooled students in the United States alone has increased by about 62%, and the numbers continue to climb. While statistics show an increase in the number of homeschooling families (Russell, 2017), little is known about how homeschool teachers with students with special needs teach 21st-century skills. While studies show that using a learning approach such as problem-based learning (PBL) with students with special needs gives them more success in the classroom due to the hands-on, authentic learning experience that takes place (Duda, 2014), little is known if and how homeschool teachers use PBL with students with special needs. Increased understanding about the experiences being shared by homeschool teachers with students with special needs was important because it allowed me to see their blog posts reflect the 21st-century skills of (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge.

Chapter 1 is the examination of the problem and the lack of research done on the experiences of homeschool teachers implementing PBL with students with special needs. I also present an overview of the study, which is a content analysis of the social media and blog posts of homeschool teachers with students with special needs. The use of PBL with students with special needs is discussed along with how their teachers' social media and blog posts reveal their experiences.

Background

Research shows that PBL is not a new approach in the field of education. Although it is not new, it has not always been referred to as PBL. For example, terms such as experiential learning (Haines, 2016; Scogin, Kruger, Jekkals, & Steinfeldt, 2017), active learning (Leo & Puzio, 2016; Mueller, Knobloch, & Orvis, 2015; Siew & Mapeala, 2017), or constructivism (Lee & Hannafin, 2016; Toppel, 2015) have been used. In the homeschool sector, the terms STEM (Gann & Carpenter, 2018), individualized or student-directed instruction (Efford & Becker, 2017; Thomas, 2016), real-world learning applications (Liberto, 2016), and literature-based instruction (Gann & Carpenter, 2018; Thomas, 2017) are often used instead of PBL. In Chapter 2, I provide a more in-depth explanation of the history and definition of PBL, along with more on PBL and 21st-century learning based on Kereluik, Mishra, Fahnoe, and Terry's (2013) 21st century learning model. In reviewing Kereluik et al.'s 21st century learning model, I determined that focusing on the subcategories of (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge fit with the PBL teaching and learning approach, but little research has been done on the teaching of these skills in the homeschool setting. For example, research shows that classroom teachers have had success in working with students with special needs in building (a) communication and collaboration (Duda, 2014; Gothberg, Peterson, Peak, & Sedaghat, 2016; Lambert & Sugita, 2016), and (b) problem-solving and critical thinking (Duda, 2014; Lambert & Sugita, 2016), but no literature was found on the experiences of homeschool teachers teaching these skills to their students with special needs. While

PBL can be complex, the literature showed three fundamental traits for successful PBL projects. They are (a) problem centered (Brassler & Dettmers, 2017; Hung, 2016; Larmer, Mergendoller, & Boss, 2015a), (b) authentic tasks (Larmer et al., 2015a; Siew & Mapeala, 2017; Stefanou, Stolk, Prince, Chen, & Lord, 2013), and (c) student voice and choice (Larmer et al., 2015a; Sahin & Top, 2015). Research shows that PBL enables students to seek and find answers to real-world problems (Akcay, 2017), as well as apply what they know giving them a more authentic learning experience (Hung, 2016). PBL also provides students with a choice in what they do and learn because it gives them a voice in their learning experience, which results in more motivation to learn (Larmer et al., 2015a). This study was positioned in this gap and is important because it increased understanding regarding a population of teachers and students that had not previously been explored, particularly in relation to PBL practices.

When implementing PBL, there are both opportunities and challenges related to the development of 21st-century learning skills with all students. There are several benefits to implementing PBL. One major benefit is that PBL allows students to learn at their own pace and provides teachers with the chance to learn alongside their students. For example, students have the freedom to explore topics and questions that are meaningful to them, resulting in the learning tasks being more individualized (Netcoh & Bishop, 2017). While this is a benefit, especially for students with special needs, it is often seen as a challenge due to the extra time spent by teachers to scaffold student projects, activities, and individualized assessments (Netcoh & Bishop, 2017). In their study, Netcoh and Bishop (2017) found another benefit of PBL being a more relaxed and

authentic learning environment. A third benefit to implementing PBL with students is that due to the increased individual and small group time that they have with their peers and teachers the 21st-century skills of (a) problem-solving, (b) critical thinking, and (c) communication improve (Netcoh & Bishop, 2017). Dole, Bloom, and Kowalske (2016b) stated that another benefit of implementing PBL is that it brings about a positive change in the classroom climate and improves the student-teacher relationship. The improvement in student-teacher relationships leads to improved learning, especially in those students who struggle. Another benefit of PBL is that there are more opportunities for students to develop their collaboration skills through the sharing of information and working together to find answers to the real-world problems they are studying (Dole et al., 2016b; Morrison, McDuffie, & French, 2015). Although there are challenges to implementing PBL, such as extra time spent in scaffolding and planning learning tasks (Netcoh & Bishop, 2017) and getting used to the role of the teacher changing to that of a facilitator (Eisenman & Kofkewith, 2016), the benefits of PBL outweigh any challenge. This study expanded on current research that showed that the implementation of PBL with students with special needs does help develop stronger problem-solving (Netcoh & Bishop, 2017; Zhang, Yu, Li, & Wang, 2017), critical thinking (Netcoh & Bishop, 2017; Zhang et al., 2017), and collaboration skills (Eisenman & Kofkewith, 2016), which are essential 21st century learning skills for all students. However, my study not only extended what is understood about PBL and 21st-century skills but also explored experiences of a population of teachers that had not previously been studied.

With the increased use of social media by teachers, I found it important to explore the use of it by homeschool teachers and how they employ it as public pedagogy. Social media is a way to reflect on experiences, share and connect with others, and learn from experiences. Social media platforms provide teachers with more ways to share their concerns, ideas, and experiences (Greenhow & Askari, 2017). Studies also show that teachers are using social media as personal learning networks and for professional development (Trust, Krutka, & Carpenter, 2016). The use of social media and Web 2.0 technologies such as blogging help to eliminate feelings of isolation (Petersen, 2014, 2015; Steiner & Bronstein, 2017) because they allow homeschool teachers to share and connect with other homeschool teachers who have similar interests (Carpenter, Cook, Morrison, & Sams, 2017; Efford, 2016; Hulcy, 2015). Engaging in social media also causes teachers to spend more time reflecting (Jolly & Matthews, 2017, 2018; Krutka, Carpenter, & Trust, 2017). Although there is research exploring the reasons that teachers blog (Carpenter et al., 2017), little research is done using publicly shared posts to examine their practices and experiences. A search for blogs using the term "homeschool lessons" resulted in over 27 million hits, and a search using the term "homeschool" resulted in over 52 million hits. While it appears that homeschool is a popular blog topic, no empirical research has used this available data to understand better what homeschool teachers say they do with their homeschool students. Examining these blogs as part of this study provided a clearer understanding of the practices and experiences shared via blogs by homeschool teachers with students with special needs.

While studies show that implementing PBL is beneficial to all students, more research is needed on the benefits of PBL with students with special needs. Research shows that the number of students with special needs being homeschooled continues to increase because homeschool teachers believe that they are more familiar with the needs of their students, making it more beneficial to the students for them to homeschool (Cheng, Tuchman, & Wolf, 2016). Although more research is needed on the experiences of these teachers teaching 21st-century learning skills with students with special needs, studies show that these students can and should learn these necessary skills (Lambert, 2015; Lambert & Sugita, 2016). Several studies show that classroom teachers have had success in developing the 21st-century skills (a) communication and collaboration (Duda, 2014; Gothberg et al., 2016; Lambert & Sugita, 2016), and (b) problem-solving and critical thinking (Duda, 2014; Lambert & Sugita, 2016) in students with special needs, but little is still understood about the experiences of homeschool teachers who teach these skills to their students with special needs. The research that has been done on homeschooling shows that due to the flexibility and individualized instruction that is available, students with special needs experience more success and motivation (Liberto, 2016; Thomas, 2016, 2017) and are more actively engaged (Thomas, 2017). Therefore, the gap in the literature is how homeschool teachers are integrating 21st-century skills into the teaching and learning of their students with special needs. As a result, in this study I explored the blog posts of homeschool teachers' who share their PBL experiences to see how they develop the 21st-century skills (a) communication and collaboration, (b)

problem-solving and critical thinking, and (c) cross-disciplinary knowledge in their students with special needs.

Problem Statement

PBL is a teaching method in which students develop knowledge and skills by working to find answers to engaging and complex questions (Larmer et al., 2015a). Kokotsaki, Menzies, and Wiggins (2016) stated that PBL is a student-centered method of learning that builds a variety of 21st-century skills, such as communication and collaboration, in meaningful, real-world scenarios. Using a PBL approach gives students who may be struggling a chance to be on the same educational level as everyone else and thus increases their confidence and motivation (Duda, 2014). PBL can be used to get students with special needs and those with low motivation actively engaged and motivated. Duda (2014) explained that the use of PBL provides students with the opportunity to develop in a way that traditional methods do not, and as a result, they begin to take ownership of their learning. Little research has been done on the experiences of homeschool teachers in regard to their experiences with implementing PBL with students with special needs. Therefore, the problem related to this study was the lack of research on homeschool teacher experiences, and the impact PBL environments have on students with special needs.

Research indicates that this problem was both relevant and timely to the field of education. First, the problem was relevant because studies show that PBL is effective for students with special needs (Hovey & Ferguson, 2014). Traditional instruction methods do often meet the needs of students or prepare them for 21st-century learning; however,

PBL has shown to meet important learning needs that are missing from traditional instruction (Habok & Nagy, 2016). However, little is known about teachers' experiences related to using and implementing PBL with students with special needs. The problem was also timely in several ways. First, in an effort to connect with other educators, teachers share their PBL experiences with others via blogs (Harju, Pehkonen, & Niemi, 2016). It appears that homeschooling teachers use social media to not only share their own experiences but also to gain new perspectives on ways to build students' 21st-century skills (Dennis, 2015).

Additionally, this study was timely because of the increased number of homeschooling families. Over the last 10 years, the number of homeschooled students in the United States has increased by approximately 62%, increasing the number of homeschooled students in the United States to about 1.77 million (Russell, 2017). While research shows that PBL is difficult to implement in traditional classrooms (Licht, 2014), little is known about how homeschool teachers are using PBL. While many homeschooling philosophies embrace unit studies (Thomas, 2016) and applying content to real-life (Neuman & Aviram, 2015), there is little research that explores homeschool teachers' experience of implementing the PBL framework, and none that address if and how this type of instruction address provides students opportunities to practice 21st-century skills. And because parents of students with special needs are homeschooling students at a higher rate than students without special needs (Cook, Bennett, Lane, & Mataras, 2013), it was timely that this topic is explored.

Purpose of the Study

The purpose of this qualitative study was to explore the PBL experiences of homeschool teachers who work with students with special needs and how PBL experiences reflect 21st-century competencies as shared in their blog posts. To fulfill that purpose, I explored the blog posts of homeschool teachers with students with special needs in relation to their use of PBL.

Research Questions

Central Research Question

How do the experiences of homeschool teachers implementing PBL with students with special needs reflect 21st-century skills?

Related Research Questions

1) How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skills of communication and collaboration?
2) How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skills of problem-solving and critical thinking?
3) How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skills of cross-disciplinary knowledge?

Conceptual Framework

In this study, I explored the use of PBL by teachers with students with special needs and analyzed the data through the conceptual framework of 21st century learning. The phenomenon that I studied was how the social media posts of teachers using PBL with students with special needs reflect 21st-century skills.

The conceptual framework for this study was the 21st-century learning model. While there are many versions, the purpose of the framework was to categorize the demands of the 21st century by highlighting skills and competencies necessary for student success (Partnership for 21st Century Learning [P21], 2016). For this study, I used the 21st century framework developed from a meta-analysis (Kereluik et al., 2013). The meta-analysis included fifteen frameworks, including well-established frameworks such as (a) P21 (2016), (b) assessment and teaching of 21st-century skills (2012), (c) technological pedagogical content knowledge (Mishra, Koehler, & Henriksen, 2011), and (d) Educational Testing Service (2007). As Kereluik et al. (2013) continued to code and analyze the various 21st century learning frameworks, more theoretical underpinnings surfaced, such as the inclusion theory (Villa, Thousand, Nevin, & Liston, 2005) and PBL theory (Larmer et al., 2015a). The finalized framework that came out of Kereluik et al.'s meta-analysis included three main areas described as foundational knowledge (to know), meta-knowledge (to act), and humanistic knowledge (to value), with each having been further organized into subcategories. However, for this study, I focused on the meta-knowledge category and two of its subcategories (a) communication and collaboration, and (b) problem-solving and critical thinking. Additionally, I included the subcategory

cross-disciplinary knowledge from the foundational knowledge category. I selected these three elements of the model because according to the literature, these particular skills have been studied in regard to the PBL instructional model, and evidence has shown student growth in these specific 21st-century skills. I provide a thorough examination in Chapter 2 to support why I chose these specific skills out of the 21st-century framework in relation to PBL.

This 21st century learning design model provides a framework that helped me design data collection instruments for content analysis from blogs of teachers sharing their public pedagogy and reflection on using PBL with students with special needs. Additionally, the framework provided a focused lens for the analysis of PBL experiences of homeschool teachers with students with special needs. Each 21st century learning skill targeted in this study parallels a related research question. For example, one related question asks what experiences of teachers implementing PBL with students with special needs reflect the 21st-century skill of communication and collaboration. The others asked a similar question in regard to the other two 21st-century skills included in this study.

Nature of the Study

The methodological approach for this qualitative study was deductive-dominant content analysis. Content analysis is a research approach in which researchers summarize, code, and compare content from various texts (Mayring, 2016). Content analysis is widely used in qualitative research and is divided into three different approaches, (a) conventional, (b) directed, and (c) summative (Hsieh & Shannon, 2005).

A conventional content analysis is used to study a phenomenon, whereas in a directed content analysis, further research is provided on a theory about the phenomenon (Hsieh & Shannon, 2005). A summative content analysis begins by identifying certain words or content of a text to gain a deeper understanding (Hsieh & Shannon, 2005). The main difference between the three is the way that the development of codes takes place and how the studies start (Hsieh & Shannon, 2005). In this study, I used deductive-dominant content analysis. Deductive-dominant qualitative content analysis is appropriate for studies when the researcher uses a deductive mode during the data analysis process (Armat, Assarroudi, Rad, Sharifi, & Heydari, 2018). Armat et al. (2018) explained that a deductive-dominant approach is used when previous findings or theories of the phenomenon being studied exist, which requires the researcher to begin by using preexisting categories or research findings. I chose this approach because I identified certain words and content from blog posts related to my conceptual framework to gain a deeper understanding of teacher experiences. Information from the material, both written and images, on blogs or other social networking sites is called extant data (Salmons, 2016). Extant data includes archived posts from blogs (Salmons, 2016) and is a prime data source for a study such as the one I conducted. I analyzed these public posts in order to answer my research questions and to identify certain words or content of a text to gain a deeper understanding of the experiences of homeschool teachers with students with special needs (Hsieh & Shannon, 2005).

Definitions

Problem-based learning (PBL): PBL is an instructional method used to develop students' ability to apply what they know to real-life situations by working together to find solutions to meaningful problems (Merritt, Lee, Rillero, & Kinach, 2017). Using the instructional approach of PBL allows teachers to integrate essential 21st-century learning skills such as (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge into the learning process (Zhang, Wong, Chan, & Chiu, 2014).

Homeschool teacher: A parent who teaches their student(s) at home instead of sending them to public or private school (Merriam-Webster's collegiate dictionary, 2018).

21st century learning: Twenty-first century learning is learning that focuses on the building of (a) life and career skills; (b) learning and innovation skills; (c) information, media, and technology skills; and (d) core subjects of 21st century theme (Kereluik et al., 2013; P21, 2007). In these categories, 21st-century skills that play a significant role in PBL are found. These skills are (a) critical thinking and problem-solving, (b) communication and collaboration, and (c) cross-disciplinary knowledge (Kereluik et al., 2013; P21, 2007).

Assumptions

This study was based on several assumptions. One assumption was that the information that homeschool teachers are posting on blogs is an honest reflection of their teaching practices. Fielding (2014) discovered that individuals' willingness and desire to

connect with people they do not know via online platforms, such as blogs, as a way to share experiences has led to advances in social and scientific knowledge. According to this, those sharing experiences through these avenues would likely reflect honestly. This assumption was important because examining information shared on blog posts is another way of collecting data on the happenings in homeschool classrooms. With the increased usage of the Internet to connect with others, there is a shift in the relationships that individuals have to lateral and direct but temporary, typically based on a single point of connection (Fielding, 2014). Another assumption was that homeschool teachers post their honest expressions of their teaching practices in relation to PBL as best as they are able, even if they do not use the PBL term explicitly. This second assumption was important because accurately describing the methods they are using to meet the learning needs of their students will provide vital insight into what skills students are being asked to practice as part of their learning. These assumptions were essential to the meaningfulness of the study, as results were dependent on the honesty of homeschool teachers' publicly shared PBL experiences with students with special needs. Because there was no way to prove their honesty, I, as the researcher, had to trust that they were upfront and honest in their blog posts.

Scope and Delimitations

The scope of a study includes the boundaries of the study itself, as well as the rationale for these boundaries. Therefore, the boundaries for this study included blog posts of homeschool teachers with students with special needs and how they reflected 21st-century skills. Therefore, only blogs posts from homeschool teachers were included

in the study. This study was also be bound by the purpose of this study, which was to explore the social media and blog posts of homeschool teachers of students with special needs, in which they shared their experiences with implementing PBL and how these experiences reflected the three selected 21st century competencies. Therefore, homeschool teacher blog sites were purposefully selected. Then, individual blog posts also were purposefully selected to ensure the scope of the data collected related to PBL experiences. Last, the scope of the study was limited by the conceptual framework for this study. Kereluik et al.'s (2013) 21st century learning framework was used to limit the data pulled from the blogs of homeschool teachers of students with special needs who are using PBL. In this framework Kereluik et al. (2013) discussed several 21st-century skills, but the scope of this study included only three: (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge. As a result, I looked for elements in the blog posts related to those three skills, limiting the scope of this study.

The delimitations for this study included the resources, time given to data collection, and the selection of social media and blog posts used. Social media and blog posts that I used were limited to those written by homeschool teachers with students with special needs. Further limitations were placed on posts used based on the use of PBL and the development of 21st-century skills. This study was also limited by the amount of time I had due to being the sole researcher.

Limitations

As with any study, there were limitations, and some were a result of the chosen research design. Therefore, there were a couple of limitations related to content analysis research that needed to be considered. The first limitation to content analysis that was addressed was the amount of time that it could take to read through and analyze the texts being examined because I was the sole researcher. This limitation was addressed by setting a timeframe in which to spend collecting and triangulating data. According to Graneheim, Lindgrena, and Lundmana (2017), another limitation to this research design is found in the researchers' ability to show their logic behind why and how they chose the categories and themes. When this is not shown, there is an increased risk of not producing a credible and authentic study (Graneheim et al., 2017). In Chapter 3, I addressed the limitation of bias by providing a more detailed description of different strategies that I used to ensure the trustworthiness of this study: data triangulation and intracoder reliability.

According to Thurmond (2001), triangulation is a combination of data. In my study, the combination of data sources included initial blog posts and responses by homeschool teachers with students with special needs. There are various types of triangulation: (a) data sources, (b) investigator, (c) methodological, (d) theoretical, and (e) data-analysis (Thurmond, 2001). For this study, I used the data sources triangulation method. For this method I used multiple blog posts from homeschool teachers with students with special needs from various posting times. Thurmond (2001) stated that collecting data from various times and individuals adds to the finding of patterns and

similarities. According to Thurmond (2001), a benefit of this type of triangulation is that it provides the researcher with a more comprehensive understanding of the data collected. When used as it was designed, triangulation will likely "enhance the completeness and confirmation of data in research findings of qualitative research" (Thurmond, 2001, p. 257).

Along with data-analysis triangulation, I used intracoder reliability in my data analysis process. Intracoder reliability required me to take time between reading and analyzing data found in the blogs, which could have been a limitation to this study (See Burla et al., 2008). Time spent in data collection and data triangulation is further discussed in Chapter 3. A possible third limitation was related to the transferability of findings from this study to other studies on the experiences of homeschool teachers shared on social media and blog posts. To address this limitation, it was essential that I chose several blog posts to examine.

Significance

The significance of a study is determined in relation to (a) an original contribution to research, (b) improving practice in the field, (c) furthering innovative learning and instruction, and (d) contributing to positive social change. In relation to providing an original contribution to the field, this study provided insight into homeschool teachers' experiences of using PBL with students with special needs. Understanding these perceptions helped to improve instructional approaches in the field of special education by highlighting whether implementing PBL promotes 21st-century skills. The world has been "transformed by technology," and this transformation has changed the way that

students learn (Morgan, 2014, p. 20). Therefore, learning to use new and innovative methods of instruction is vital. In relation to furthering innovative learning and instruction, this study provided evidence of the benefits and challenges of implementing PBL for students with special needs. The outcome of this study provided homeschool teachers with more resources on how to effectively implement a meaningful PBL experience. This study may bring about a positive social change as the increased understanding may lead to better instruction for all students, but specifically students with special needs.

Summary

In this chapter, I described the (a) background, (b) problem statement, (c) purpose of the study, (d) research questions, (e) conceptual framework, (f) nature of the study, (g) definitions of some key terms, (h) assumptions, (i) scope and delimitations, (j) limitations to the study, and (k) the significance of this study. In Chapter 2, I include a review of the literature as it related to the purpose and the problem of this study and a definition of PBL, as well as a discussion of the implementation of PBL, the use of social media by teachers, and students with special needs.

Chapter 2: Literature Review

Introduction

The purpose of this study was to explore the publicly shared PBL experiences of homeschool teachers who work with students with special needs and how these experiences reflect 21st-century competencies. Although the number of homeschool teachers in the United States is increasing (Russell, 2017), little is known about their experiences related to implementing PBL, building 21st-century skills, and homeschooling students with special needs. With the lack of literature found on teachers experiences with homeschooling, this study may help bring about positive social change through the increased understanding of how to effectively implement a meaningful PBL experience for homeschool students, specifically those with special needs. Therefore, the problem related to this study is the lack of understanding of homeschool teacher experiences, implementing PBL learning environments with students with special needs. While research shows that PBL is difficult to implement in traditional classrooms (Licht, 2014), little is known about how PBL is used in the homeschool classroom. While many homeschooling philosophies embrace unit studies (Thomas, 2016) and applying content to real-life (Neuman & Aviram, 2015), there is little research that explores homeschool teachers' experience of implementing the PBL framework, and none that address if and how this type of instruction provides students opportunities to practice 21s^{t}-century skills. And because parents of students with special needs are homeschooling students at a higher rate than students without special needs (Cook et al., 2013), it was timely to explore this topic.

Chapter 2 includes a review of the literature related to the purpose and the problem of this study. First, I describe the literature search strategy I used in obtaining articles for review. Next, I provide a detailed description of my conceptual framework, related to three specific elements of 21st-century skills, cross-disciplinary knowledge, problem-solving and critical thinking, and communication and collaboration. The literature review begins with the history of PBL and its connection with 21st century learning. This section also includes a definition of PBL that was used for this research project. Then I address the topic of implementing PBL, including benefits and challenges of implementation, as well as implementation in homeschool settings and teacher experiences in implementing it with students with special needs. In the next section of the literature review, I discuss social media and teachers, more specifically, social media use by homeschool teachers and social media as public pedagogy. The last section of the literature review is on the topic of students with special needs related to 21st-century skills and homeschooling. Chapter 2 concludes with a summary of the literature, declaration of the gaps, and final conclusions.

Literature Search Strategy

The literature review was conducted examining primarily peer-reviewed journal articles, but also other publications such as dissertations and nonempirical articles from practitioner journals. I used the following educational databases with access from Walden University Library: Academic Search Complete, ERIC, Education Source, Taylor and Francis Online, SAGE Journals, and other academic searches. In addition to the databases accessed through Walden University's Library, Google Scholar, blogs,

Twitter, and Facebook provided additional platforms in which related resources were available that support this study. The searches for literature published in the last 5 years led to the exploration of the following key terms and their synonyms: *21st century learning skills, problem-based learning, homeschool, homeschool teachers, teachers, social media, public pedagogy, experiential learning, active learning, special needs, special education, STEM, student-directed learning,* and *real-world learning.* In searching the databases for terms related to 21st-century skills, the following three skills were searched in varying combinations along with the key terms PBL, special needs, and homeschool: *communication and collaboration, problem-solving and critical thinking,* and *cross-disciplinary knowledge.* Each of these fourteen themes was searched in varying combinations to find more detail and increase the range of material available for this study, thereby narrowing the results. Results showed that information on homeschooling with special needs and homeschool teacher involvement with social media was limited. As a result of these searches, I obtained and reviewed over 200 articles with 175 of them used in this chapter.

Areas in this chapter that yielded little research required that I use some in nonempirical resources in the review. For the sections on homeschooling and homeschool teachers there was little research found in regard to PBL, social media, and special needs; therefore, it was necessary to review dissertations, practitioner journals, and social media posts. I worked with the Walden University librarian throughout the course of this chapter to ensure that I was searching in a way that would produce both a wide and narrow range of material that resulted in saturation of the literature.

Table 1

Key Research Themes and Search Words Used for Literature Review

Research theme	Search words
Problem-based learning	Active learning, experiential learning, hands-on learning, inquiry-based learning, literature-based learning, project-based learning, STEM, student-directed learning, real-world learning, history of, definition of, implementing PBL, PBL and special needs
21st century learning	21st-Century Skills, Communication and collaboration, problem-solving and critical thinking, cross-disciplinary knowledge, 21st-Century Skills and Special Needs
Social media	Twitter, blogging, blogs, Facebook, as public pedagogy
Homeschool	Home education, homeschooling with special needs, PBL and homeschool
Homeschool teachers	Parent educators
Special needs	Special Education, students with special needs, at-risk students

Conceptual Framework

In this study, I studied and analyzed the use of PBL by teachers with students with special needs through the conceptual framework of 21st century learning. The phenomenon that I studied was how the social media posts of teachers using PBL with students with special needs reflect 21st-century skills.

In this study, I used Kereluik et al.'s (2013) version of the 21st century learning model. Kereluik et al.'s finalized framework has three broad categories that are each broken down into three more subcategories (see Table 2).

Table 2

Kereluik et al.'s 21st-Century Skills Categories

21st -century skill category	Subcategory 1	Subcategory 2	Subcategory 3
Foundational knowledge (to know)	**Cross-disciplinary knowledge**	Core content knowledge	Digital/ICT literacy
Meta knowledge (to act)	**Problem-solving & critical thinking**	**Communication & collaboration**	Creativity & innovation
Humanistic knowledge (to value)	Life/job skills	Cultural competence	Ethical/emotional awareness

Note: The bold text shows the categories being focused on in this study.

Prior to Kereluik et al.'s (2013) contributing to the 21st century learning framework, P21 (2007) described this framework as having four categories: (a) life and career skills; (b) learning and innovation skills; (c) information, media, and technology skills; and (d) core subjects of 21st century themes. There are several subcategories in these four areas as there are in Kereluik et al.'s 21st century learning model. The learning and innovation skills category include (a) critical thinking and problem-solving, and (b) communication and collaboration (P21, 2007). Interdisciplinary knowledge from the Kereluik et al. (2013) model is intertwined in the core subject's category of 21st century themes found in the P21 (2007) model. Kereluik et al. stated that teachers were not effectively preparing their students for the demands of the 21st century; therefore, they understood the importance of not only knowing how students are being taught but

also knowing and changing how teachers are being trained and prepared to teach these skills effectively.

For this study, I selected one subcategory from Foundational Knowledge, and two from Meta Knowledge that I used to examine the phenomenon of teachers' experiences implementing PBL with students with special needs. Each category is described in the following sections as well as justification from the literature linking the category as being critical to PBL and students with special needs.

Foundational Knowledge

The Foundational Knowledge category answers the question of *what* students need to know. From this category, I focused on cross-disciplinary knowledge in this study. Cross-disciplinary knowledge is knowledge from across different fields or subjects that are studied simultaneously (Kereluik et al., 2013). According to Kereluik et al. (2013), this type of knowledge is vital to the success of students and teachers in the 21st century. This knowledge denotes the ability of an individual to understand, organize, and connect large quantities of data from different fields of knowledge. Another reason I selected cross-disciplinary knowledge to explore as a 21st-century skill in this study was that the literature had shown its importance when working with students with special needs (Zhang et al., 2014). Studies have found that effective PBL learning includes cross-discipline content (Habok & Nagy, 2016). For example, Hill (2014) found that PBL allows students to engage in real-life learning opportunities while facilitating literacy across various content areas.

Meta Knowledge

The Meta Knowledge category requires one to act on knowledge gained. In this category, the two subcategories that were focused on in this study include (a) critical thinking and problem-solving and (b) communication and collaboration (Kereluik et al., 2013). Critical thinking is defined as the decoding of information and making knowledge-based decisions based on the information obtained (Kereluik et al., 2013, p. 130). Problem-solving is the use of critical thinking skills to effectively solve a problem or achieve a specific goal (Kereluik et al., 2013, p. 130). According to Kereluik et al., problem-solving and critical thinking involve the skills needed for success not only in the classroom but in all areas of life. Germaine, Richards, Koeller, and Schubert-Irastorza (2015) stated that critical thinking is being able to reason and recognize connections in concepts and disciplines that enable students to solve problems. Critical thinking requires thinking that has depth and breadth enough to solve complex problems (Germaine et al., 2015). The skill of critical thinking and problem-solving was chosen to be explored in this study because an examination of the literature revealed the importance of this skill in PBL learning. Research shows that PBL provides students with more opportunities to think deeper and gain a better understanding of what is being learned (Hopper, 2014). PBL engages students in real-life, meaningful learning opportunities that allow students to develop problem-solving skills (Lee, Blackwell, Drake, & Moran, 2014). Since previous studies have shown links between PBL and critical thinking and problem-solving, it was included as one of the elements of the conceptual framework for this study.

Communication and collaboration are the second subcategories in the Meta Knowledge category that was explored in this study. Communication is the ability of students to state thoughts through oral, written, nonverbal clearly, and digital methods of communication, as well as being an active and respectful listener for all audiences (Kereluik et al., 2013). Collaboration is similar to communication but requires that individuals are flexible, willing to participate, and recognize the efforts and success of groups and individuals (Kereluik et al., 2013). Germaine et al. (2015) stated that collaboration is the ability to work with others to meet a common goal effectively; therefore, creating a learning environment that allows students to build this skill as well as other 21st-century skills. Students need this skill not only to see success in the classroom but also to experience success in the workforce. Having strong communication and collaboration skills will ensure that students are prepared to work in a global economy (Kereluik et al., 2013). Communication is not just clearly stating thoughts and ideas but is also effectively listening as a way to interpret meaning (Germaine et al., 2015; Kereluik et al., 2013). Germaine et al. went on to say that effective communication requires that the message being given is heard and understood in a way that builds a connection between two or more people. Effective communication provides the human connection that is imperative if students are to activate or demonstrate 21st-century skills (Germaine et al., 2015).

Communication and collaboration were chosen as a skill to be explored because of the importance of this skill in PBL learning. Duda (2014) discovered that using PBL with students who were struggling or at-risk helped them to develop stronger

communication and collaboration skills. Scogin et al. (2017) found that PBL allowed students more opportunities for building their communication and collaboration skills than traditional learning environments. Hopper (2014) found that the communication and collaboration required in PBL creates a higher level of engagement from all students; therefore, increasing the knowledge learned. And for this reason, communication and collaboration were chosen as a 21st-century skill to be examined as part of this study.

The phenomenon of PBL and 21st-century skills have been studied in some ways. First, it has been studied as an alternative learning process that allows for the integration of multiple subjects and 21st-century learning skills in one setting (Zhang et al., 2014). PBL changes the role of both teachers and students by creating a more student-centered learning environment (Zhang et al., 2014). Second, PBL has been studied as a type of experiential learning that engages students in meaningful, real-life learning opportunities resulting in students becoming active participants instead of passive observers (Scogin et al., 2017). Third, PBL has been studied in how it helps to develop the necessary 21st-century learning skill of cross-disciplinary knowledge by the way that teachers can incorporate learning across different curriculums (O'Keeffe & Medina, 2016). This type of learning also promotes collaboration and communication through the learning communities created to complete the project (O'Keeffe & Medina, 2016). However, this PBL study benefited from the selected three sub-categories because according to the literature, these particular skills have been studied in relation to the PBL instructional model and evidence has shown student growth in these specific 21st-century skills. PBL is an instructional approach that allows teachers to embed some 21st-century learning

skills, such as (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge into the learning process (Zhang et al., 2014). This study also benefited from this framework as it was used to construct data collection tools and in the content, analysis to answer the central research question of how social media posts reflect 21st-century skills.

This research study benefited from Kereluik et al.'s (2013) 21st century learning framework by using the selected skills as a guide for how blog posts were reviewed. The 21st century sub-categories were used to develop a priori coding that was used during the data analysis phase. Blog posts were coded based on the 21st-century skills that this study focused on, as discussed by the homeschool teacher with students with special needs.

Problem-Based Learning

PBL, as a pedagogical learning method, has been in K-12 education for many years, but its origins go back much further and do not start in public education. The learning experiences provided in PBL throughout time have been referred to, and researched under a variety of terms, including experiential learning (Haines, 2016; Scogin et al., 2017), active learning (Leo & Puzio, 2016; Mueller et al., 2015; Siew & Mapeala, 2017), or constructivism (Lee & Hannafin, 2016; Toppel, 2015). As an introduction to PBL, the following sections will include the history of PBL and its connection with 21st century learning. This section will also include a definition of PBL that was used for this research project.

History of Problem-Based Learning

PBL has been around for many years under a variety of terms, including experiential learning, active learning, and constructivism. In this section, an overview of the history of PBL is shared along with the progression of PBL and its use throughout history. The terms experiential learning, active learning, and constructivism are also used when describing the experiences students have in PBL units or lessons.

Education is a process of learning through experience (Dewey, 1897). Dewey (1916/1944) explained that the first approach to any subject in school should be as unscholastic as possible. PBL fits with Dewey's approach to learning which is known as, "learning by doing" because it requires student (a) engagement, (b) inquiry and investigation, (c) problem resolution, and (d) debriefing (Merritt et al., 2017). Dewey (1938) stated that experiential learning, not only empowers students but also maximizes their learning potential and better prepares them for life outside the classroom. PBL provides a structure for learning that allows students to have greater comprehension skills and can be traced back to the progressive movement, specifically to Dewey's belief that teachers should teach to students interests because of their natural tendency to investigate and create topics in which they are interested (Delisle & ASCD, 1997). Therefore, giving students something to do, not just something to learn (Dewey, 1916/1944).

Traditionally, teachers are considered agents through which (a) knowledge, (b) skills, and (c) rules are communicated but with PBL the role of the teacher changes resulting in a student-centered learning environment. Dewey (1998) explained that in traditional learning environments students are expected to learn what has been put into

textbooks and what is going through teachers heads before they have had a chance to experience much on their own. This type of learning is focused on the finished product instead of allowing students to create their own finished product (Dewey, 1998). While Dewey (1916) used the phrase "learning by doing" Kilpatrick (1918) referred to this teaching and learning approach as the project method.

According to Kilpatrick (1918), learning is something that takes place every day, in many different settings and should not just prepare students for life outside the classroom. Since students are naturally curious and frequently ask questions providing learning opportunities that promote this will keep a love for learning alive for students, even those who struggle. Both Dewey and Kilpatrick believed that students learn by doing; therefore, implementing learning that begins with real-life questions builds students interests and motivation to learn. Kilpatrick (1918) stated that students learn by doing, and educators should give them an unlimited amount of opportunities to engage in purposeful learning. The use of project learning activities offers a wider variety of educational experiences that are relatable to real-life (Kilpatrick, 1918). The educational approaches discussed by both Dewey (1916/1938/1944/1998) and Kilpatrick (1918) strongly support the implementation of PBL in both medical and K-12 educational settings. The support is first seen in the way that, like PBL, both promote a learning environment in which students learn by engaging in authentic and meaningful activities to which they can relate. PBL is also traced back to Dewey (1916/1938/1944/1998) and Kilpatrick (1918) because they believed that students learn best when given opportunities

to build the 21st century learning skills of (a) problem-solving and critical thinking and (b) communication and collaboration.

Experiential learning is traced back to Jean Piaget, William James, John Dewey, Carl Rogers, Kurt Lewin, and David Kolb. Based on the theories of Piaget, James, Dewey, Rogers, and Lewin, Kolb (2015) developed the experiential learning theory defined as a type of learning where students learn from life experiences instead of in a more traditional educational setting. He posited that learning takes place in an experiential learning environment; students gain a deeper understanding of what they are learning. According to Kolb (1984), the central tenet to experiential learning is as follows: "learning is the process whereby knowledge is created through the transformation of experience" (p. 41). Therefore, knowledge is a result of obtaining and transforming experience (Kolb, 1984).

Similarly, Piaget believed that students learn through play. His theory is closely tied to the learning through experience theories of James, Dewey, Rogers, and Lewin. Although PBL was not a term used by these theorists experiential learning includes the same pedagogical approach as current day PBL learning environments.

Post Kilpatrick and Dewey, the movement of PBL gained traction, not in public K-12 schools, but medical education. The implementation of PBL was initially seen in the field of medical education because educators wanted students to have an opportunity to apply the medical tasks they were learning (Merritt et al., 2017). The underlying theory behind the development of this type of curriculum is that it leads students towards a desire for lifelong learning as well as a realistic approach to obtaining knowledge

(Tsigarides, Wingfield, & Kulendran, 2017). PBL was designed initially by two medical schools in North America in the 1950s and 1960s, Case Western Reserve University and McMaster University (Tsigarides et al., 2017). Naturally, the implementation of the PBL-based curriculum by Harvard gave this approach credibility and paved the way for other medical schools (Johnson & Finucane, 2000). Johnson and Finucane (2000) indicated that the main reason for the implementation of PBL at the new School of Medicine at McMaster University in 1969 was due to the shortage of doctors in Ontario and with the implementation of this approach their learning environments and educational concept became more modern. When PBL first began to be implemented in medical schools, the schools were typically small and new, but its success led Harvard Medical School to implement a PBL-based curriculum in 1985 called "New Pathway" (Johnson & Finucane, 2000). A study done comparing medical students who learned in the PBL model to those who did not at other medical schools showed that students who learned using this model were more likely to choose a specialty than those who did not (Moore, Block, & Mitchell, 1990; Tsigarides et al., 2017). Therefore, showing that students who learn by doing, gain a better understanding of their strengths and likes, allowing them to choose medical specialties fitting for them. Barrows (1986) found that learning that is driven by practice, by applying knowledge to a task, promotes a structuring of knowledge.

Medical education first adopted this approach because it allowed medical students to practice medical procedures and knowledge allowing them to use what they had learned in class in a real-world learning opportunity (Merritt et al., 2017). When medical

educators began implementing PBL into their classrooms, more than sixty years ago, students more effectively learned content and clinical reasoning (Merritt et al., 2017; Tsigarides et al., 2017). The implementation of PBL provided students with an opportunity to gain cross-disciplinary knowledge as well as obtain critical thinking and problem-solving skills (Tsigarides et al., 2017). In a qualitative case study, Jindal, Srivastav, Mahajan, and Baro (2016) studied two groups of one hundred medical students each and used six PBL exercises on various topics. Each group of one hundred was broken down to groups of fifteen to eighteen to complete the exercises (Jindal et al., 2016). Results showed that medical students felt that PBL is intellectually stimulating and enhances their previous knowledge while encouraging collaboration; therefore, taking more responsibility for their learning. Building on previous knowledge allows students to deepen further their understanding of the content being learned.

In a meta-analysis, Albanese and Mitchell (1993) examined the effects described in the literature of PBL used in medical schools from 1972 to 1992. The analysis compared PBL studies to a more traditional approach, and the authors' found that PBL was more nurturing and enjoyable for students (Albanese & Mitchell, 1993). Other findings included medical students who were engaged in PBL performed better on clinical exams and faculty evaluations. It was also found that medical students were more likely to enter family medicine after being enrolled in a program using PBL (Albanese & Mitchell, 1993). Implementing PBL in medical education enabled medical students to become actively engaged in managing possible scenarios they would

encounter in a hospital or clinic; therefore, producing better performing medical professionals (Albanese & Mitchell, 1993).

While PBL was not used as a pedagogy in American K-12 schools until the mid to late 20th century, there were some individuals creating learning environments based on similar philosophies much earlier. For example, Maria Montessori began using a method similar to PBL with preschool aged students, known as the Montessori Method, in Rome in 1907 with varied success until the 1920s. Unfortunately, this type of learning disappeared and did not resurface until forty years later, in America in the 1960s (American Montessori Society, 2017). Montessori developed a school for young students, especially those with special needs because she believed that if given proper training could be successful. Through her study she found that students leaving her school were more prepared, despite their handicaps, for entering primary school than their atypical peers (Plekhanov & Jones, 1992), giving support that using an experiential learning approach, such as PBL is beneficial to all students.

The implementation of PBL into K-12 classrooms has allowed students to take a more active role in their learning, resulting in a deeper learning. In a qualitative study, Gallagher (1997) found that when implemented into K-12 schools, the teachers become the guide and allow students to take on more responsibility for their learning. Due to the difference in metacognition reasoning between K-12 students and medical students, K-12 educators have to begin PBL implementation by building a foundation on self-directed learning and reflection (Gallagher, 1997). In a study conducted using ninety-sixth grade students from a highly diverse alternative middle school, Wirkala and Kuhn (2011) found

that students who were involved in a PBL environment showed better comprehension and knowledge retention than their peers who were involved in a more traditional learning environment. When learning environments provide students with experiential learning, they retain more and become more excited about the learning process.

Active learning is also known as learning by doing and connects with PBL through the asking of questions, then using critical thinking and problem-solving skills to find answers to those questions (Hudson, 2016). In 1945, Revans was the first to coin the phrase active learning. Revans (1982) explained that in active learning, individuals learn from each other by working together to find solutions to their current problems and answers to their questions. In active learning, students are doing more than just listening; they are reading, writing, discussing, and are actively engaged in problem-solving (Bonwell & Eison, 1991). When engaged in active learning opportunities, such as PBL, students develop higher order thinking skills such as analysis, synthesis, and evaluation of content they are learning (Bonwell & Eison, 1991). The constructivism approach, also another term for PBL, was developed on the pretense that students build on prior knowledge or experiences to gain a deeper understanding of the content they are studying (Sharma, 2014). In a quasi-experimental study with ninth-grade biology students from the Pacific Northwest, Leo and Puzio (2016) found that students need more opportunities to learn from one another and active learning or constructivism has a positive impact on students learning.

Since the turn of the century, PBL is more widely used in K-12 learning environments. Research on the implementation and success of PBL programs range in

their accolades for this method of learning and instruction. Various studies have been conducted on the use of PBL in K-12 education and have proven to be successful in middle-grade science classrooms (Siew & Mapeala, 2017), college history classrooms (Stallbaumer-Beishline, 2012), as well as in high school physics classrooms and with those with special needs (Duda, 2014). Stallbaumer-Beishline (2012) conducted a qualitative study on the use of PBL in a college history class and found that identifying problems is at the start of any historical research and as a result creates an authentic learning experience. When using PBL in a history classroom, students should be exposed to a historiographical problem and then required to develop a solution (Stallbaumer-Beishline, 2012). For example, Stallbaumer-Beishline (2012) stated that students could conduct a film analysis based on their expertise on the Holocaust. Although the philosophy behind PBL has been around for many years, there are still areas that need further exploration. Wilder (2015) stated that due to the success of PBL in medical education, the K-12 community adopted the approach and experienced the same success in the development of the 21st century learning skills of students related to (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge.

Problem-Based Learning and 21st Century Learning

PBL is an approach educator use to provide students with the tools they need to be successful in the 21st century through the solving of real-world problems. Kereluik et al. (2013) divided 21st century learning skills into three categories then divided those categories into three subcategories each. The three subcategories that were explored in

this study are (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge. In the conceptual framework sections, I discussed the PBL literature base related to these three subcategories and the reason they were included in this study, however, in this section I will discuss logistically, how PBL lessons or units have shown success in giving students practice in using these skills.

Communication and collaboration. Communication is the ability to clearly state one's thoughts as well as the ability to actively listen to others (Kereluik et al., 2013). When communicating one's thoughts and ideas, communication can take place verbally, written, and/or digitally. Collaboration is the ability to work effectively with others to reach a common goal (Dole, Bloom, & Doss, 2016a; Germaine et al., 2015). Collaboration is not only done through group projects but also when individuals communicate ideas and findings. When given the opportunity to collaborate with their peers in face-to-face (f2f) settings, students build their verbal communication skills through the requirement to discuss their findings and ideas, which is why these two skills are often discussed together. Student collaboration that takes place online provides students with opportunities to communicate through written and digital methods.

In PBL the role of the teacher becomes that of the facilitator, which requires students in PBL to strengthen their communication and collaboration skills (Dole et al., 2016a; Keegan, Losardo, & McCullough, 2017; Linder, 2016; O'Keeffe & Medina, 2016; Rico & Ertmer, 2015). This change in roles requires students to communicate and collaborate with their peers to find a solution to the real-world problem they are working to solve. When the teacher becomes the facilitator, students are no longer listening and

absorbing information. Instead, they are required to research and communicate their findings verbally, digitally, and/or through written forms. Research shows that effective PBL includes a variety of communication methods, such as verbal through f2f settings and digital or online in collaborative online learning groups (Chen, Yang, & Hsiao, 2016; Crist, Duncan, & Bianchi, 2017; Keshwani & Adams, 2017; Kuo, Belland, Schroder, & Walker, 2014).

Student-directed learning "is the practice of studying a topic with little or no direction from formal education" (Haworth, 2016, p. 359). Student-directed learning, such as PBL provides students with more opportunities to communicate and therefore, understand communication differences (Keegan et al., 2017). For example, if students have language differences due to language delays or have cultural and linguistic differences, students have to learn the best way to communicate with their peers. A PBL environment provides students with many opportunities for communication and collaboration. For instance, students are presented with a real-world problem then asked to work through the problem in their collaborative groups until they find a solution (Monge & Frisicaro-Pawlowski, 2014); therefore, enabling students to develop more efficient and effective communication and collaboration skills (Hogaboam et al., 2016; Jones, Smith, & Cohen, 2017; Lim, Yan, & Xiong, 2015). To be proficient in the 21st-century skill of communication and collaboration students should have the ability to clearly speak through various forms of communication as well as have a willingness to listen and participate with others (Kereluik et al., 2013). Therefore, they should be given a sufficient number of opportunities to engage in a learning environment that promotes

the development of this skill for all ages. Practicing communication and collaboration skills as part of PBL can be accomplished with varying ages of students from early childhood all the way to graduate school.

Communication and collaboration skills in PBL lessons have shown to be effective even for students in early childhood classrooms. When implementing PBL with this age group students should be given choices in the tasks that they complete. Preschoolers will often form groups with those sitting close to them; therefore, a wide range of abilities can be found in each group (Siew, Chin, & Sombuling, 2017). Early childhood teachers may need to be more hands-on in their facilitating, but given the right type of instruction students, this young greatly benefit from PBL because it better prepares them for future learning and work experiences. Providing communication and collaboration practice with young students comes in various forms. For example, students asked questions and worked to solve problems based on the curriculum activities in the workbooks (Ata Akturk, Demircan, Senyurt, & Cetin, 2017). Students were encouraged to ask questions and work to develop solutions to real-world problems through collaborative activities, such as analyzing and communicating their findings with peers (Ata Akturk et al., 2017).

With the influence of technology in the elementary classroom, students are given many opportunities to develop the 21st-century skill of communication and collaboration. Technological tools allow students to communicate and collaborate with others both in and out of the classroom, making learning possible anytime and anywhere. Elementary students can engage in collaborative activities with others through the use of online tools

such as Quizlet and Skype (Kuo et al., 2014; Linder, 2016). For example, students were asked to work together to create card sets to put on Quizlet based on important concepts or vocabulary from their reading; therefore, building their communication and collaboration skills through the discussion that took place to develop the card sets (Linder, 2016) effectively. Skype allows students to communicate and collaborate with others with similar interests outside of the classroom or even those from other schools during school hours. Students can work together on solving problems through communication tools such as Skype. However, not all modes of communication among students at this age showcase their best thinking. For example, in a study where elementary students' communication through oral means and technology were examined, analysis of dialogue among groups showed that students were better oral communicators and were less able to communicate higher level thinking in their digital communications (Sekeres & Castek, 2016). This study also showed that collaborative skills vary greatly at this age. Some groups working together communicated at higher levels, and were better able to construct a final product than other groups. This study highlighted the importance of teachers providing prompts for students to help them communicate their thinking as they work together (Sekeres & Castek, 2016, p. 75).

As with early childhood and elementary education, there are a variety of ways that the 21st-century skill of communication and collaboration can be promoted and developed in the middle school classroom. PBL often encourages the use of "online applications such as Quizlet, StoryboardThat, Kidblog, Padlet, and VoiceThread" which promotes collaboration (Linder, 2016, p. 21) by providing online spaces and organizational tools

for groups to use. Communication and collaboration skills are built by applying what they are learning to real-world problems. Through the creation of group presentations on Google Drive, activities on Moodle, Twitter, blogs, and other social media sites, students practice collaboration and written communication skills (Kuo et al., 2014; Longo, 2016; O'Keeffe & Medina, 2016). These online mediums allow students to collaborate outside the classroom from virtually anywhere. Collaborative groups can be formed randomly or purposefully so that students can communicate and collaborate to find answers to their questions. In these groups, students build communication and collaboration skills when given time to share notes and debrief on lessons or activities (O'Keeffe & Medina, 2016). In one study, Google Drive was shown to support students in collaboration through the sharing of work with one another and their teacher (Longo, 2016). In another study when students were given real-life scenarios, such as the digestive system and asked to view videos and respond to an online journal using Google Doc or Moodle they were more actively engaged (Longo, 2016); therefore, improving their written communication skills. Through PBL activities, students develop questions and discover answers to real-world problems, then share their findings with others through various methods. Middle school students that are engaged in f2f discussions combined with SMART Boards have also shown to help students build the necessary 21st-century skills (Longo, 2016). The use of SMART Boards and clickers as formative assessment provided students and teachers with immediate results while also giving students a chance to discuss their answers and any differences they saw (Longo, 2016). Interactive technologies, such as SMART Boards and iPads, allow students to work together to come to a shared goal. Therefore,

implementing opportunities for communication and collaboration through digital and f2f methods is essential to the growth and development of middle school students.

The implementation of PBL brings about many opportunities for high school students to communicate and collaborate. Students often work in collaborative teams to find solutions to real-world problems, which requires them to work through any communication difficulties that may arise (Morrison et al., 2015). The use of technology, along with the collaborative teams allowed students to gain a deeper understanding of the real-world problems for which they were seeking answers (Morrison et al., 2015). Through the use of technology, students have additional methods of communication and collaboration, which helps to ensure that students are effective team members, both academically and professionally, since they were able to discuss findings and questions with their group members. When working through the problem, students had to use technology to research, communicate, and collaborate in order to be successful in the group activity. This type of learning environment got students involved in working through issues with team members and taught them to communicate effectively. The implementation of PBL provides students with choices in what activities to complete as well as a variety of tasks that help them develop adequate communication and collaboration skills. In another study of three high school students, students were engaged in activities such as physical experiments, graphs, and digital simulations, in which they were expected to communicate with their peers to successfully complete the tasks (Jornet & Roth, 2014). Study participants were given activities in which they received little guidance and engaged in others that were teacher-led. For example,

students were asked to "investigate material, observe what happens, discuss with each other, and record a small video with their iPods in which they illustrate and explain what they observed" (Jornet & Roth, 2014, p. 384). It is natural for students of all ages to ask questions about how things work or how they could bring about change; therefore, it is important that teachers allow students to ask questions then seek answers to those questions. PBL allows for this, and through the use of technology, students are able to connect with students from around the world.

Like with the use of PBL in early childhood through high school, the opportunities to develop communication and collaboration skills continue into college. Studies show that students build written and digital communication skills through the development of Wikis (Crist et al., 2017), verbal communication skills through the sharing of bad test results by medical students (Hogaboam et al., 2016), verbal communication through laboratory experiments and facilitating elementary after-school STEM clubs (Aydin, 2016; Keshwani & Adams, 2017), and written communication through Google accounts, such as Google Docs and Google+ (Haworth, 2016). In one study, students created Google accounts and used them as personal learning environments (PLE) as a way to communicate and collaborate with their peers. Students used their Google accounts in a variety of ways. For example, they used their (a) Google Drive for storing and sharing documents, (b) Google Docs for collaborative groups work, (c) Gmail for communication, (d) Google+ for group communication, collaboration, and document sharing, and (e) Google Hangouts for live group meetings and chats (Haworth, 2016, p. 361). Google accounts allow students to collaborate and communicate in several

different ways, therefore, improving their written, verbal, and digital communication skills. Having so many methods of communication and collaboration within their Google account allows students to communicate and collaborate from virtually anywhere at any time. To be prepared to work in a technology-driven society successfully, it is vital that students are given opportunities to develop these types of digital communication skills. Collaboration skills are improved through a variety of methods such as, (a) visually supported technology, (b) technology-mediated learning environments, and (c) face-to-face projects. For example, online collaboration tools, like Google+ (Haworth, 2016), various social media sites (Cho, Cho, & Kozinets, 2016), and mobile devices (Albers, Davison, & Johnson, 2017) allow students to collaborate with both in and outside of their classroom. Through the increase of social media sites, research shows that college students expand their communication and collaboration from f2f to group activities using Facebook groups or Google accounts. Visually supported technology tools, such as Pinterest and Mural.ly, have been used to allow students to share artifacts like photos, videos, and audios (Cho et al., 2016). In a study using college students, instructors gave each collaborative student group the freedom to choose which mobile learning tool was best for their group to most efficiently complete their tasks (Albers et al., 2017). As a result, they found that students preferred the mobile learning tool WhatsApp because it allowed them to (a) develop poster presentations, (b) complete community-based pieces of the task, and (c) collaborate successfully (Albers et al., 2017). With collaboration tools such as these and f2f activities in the classroom, students are provided with more opportunities to engage in collaboration through the sharing of documents, thoughts, and

ideas that enable them to complete the assigned tasks. When encouraged to engage in collaborative activities with their peers, students are more successful when teachers provide different options for students to learn communication skills effectively in order to complete the tasks in PBL.

Building collaboration and communication skills are just as important for teachers as it is for students when it comes to the implementation of PBL in any learning environment. To effectively implement PBL into their classrooms, studies show that teachers need to be involved in a PBL environment themselves (Dole et al., 2016a; Jones, et al., 2017; Lim et al., 2015). When teachers are engaged in PBL activities, they better learn their role in helping students develop effective communication skills because to be successful with this learning method this 21st-century skill is vital to gaining knowledge a building collaboration skills. Teachers enrolled in an online graduate course were required to interact with their peers using the technological learning platforms, Elluminate Chat, and Voice as well as Moodle (Madden, Jones, & Childers, 2017). This program allowed teachers to see the importance of providing their students with opportunities to build their verbal, written, and digital communication skills. Teachers stated that the program allowed for better interaction, or collaboration, between (a) teachers and students and (b) student to student (Unal & Unal, 2017).

The literature has shown that students across many ages and disciplines benefit from units that promote the building of communication and collaboration skills because they can improve in their skills of solving real-world problems by working together and sharing their findings. Therefore, acknowledging the importance of providing students

with learning opportunities that allow students to develop strong communication and collaboration skills. In my study, I examined teachers' publicly posted experiences and perceptions related to how they provide communication and collaboration experiences for students with special needs.

Problem-solving and critical thinking. While various definitions are used in the literature to describe problem-solving and critical thinking, they have commonalities. The 21st-century skill, problem-solving involves students having the ability to interpret information, make decisions, and work collaboratively toward finding a resolution (Kereluik et al., 2013), whereas, critical thinking is the ability to use reflective thinking to make a decision or complete a task (Aizikovitsh-Udi & Cheng, 2015). The collaboration and inquiry involved in effective PBL enable students to develop the 21st-century skill of problem-solving and critical thinking because they are engaged in solving real-world problems (Morrison et al., 2015), which is at the crux of PBL. Well-designed PBL lessons begin with a real-world problem and require students to ask and seek alternative answers in their quest to solve those problems and is conducive to the development of problem-solving and critical thinking skills. According to Cicchino (2015), critical thinking supports and empowers students in their study skills and creativity while requiring them to apply prior knowledge to new information for evaluation.

PBL experiences have shown to be effective in helping early childhood students practice problem-solving and critical thinking skills. Developing problem-solving and critical thinking skills in students in early childhood education helps to prepare them for elementary school better. For example, sorting activities are often used in early

childhood classrooms and are used to develop critical thinking skills. When sorting objects, teachers ask students to sort by shape, color, or other characteristics which engages students in inductive reasoning and critical thinking because use prior knowledge to sort the objects and gain new (Aizikovitsh-Udi & Cheng, 2015). Encouraging students to develop their own categories also helps to promote critical thinking because it causes them to think deeper about what they are doing. Early childhood teachers often give students opportunities to practice critical thinking skills with activities that encourage problem-solving tasks. In one study, early childhood students were engaged in mathematical activities that were playful and meaningful by establishing relationships between real-life problems and math concepts (Lopes, Grando, & D'Ambrosio, 2017). Using play is one way to promote the development of problem-solving and critical thinking skills because it helps students to make a connection between mathematical problems and their every-day lives (Lopes et al., 2017). The results of a similar study show that student-centered curriculum, such as PBL, promotes the development of critical thinking skills in early childhood students through learning activities like storytelling, simulations, and a variety of playing materials (Mligo, Mitchell, & Bell, 2016). Students of all ages, but especially those in early childhood need opportunities to see, think, and wonder about what they are learning and how it corresponds to their life to effectively develop critical thinking and problem-solving skills.

Activities that promote problem-solving and critical thinking become more involved as students grow; therefore, in the elementary classroom, students are engaged

in more complex activities, such as exploration and evaluation. In one study, elementary students were engaged in critical thinking and problem-solving a PBL unit where they had to solve various problems related to being stranded on an island (Dailey, 2017). Using this method required students to engage activities, such as designing and building a tower to watch for dangers on the island, designing a solar cooker so they could eat, water conservation, or creating a raft for getting rescued (Dailey, 2017). Results from this study showed that through the use of problem-solving required to carry out the steps to build a soundly built tower, elementary students had to take time to measure height and duration of standing; therefore, resulting in deep, reflective thinking to ensure the tower was built correctly (Dailey, 2017). In another study, elementary students were encouraged to think critically through reflection, then share their findings (Lee & Hannafin, 2016). For example, students were asked to gather artifacts and analyze findings, then reflect on their experiences; therefore, promoting the development of critical thinking skills. When students reflect on their findings, they become more deeply involved in what they are learning. As a result, they become more actively engaged in problem-solving and critical thinking activities because they were required to blog or complete traditional writing tasks about the problem they were studying as a method of reflection (Lee & Hannafin, 2016). Students stated that they preferred blogging over the traditional assignments because it helped them to perform at a high level due to the critical thinking required for producing quality work that would be posted online (Lee & Hannafin, 2016). Collectively, these studies show that engaging students in critical thinking and problem-solving activities require young students to use prior knowledge

with what they are learning as a way to think more deeply about the content they area learning.

PBL experiences have also shown to be effective in helping middle school students to develop their problem-solving and critical thinking skills. In a quantitative study of 270 fifth graders learning physical science, a pre-posttest measuring critical thinking skills focused on (a) comparing and contrasting, (b) sequencing, and (c) identifying cause and effect in physical science (Siew & Mapeala, 2017). Results showed that thinking maps were an effective tool to improve critical thinking skills in PBL units compared to conventional problem-solving. The Siew and Mapeala study highlights the importance of teachers providing critical thinking strategies With in PBL to help bolster student skills. Similarly, in a study using middle school math students, Jaelani and Retnawati (2016) found that when engaged in PBL math activities that were problem-focused students engaged in multiple levels of thinking, resulting in an improvement in their problem-solving and critical thinking skills. Results showed that implementing PBL in mathematics classrooms led to some challenges, such as a lack of confidence in students when they found they did not always get the same answers as their peers (Jaelani & Retnawati, 2016). Even with these results, the study showed that the higher-order thinking skills involved in solving mathematical problems often lead to an improvement in problem-solving and critical thinking skills. When Erwin (2015) implemented PBL by having middle school students use real-world data sets to learn about mortality rates, they deepened their knowledge and understanding of the content they were studying. Thus, showing that allowing students to approach real-life problems

using real-world data contributes to skill building for middle school students. Not only does the development of the 21st-century skill, problem-solving and critical thinking involve teaching students to think for themselves, it also requires that they are taught to reflect (Aizikovitsh-Udi & Cheng, 2015; Cicchino, 2015; Jaelani & Retnawati, 2016). Reflection is the part of the critical thinking process in which students analyze what they have learned, and a PBL environment engages students in real-world activities that allow students to reflect and think deeply about what they are learning.

Additional research shows that PBL helps build critical thinking and problem-solving skills in high school students. When implementing PBL into the high school classroom, it is essential that they are given opportunities to think critically about solving real-world problems. Duda (2014) found that since problems in the real world are typically not neatly defined like those that may be on a worksheet, it was beneficial for students to be provided with ill-defined and open-ended projects or problems that required them to problem-solve and use their critical thinking skills. In this qualitative study, high school physics students participated in four projects: in the first they used a program specifically for scientific documents called LaTex to format equations, for the second they wrote an article review, in the third they wrote a paper in preparation for in-class presentations, and in the fourth project they put together information from the entire project into a scientific poster (Duda, 2014). Duda found that (a) students were challenged more because the limits were taken off of his expectations, (b) the students who typically struggled, excelled because it gave them a chance to learn in a way best fitting to them, and (c) students took ownership of their learning through since they had

to learn ways to problem-solve. In another study, high school technology students were engaged in solving real-world problems in technology and history classes (Morrison et al., 2015). Classroom observations showed that in solving real-world problems in technology and history classes, students learned to problem-solve and think critically (Morrison et al., 2015). In interviews, students shared that they found their teachers' prompts helped them to think critically and learn to problem-solve because they were not told what to think or how to solve the problem (Morrison et al., 2015).

Similarly, a study of high school chemistry students was done using PBL lessons on the purification of water (Abubakar & Arshad, 2015). Students were engaged in a self-directed learning process in which they sought answers for real-world water issues, such as cholera and pipeline blockages (Abubakar & Arshad, 2015). Results of the study showed that using a PBL model helped students obtain problem-solving skills that they can apply in other areas of their lives (Abubakar & Arshad, 2015). Duda (2014) and Abubakar and Arshad (2015) studied critical thinking and problem-solving in a high school PBL science classrooms, while Morrison et al. (2015) studied problem-solving in a STEM high school. Findings from the Morrison et al. (2015) study show that when engaged in PBL problem-solving and critical thinking activities students experience more academic satisfaction, indicating that high school students appreciate being able to problem-solve in a real context.

Similarly, in a mixed methods study of tenth-grade students participating in an after school program focused on using mathematics to solve probability problems, both critical thinking dispositions and critical thinking skills were analyzed in pre-post testing

(Aizikovitsh-Udi & Cheng, 2015). In this study, students were asked to explore math and science concepts through the use of real-world problems, such as practicing critical thinking through the subject of probability (Aizikovitsh-Udi & Cheng, 2015). Results showed that when teachers are explicit in teaching critical thinking skills, these skills become a significant part of their thinking habits and students are therefore more likely to practice critical thinking skills (Aizikovitsh-Udi & Cheng, 2015). This type of thinking often involved a bit of risk taking and thinking about the impact of their decisions. As a result, a learning environment focused on solving a problem requires decision-making would be conducive to the development of critical thinking skills (Aizikovitsh-Udi & Cheng, 2015). The task of problem-solving and critical thinking activity in a PBL setting teaches students of all ages to analyze and make decisions or think about what they are currently involved in (Erwin, 2015).

PBL learning opportunities also benefit undergraduate students as well as those in K-12 settings and provide ways to strengthen problem-solving and critical thinking skills. In one study, physics students at a university in Indonesia were engaged in PBL activities about electricity and magnetism that involved a pre-test followed by the development of questions to find the answers to (Pandiangan, Sanjaya, & Jatmiko, 2017). Results of this study show that a PBL environment increased physics students problem-solving skills. Crist et al. (2017) used a Wiki research project to promote the development of critical thinking skills in students. Students felt that the project of developing a Wiki helped in the development of their critical thinking skills because to be successful they were required to reflect on what they were learning (Crist et al., 2017). Through the

development of the Wikis, students were able to show their critical thinking skills through the completion of the learning task as well as through the sharing of their findings with their peers. When students are engaged in PBL units, they are required to solve real-world problems by thinking critically to find the answers. In one study, undergraduate students who were wanting to become teachers were engaged in the thinking process by (a) exploring perspectives, (b) questioning assumptions, (c) looking for connections, and (d) synthesizing information (Chua, Tan, & Liu, 2016, p. 191). For instance, they were given real-world scenarios and were to identify facts so they could come to a common understanding that would allow them to develop questions and establish relevant links between the problem and their prior knowledge (Chua et al., 2016). This type of approach requires individuals to think deeply about what they are learning, especially when being shared with others through activities such as journaling or mind-maps. For example, in one study, undergraduate writing composition students were engaged in persuasive writing activities in which they were graded based on the use of six key elements of critical thinking (Kumar & Refaei, 2017). Results from this study showed that when undergraduate students were given problem scenarios, they better analyzed the audience as well as the purpose of their writing (Kumar & Refaei, 2017). Together these studies show that providing college students with PBL activities improves their problem-solving and critical thinking skills.

Just as it is vital that students in early childhood through undergraduate programs are provided with opportunities for developing problem-solving and critical thinking skills, it is important for teachers to have these PBL opportunities as well. When teachers

are provided with this type of learning opportunity, they are better able to implement it into their classroom. In one study, teachers were involved in a graduate course that required them to create a virtual family, including a home, place of work, and an information area (Parson & Bignell, 2017). Throughout the project, the teachers completed a questionnaire as a way to assess their attitudes and views of the project as a whole and were expected to write a written response to a writing prompt concerning the virtual children's safety (Parson & Bignell, 2017). This activity caused them to think and reflect critically about both the buildings and family design as well as any other factors that would affect one's safety. To effectively teach students how to develop proficient problem-solving and critical thinking skills, teachers need adequate training and practice in how to model these skills. Therefore, the goal of teaching and developing critical thinking skills in students is so they can apply prior knowledge and skills to any situation that may arise (Aizikovitsh-Udi & Cheng, 2015). Problem-solving and critical thinking skills are promoted in students of all ages when PBL lessons are developed around real-world problems because they require them to find answers questions that are relevant to them.

The literature has shown that students across many ages and disciplines benefit from units that promote the building of problem-solving and critical thinking skills because they can improve in their skills of solving real-world problems and reflecting on the solutions by applying the knowledge to future situations. Therefore, acknowledging the importance of providing students with learning opportunities that allow students to develop strong problem-solving and critical thinking skills. In my study, I examined

teachers' publicly posted experiences and perceptions related to how they provide problem-solving and critical thinking experiences for students with special needs.

Cross-disciplinary knowledge. Cross-disciplinary knowledge is "knowledge that integrates and synthesizes information from across fields or domains" (Kereluik et al., 2013, p. 130). Kereluik et al. (2013) stated that this type of knowledge requires students to comprehend and connect data or information that they obtain through various resources. Brassler and Dettmers (2017) explained that not only do students learn more effectively when involved in the PBL model, their cross-disciplinary knowledge is also enhanced. Throughout their two-year study on a wiki project, Crist et al. (2017) learned that teaching and learning done in an environment that focuses on multiple subject areas allowed students to make real-world connections to the content they are learning. Cross-disciplinary knowledge is an important skill for all ages to have, but PBL studies have not been found showing the implementation of this skill in early childhood classrooms.

Building the cross-disciplinary knowledge skills through the implementation of PBL is important in elementary classrooms. Elementary students are often in self-contained classes, where the blur between subjects is easier for teachers to manage. When students use cross-disciplinary knowledge to solve real-world problems, they gain a deeper understanding of the problem at hand. In one study, elementary students gained cross-disciplinary knowledge through the combining of computer-supported PBL collaborative learning activities in the science classroom (Hsu & Lee, 2015). In this science classroom, students used online gamification, therefore, building their cross-disciplinary knowledge through social networking and IT skills required in the online

game animation tasks, in which they also learned essential science content (Hsu & Lee, 2015). Science, Technology, Engineering, and Math, or STEM activities naturally require students to develop knowledge and complete projects across multiple disciplines. While there is a lot of research being published related to the effectiveness of STEM activities, there appears to be little on how it benefits students of all ages with special needs but instead discuss at length the benefits for atypical students. For example, implementing STEM activities in elementary classrooms encourages students to build their cross-disciplinary knowledge through the merging of science and math ideas to solve a problem or develop a project (English & King, 2015). English and King (2015) studied the use of cross-disciplinary knowledge through STEM activities in a fourth-grade classroom, while Keshwani and Adams (2017) conducted a study with elementary age students who were involved in after-school STEM clubs and engineering students to identify the impact of a cross-disciplinary, PBL environment. In this study, undergraduate engineering students worked with small groups of elementary students in an after-school STEM club using various STEM topics. The results of this study show that elementary students are greatly impacted by their knowledge through the crossing of content areas. Elementary students participated in focus groups and questionnaires in which they reported that they gained STEM knowledge (Keshwani & Adams, 2017).

Like in elementary classrooms, middle school students who are engaged in PBL activities have new opportunities for developing cross-disciplinary knowledge. Learning in a classroom that uses multiple disciplines in one project or to solve a real-world problem allows students to build on their strengths and prior knowledge, which could

result in deeper learning. In one study, middle school students were engaged in a PBL project called Tour America, in which they became the concert tour managers for a fictional band that was preparing to begin a yearlong U.S. tour (Hill, 2014, p. 453). For the project, students put themselves into groups of two to five, and each group engaged in a different part of the project to help ensure success. Throughout the project some students (a) students created press releases for emails to various media outlets and texts, (b) wrote persuasive speeches and prepared the audio for radio and television announcements, (c) used the Internet to determine the number of seats that needed filling to cover merchandise and band member costs, (d) wrote requests for different venues, and (e) developed websites that included the band's history as well as information on band members (Hill, 2014). Others dressed and performed as the band members after a writing song to promote their tour (Hill, 2014). This type of learning opportunity allowed students to use multiple content areas, such as language arts, math, and technology, to effectively complete their project. In a similar study that combined music with other content areas, middle school students engaged in a project called Birdsong, where they learned ecology along with music (Younker & Bracken, 2015). The Birdsong project engaged students in comparing bird vocalizations and musical patterns (Younker & Bracken, 2015). Interdisciplinary projects such as Tour America and Birdsong allow students to use prior knowledge while still gaining real-world experiences.

High school students are often engaged in cross-disciplinary lessons and activities that combine content areas such as research and writing with history or science and math. In one study, thirty high school students were engaged in a geoarchaeology PBL unit,

titled “Living with Volcanoes,” that combined geoscience and archaeology (Jolley & Ayala, 2015). According to Jolley and Ayala (2015), geoarchaeology provides students with a new way of looking at “past human inhabitation and environmental interaction” (p. 297). Throughout the unit, students were engaged in short lectures, group work, and interactive tasks to answer questions concerning the eruption of Mt. Vesuvius in 79AD and its impact on Pompeii and the surrounding areas (Jolley & Ayala, 2015). Results of this study showed that students involved in this unit learned essential concepts from both geoscience and archaeology; therefore, improving their awareness of both fields. In another study, high school students were engaged in a cross-disciplinary unit connecting English, Studio Art, and Global History in a unit based on the Expeditionary Learning Outward Bound model (DiCamillo, 2015). This unit was designed to help students understand what happened during this expedition with issues such as security (DiCamillo, 2015). Study results showed that although students saw the interdisciplinary connections between their English and Studio Art classes but failed to see it with their other courses. In another high school study, students in a robofest challenge were put into teams to “design, build, and program autonomous robots” using STEM components (Chung, Cartwright, & DeRose, 2017, p. 24). Results showed that students engaged in these robotic challenges achieved higher STEM scores than those who were not involved in the challenge (Chung et al., 2017, p. 24), indicating that engaging students using traditional methods of learning did not allow them to connect knowledge from other disciplines. Another study found that cross-disciplinary studies, also known as thematic units, with high school students offer students a learning environment that is engaging and involves

real-world experiences in both technology and engineering (Moyer, 2016). During this cross-disciplinary study, students engaged in high-tech activities in which they worked in robotics and product design, including 3D printing and Programmable Logic Control (Moyer, 2016). Results show that broad or specific themes used in cross-disciplinary studies facilitate learning and keep students actively engaged (Moyer, 2016). Learning opportunities such as these allowed students to develop writing skills along with history or STEM through the completion of writing tasks discussing the results of their findings.

Cross-disciplinary learning is more difficult in secondary and post-secondary education because students often take specialized courses; however, a review of the literature shows that logistically, these challenges can be overcome and benefit older students. For example, while working on the design of cross-disciplinary projects, IT students used prior knowledge and skills from other subject areas (Stozhko, Bortnik, Mironova, Tchemysheya, & Podshivalova, 2015). In the designing of these projects, students had to use prior knowledge to deepen the understanding of new information they were learning. For example, science teachers and students collaborated with IT specialists to find solutions to real-world problems using information technology tools (Stozhko et al., 2015). The results of this study showed that in a cross-disciplinary study, students learned to apply knowledge across content areas as well as providing them with a positive learning experience (Stozhko et al., 2015). In a study at Virginia Tech a course was designed to promote the three 21st century learning skills focused on in this study: (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge (Wagner, Baum, & Newbill, 2014). Looking more closely

at the cross-disciplinary piece of this study, it was found that students have learned to value and understand the need for others' skills and knowledge from different disciplines to effectively solve the real-world problems they were studying (Wagner et al., 2014). Students stated that it helped them break out of their imaginary bubble and broaden their thinking to solve the problem using multiple disciplines (Wagner et al., 2014). In another study, undergraduate engineering students paired with undergraduate education students to work in an after school program with elementary students and found that cross-disciplinary experiences enhanced learning (Keshwani & Adams, 2017). They found that although the project did not allow the engineering students to build design or critical thinking skills, the students stated that they did gain a deeper understanding of working with various audiences while improving their cross-disciplinary knowledge and communication skills. The engineering and education students in this study, like the IT students (Stozhko et al., 2015) and the Virginia Tech students (Wagner et al., 2014) had to work together to apply knowledge from each of their fields to effectively develop a program that was conducive to engaging elementary students in cross-disciplinary units. When these students from various specializations came together to solve a cross-disciplinary problem, they learned to "appreciate and respect one another's opinions, skills, and knowledge" (Wagner et al., 2014, p. 671).

Engaging teachers in PBL activities that show them how to implement cross-disciplinary lessons and tasks into their classrooms gives them a better understanding of the benefits of this approach to learning. In a study with teachers involved in post-degree programs, the instructor engaged them in two activities that taught mathematical concepts

through dance (Hall & Jao, 2017). These teachers were engaged in two different activities in which they learned angles through what dancers call turnout and other dance stances (Hall & Jao, 2017). Hall and Jao (2017) explained that turnout is the way dancers position their feet where their heels meet, and their toes turn out. For example, each pair first traced their partner's feet in the turnout stance and measured the angles while they were given additional information on the importance of it in dance; then explored more angels in dance using pictures and movements (Hall & Jao, 2017). Activities that engage students in using and building on different content knowledge teaches them new concepts in a way that is relatable to them. As a result, the activities that taught angles and shapes through dance engaged students in learning math using a real-world context (Hall & Jao, 2017). In another study, an engineering teacher partnered with an art teacher to provide their students with a more creative way of STEM learning (Sochacka, Guyotte, & Walther, 2016). By crossing STEM learning with the Arts, students were encouraged to think more creatively by drawing prior knowledge from both content areas. Through this study, these teachers found that by using cross-disciplinary learning while teaching on waste, students gained a more "holistic and connected understanding" of a real-world engineering problem (Sochacka et al., 2016, p. 33). As is seen in these two studies providing students with learning activities that cross multiple disciplines, gives them opportunities to learn concepts in which they may have otherwise struggled.

The literature has shown that students across many ages and disciplines benefit from cross-disciplinary units, and can improve in their skills of pulling what they learn from different subjects to solve a variety of problems. Therefore, acknowledging the

importance of providing students with learning opportunities that cross content areas. In my study, I examined teachers' publicly posted experiences and perceptions related to how they provide cross-disciplinary experiences for students with special needs.

Defining Problem-Based Learning

PBL is an umbrella term for both problem- and project-based learning making the definition not always easy to determine; therefore, to make it clear which was used in this study, a discussion of the critical elements of PBL follows. Merritt et al. (2017) defined PBL as an instructional method that is used to help students develop the ability to apply their knowledge to real-world settings by working together on meaningful problems (p. 4). PBL is described in different ways, but a review of the literature shows that there are a number of unifying characteristics of PBL. These include challenging problems or questions (Brassler & Dettmers, 2017; Hung, 2016; Larmer et al., 2015a), sustained inquiry (Larmer et al., 2015a), authenticity (Larmer et al., 2015a; Siew & Mapeala, 2017; Stefanou et al., 2013), student voice and choice (Larmer et al., 2015a; Sahin & Top, 2015), reflection (Keegan et al., 2017; Larmer et al., 2015a; Lepp & Fierke, 2017), critique and revision (Larmer et al., 2015a), and public product (Larmer et al., 2015a). Based on the literature, seven critical elements must be present in well-developed PBL units or lessons. For the purpose of this study, PBL learning experiences that include these three elements were explored; (a) centered around a challenging problem, (b) authenticity, and (c) student voice and choice.

Problem-centered. The first critical element of PBL is that the learning must be centered around a challenging problem. The organization of PBL is centered around a

problem that students are working toward achieving a shared goal while remaining independent and often are used to cross multiple content areas (Brassler & Dettmers, 2017; Hung, 2016; Lee et al., 2014). PBL begins with a problem that requires the careful construction of learning environments where students learn content in order to solve a problem, rather than learn isolated facts in the hope of being able to recall and use facts someday in the future (Larmer et al., 2015a). Based on their unifying characteristics of PBL, Larmer, Mergendoller, and Boss (2015b) described PBL as being centered around an engaging problem or question in which students have a real need of finding a solution. The best problems and questions should balance the difficulty of the challenge for the age and ability of the student, but not be so difficult as to intimidate students (Larmer, Mergendoller, & Boss, 2015b).

In PBL students have the opportunity to identify and seek answers to a problem or issue that is of interest to them, whereas, traditional learning environments often involve a lot of memorization of facts (Akcay, 2017). Problem-centered learning allows students to apply what they know and motivates them to learn more (Hung, 2016). In a qualitative study, Dole et al., (2016a) conducted online interviews with licensed gifted teachers to determine how PBL had changed teaching. Although PBL requires students to choose an authentic problem or situation before researching and designing solutions teachers should be willing and committed to changing their pedagogy when implementing this method of teaching and learning (Dole et al., 2016a). Results showed that teachers involved in this study were both committed and willing to change their teaching and learning pedagogy (Dole et al., 2016a). In an attempt to further describe the importance of the problem,

Hung (2016) stated that PBL starts with students identifying a relevant problem and working to find a solution to that problem.

Carefully constructing problem scenarios is critical in PBL projects. PBL (a) starts from a problem, (b) processes through the problem, and (c) ends with students learning from the problem they are solving (Hung, 2016). Larmer and Mergendoller (2010) suggest that teachers activate students' need for knowledge of a certain topic by introducing projects with an "entry event" that causes students to ask questions. Therefore, working with students to develop strong problems is essential to the success of PBL. Teachers may set boundaries for the problem but allow students some flexibility into the questions they ask while seeking a solution (Dole et al., 2016b; Hung, 2016). Once students have created a driving question for their project, they can focus all their effort on finding answers and coming up with a solution to the problem (Larmer & Mergendoller, 2010). Students who are able to explore their interests by finding answers to their questions, build their problem-solving and critical thinking skills more authentically. This type of connection with the problem allows students to engage in a real-world problem that results in a more meaningful learning outcome.

To gain a better understanding of the importance of the structure of problems in PBL, Ge, Law, and Huang (2016) explained that it is important to look at the relationship between ill-structured problems and how students learn. Ill-structured problems are problems that are faced in day-to-day life and more difficult to solve compared to well-structured problems that can be solved through simple search processes (Ge et al., 2016). Instead, ill-structured problems require the design process and often solves four

distinctive cognitive and metacognitive processes (a) problem representation, (b) developing solutions, (c) making justifications and constructing arguments, and (d) monitoring and evaluation (Ge & Land, 2003; Ge & Land, 2004; Jonassen, 1997). Therefore, in addition to PBL units including an initial problem for students to solve as the driving force of the learning experience, the way the problem is solved includes various critical thinking and problem-solving skills throughout the length of the project. Having a problem at the crux of any PBL project is a critical element and is significant to this study because only learning experiences that involve students' quest to solve problems and use critical thinking skills to do so were included as part of the study.

Authenticity. Authenticity is the second critical element significant to the implementation of PBL. When learning is said to have authenticity, it can mean that the learning or task is authentic in (a) context, (b) the real-world processes and tools students use, (c) how the finished product impacts others, or (d) how the experience speaks to students concerns, interests, cultures, identities, and issues (Larmer et al., 2015a, p. 3). Authenticity is closely associated with how relevant the problem or question in which they are seeking a solution is to students.

Empirical research has shown that authentic tasks are critical to the success of PBL. Authenticity has shown to be critical in medical education (Jindal et al., 2016), in K-12 education (Wirkala & Kuhn, 2011), middle school science (Siew & Mapeala, 2017), high school physics (Duda, 2014), and college history (Stallbaumer-Beishline, 2012). Authenticity is a key element of PBL and has shown to promote a level of motivation and active engagement that a more traditional learning environment does not

(Hung, 2016). Research shows that authentic tasks are important to PBL because it connects student learning to real-world context and encourages self-directed learning.

First, authenticity helps students connect their learning to real-world processes, tasks, and tools that allow them to apply the context of what they are learning to situations they face in day-to-day life. Problems used in PBL should be authentic in context, but simulated and require an appropriate amount of help from the teacher (Stefanou et al., 2013). After talking with high school science teachers who had implemented PBL, Larmer and Mergendoller (2010) found that teachers felt that students learned more when the task spoke to what students were living. Therefore, learning tasks should speak to the concerns, interests, and issues of students so that the work they produce is high quality (Larmer & Mergendoller, 2010; Larmer et al., 2015b). Authentic learning experiences allow students to designate their learning objectives based on their learning needs and interests (Lepp & Fierke, 2017). In a qualitative case study that used six students and two instructors, Dondlinger and McLeod (2015) sought to provide an authentic learning experience for students that would promote the development of complex problem-solving and critical thinking skills. Results indicated that allowing students to develop games based on real-world problems supported the development of adequate problem-solving skills to help them solve both well-structured and ill-structured problems. Effective PBL focuses on problems that take place in real-life settings, makes learning more authentic to students (Merritt et al., 2017). These student-centered learning approaches allow students to make authentic context connections to what they are studying (Larmer & Mergendoller, 2010).

Next, authenticity is important to PBL because it encourages self-directed learning. When implementing PBL, students are required to take more control of their learning resulting in more time and effort take to produce results that show their understanding of content learned. Keegan et al. (2017) found that with the implementation of PBL students took responsibility for their learning which enhanced their perceptions and attitudes because they are allowed to apply what they are learning to their interests, cultures, and identities rather than just memorizing content. Authenticity is a critical element to this study because when given authentic learning opportunities, students gain a deeper understanding of the content learned. Having authentic learning opportunities at the center of every PBL project is a critical element and was significant to this study because learning experiences that students can relate to keep them actively engaged and allows for the development of essential 21st-century learning skills, such as problem-solving and critical thinking, which were included in this study.

Student Voice and Choice. Student voice and choice is the third critical element to the implementation of PBL and is described as students having a say in (a) what projects they complete, (b) what resources they use to find a solution, and (c) what role they take in the completion of the project (Larmer et al., 2015a). An exploratory study was conducted by Stefaniak and Tracey (2015) using one hundred and nine undergraduate students, to learn how students learning was enhanced when they were engaged in a student-centered learning environment. The results of this study showed that when students were given a voice and choice by being allowed to develop real-world examples to explain the various theories and concepts discussed in the course textbook,

they gained a deeper understanding of course content and were more actively engaged (Stefaniak & Tracey, 2015). This deeper understanding and enhanced engagement resulted in students applying the content and knowledge learned in the public speaking course to other courses in which they were enrolled (Stefaniak & Tracey, 2015).

First, student voice and choice is important to PBL because it allows students to take control of their learning and gets them involved in learning content that is of interest to them. Larmer and Mergendoller (2010) stated that once a student's interest is piqued by a problem or question the more "choice and voice" they have in finding a solution and developing a project the better. By giving students a choice in the problem or question, they seek a solution or answers to and a voice in what projects they complete; learning becomes more authentic (Larmer & Mergendoller, 2010). When students are allowed to make decisions for themselves, even minor ones, they are more willing to learn. Hudson (2016) explained that with the implementation of PBL, teacher, and student roles completely change, giving students more control over what they learn because of their freedom to choose. Giving students a voice and choice allows teachers to be enablers of learning rather than dictators and gives students authentic learning experiences (Hudson, 2016).

Next, student voice and choice give students a learning environment that is student-centered instead of teacher-directed. According to Larmer et al. (2015a), giving students a choice and a voice gives them a sense of ownership, which results in them caring more about their projects and working harder to complete a project that is well thought out. When students are asked to complete a task or assignment that is irrelevant

to them, it becomes a chore, whereas when students are allowed to make decisions and solve authentic problems, they are more actively engaged. By giving students a choice and a voice in what they do they will often (a) develop driving questions, (b) decide how to investigate it, (c) demonstrate what they have learned, and (d) show or present their work publicly (Larmer et al., 2015a, p. 3). In a qualitative study, Sahin and Top (2015) conducted eleven semi-structured interviews using high school students to determine how student voice and choice in both classroom and out-of-classroom projects helped students find solutions to various problems. The results of the study showed that when given a choice, students were more actively engaged in the content being learned and were more willing to share their findings with others (Sahin & Top, 2015). The key element of student voice and choice is significant to this study because when students who struggle are given more control of their learning, they are on a more equal playing field with their peers (Duda, 2014); therefore, this element is vital to the success of all students no matter their learning needs. The element of giving students a voice and choice was an element I used when selecting publicly shared PBL experiences to explore as part of this study.

Literature has shown that while PBL is often described in different ways, there are several unifying characteristics, such as being centered on a challenging problem (Brassler & Dettmers, 2017; Hung, 2016; Larmer et al., 2015a), authenticity (Larmer et al., 2015a; Siew & Mapeala, 2017; Stefanou et al., 2013), and student voice and choice (Larmer et al., 2015a; Sahin & Top, 2015). Reflection (Keegan et al., 2017; Larmer et al., 2015a; Lepp & Fierke, 2017), critique and revision (Larmer et al., 2015a), sustained inquiry (Larmer et al., 2015a), and public product (Larmer et al., 2015a) are also unifying

characteristics of PBL. This study focused on PBL experiences that included the elements of (a) problem-centered, (b) student voice and choice, and (c) authenticity.

Implementing Problem-Based Learning

The implementation of PBL in the classroom is not a new approach to the education world. Research shows that homeschool teachers do not often use the term PBL, but instead use terms including STEM (Gann & Carpenter, 2018), individualized or student-directed instruction (Efford & Becker, 2017; Thomas, 2016), real-world learning applications (Liberto, 2016), and literature-based instruction (Gann & Carpenter, 2018; Thomas, 2017). As an introduction to implementing PBL in the classroom, the following sections include how PBL is implemented in the homeschool classroom. This section also includes a description of teachers experiences in implementing PBL with students with special needs.

Problem-Based Learning in Homeschool

PBL, with its multidisciplinary approach, is not always easy to implement in public schools, but in the homeschool environment, it is a common approach to learning. This method allows homeschool teachers to work with students at various ages who each learn at their own pace while learning topics that meet their interests and still meeting state guidelines (Thomas, 2016). Homeschool teachers implement PBL in homeschool environments differently. For example, in one study, the homeschool teacher developed a series of learning science and literary activities based around her daughter's sudden newfound interest in tadpoles (Efford & Becker, 2017). Homeschooling environments allow for this kind of learning to take place daily, whereas it is not as easy to implement

in a traditional environment. In their study and based on their personal experiences as homeschool teachers, Efford and Becker (2017) explained that by implementing a student-centered learning approach, such as PBL, students' interests could be used as a tool to expand on prior knowledge and experiences. By engaging in teachable moments with their students, they are able to provide a homeschool learning environment that meets the individual needs of their student(s) (Efford & Becker, 2017). Having the freedom to embrace teachable moments while their student or students are interested in a particular real-world problem or topic allows homeschool teachers to focus on students' specific needs and interests. Being able to explore student interests in ways that are engaging, provides students with the opportunity to learn more naturally about real-world problems (Efford & Becker, 2017). A variety of educational models are used in homeschool environments. Efford and Becker (2017) discovered that when homeschooled students direct their learning and have a choice in what and how they learn, they are more motivated to learn. This type of engagement leads to improved problem-solving, critical thinking, communication, and collaboration skills (Efford & Becker, 2017; Hall & Miro, 2016; Hwang, Lai, & Wang, 2015). Efford and Becker (2017) found that student-centered learning, such as PBL, gives students the freedom to discover and explore with very few constraints or mandates. Effective PBL meets students "on the edge of prior knowledge and leads him or her into new knowledge by connections through that prior knowledge (Efford & Becker, 2017, p. 38).

Further along on the PBL spectrum, might be homeschooling teachers who use individualized instruction and self-directed studies, such as STEM because it promotes an

authentic learning environment. Homeschool teachers are drawn to STEM education because it promotes collaboration between students and their parents as well as between multiple homeschool students (Gann & Carpenter, 2018). In a study of twenty-nine homeschool teachers, results showed that through the implementation of STEM learning they were able to customize their instruction to meet the individual needs and interests of their students (Gann & Carpenter, 2018). For instance, when implementing PBL, homeschool teachers found that individualized and self-directed learning took place along with collaboration and application or connection of real-world problems (Gann & Carpenter, 2018). These homeschool teachers discovered that when using a variety of learning methods, they better understood their student's learning style (Gann & Carpenter, 2018). Teachers felt that encouraging students to engage in the research and exploration of topics that were relevant to them allowed their students to make more connections between what they are learning and the real-world (Gann & Carpenter, 2018). Learning approaches such as this allow students to engage in real-world topics leading to a more authentic learning experience. STEM education and PBL promote exploring each student's natural curiosity (Gann & Carpenter, 2018). Homeschooling allows for more flexibility in each family's day as well as in the curriculum and incorporation of real-world applications. STEM education enables students and homeschool teachers to make connections between multiple disciplines (Gann & Carpenter, 2018). For example, homeschool teachers appreciated that the coop provided STEM activities, such as a robotics club where students worked cooperatively with others and applied science and math knowledge to solve problems (Gann & Carpenter, 2018).

In this study, teachers found that as in other PBL methods, their role became that of a facilitator, making it a more student-centered environment (Gann & Carpenter, 2018). During STEM implementation by homeschool teachers, Gann and Carpenter (2017) found that the topics were selected based on the interests and needs of the students. These homeschool teachers implemented several different methods of instruction through the use of local co-ops, online courses, self-study courses, as well as STEM activities (Gann & Carpenter, 2017). STEM activities took place as an extension of their curriculum along with the involvement in homeschool robotics teams and STEM clubs (Gann & Carpenter, 2017). Research shows that homeschool teachers implement a variety of instructional approaches, such as STEM that allow their students to experience PBL (Carpenter & Gann, 2016; Gann & Carpenter, 2017; Gann & Carpenter, 2018).

Last, homeschooling teachers who prefer more structure might organize their learning environments differently. For example, they may use a combination of boxed, student-led, and literature-based curriculum to still meet their students' individual needs, while also keeping with some of a traditional approach (Gann & Carpenter, 2018; Thomas, 2017). This freedom to choose the learning approach that best fits their students' needs allows homeschool teachers to use diverse methods of instruction (Thomas, 2017). Some homeschool teachers who use literature-based approaches have students read novels, such as The Adventures of Huckleberry Finn to teach students a particular time period but in a way that is more meaningful to them and the topics, they are learning allowing for a more authentic learning experience. Still, others strictly use PBL. In such environments, a combination of resources and learning tools are used, such

as videos, hands-on activities, experiments, and texts to customize students specific learning needs (Gann & Carpenter, 2018). For example, one homeschool teacher stated in her interview, "that at first, her daughter was using DVDs for math instruction; however, Deb realized that her daughter understood math better by reading and taking notes instead of listening to a lecture" (Gann & Carpenter, 2018, p. 470). Studies show that homeschool teachers have the flexibility to implement a variety of instructional methods to provide their students with a more individualized and authentic learning experience (Bell, Kaplan, & Thurman, 2016; Carpenter & Gann, 2016; Gann & Carpenter, 2017). Despite the challenges found when implementing PBL, the benefits far outweigh any negative. Liberto and English (2016), homeschool teachers, found that using real-life experiences during their instructional time appeared to make learning difficulties less serious. More traditional approaches to learning restrict students from engaging in learning based on their interests (Liberto & English, 2016). When so many regulations and mandates are put on teachers, effective learning is less likely, and student's well-being is often comprised (Liberto & English, 2016). This interest-inspired and authentic learning environment promotes learning and often dissolves learning difficulties (Liberto & English, 2016).

Teacher Experiences Implementing Problem-Based Learning with Students with Special Needs

Research shows that the implementation of PBL brings about more actively engaged students of all learning abilities. In PBL students learning is supported through student choice and interests but requires both students and teachers to have a mind shift

of their roles (Dahms, Spliid, & Nielsen, 2017). Although there are not many studies directly linking PBL and students with special needs, the attention and pedagogy strategies that PBL provides has been shown to be effective with students with special needs. Students, especially those who typically struggle, often learn more efficiently with the implementation of PBL because they can choose activities and learn based on their interests and needs. While PBL can be effective for all students, studies show that lower-achieving students gain the confidence they need to use prior knowledge to solve the real- world problem for which they are seeking answers. For example, students with special needs often experience success in a learning environment that builds critical thinking through applying real-world topics, such as in PBL, then those students who are higher-achieving (Belland, 2016; Duda, 2014). Duda (2014) used a PBL approach in his high school physics class and found that students who typically struggled excelled with the use of this type of learning. In addition to high school physics learners, PBL engages learning disabled (LD) high school math learners. Students were immersed in a combination of video-based problems and real-world scenarios in which they were required to engage in a hands-on approach to learning the math concepts needed (Marita & Hord, 2017). Teachers who implemented PBL in their mathematics classrooms found that their students successfully developed efficient problem-solving skills as well as experienced increased motivation to learn (Marita & Hord, 2017). Along with the growth in problem-solving skills and motivation, the results showed that students experienced significant progress in computing fractions throughout the study (Marita & Hord, 2017).

As research shows the implementation of PBL in any classroom takes proper planning by teachers the benefits and results of this type of learning outweigh such challenges.

While the implementation of effective PBL takes time and efficient planning, when teachers (a) focus their planning on the specific needs of their students, (b) are willing to try new things, and (c) are persistent in their efforts to provide effective PBL, students greatly benefit (Edwards, 2017). While most studies on PBL and other student-centered learning approaches focus on core subjects, this approach to learning is also effective in the physical education classroom. Using PBL in physical education classes allows teachers to meet a variety of skills and learning interests; therefore, having a positive impact on the physical education of all students (Coyne, Hollas, & Potter, 2016). In interviews, teachers shared that when implementing PBL students are better able to meet each student at his or her learning level and interest; therefore, more effectively addressing their strengths and weaknesses (Coyne et al., 2016). In this study, teachers found that by implementing PBL, they were better able meet each students' individual needs because pieces of each project/problem can be tailored based on students' strengths and weaknesses (Coyne et al., 2016) which is a critical factor with working with students with special needs.

Creating a learning environment that meets the individual learning needs of each student is possible when implementing PBL. The implementation of PBL allows students to learn at their own pace and provides teachers with the opportunity to learn alongside the students. In one study involving a middle school team of teachers and their students, they found that with the implementation PBL came extra time for scaffolding

student activities and projects and creating individualized assessments (Netcoh & Bishop, 2017). PBL and other personalized learning approaches allow students to explore topics and questions that are meaningful and of interest to them (Netcoh & Bishop, 2017), therefore, making meeting the needs of diverse learners more possible. When implementing PBL, teachers become the facilitator and can spend more individual or small group time with students resulting in an increase in students problem-solving, communication, and critical thinking skills (Netcoh & Bishop, 2017). The opportunity to learn in a more relaxed and authentic learning environment brings about more engagement and less stress for students, which is often more conducive for students who are behind or struggle. Another study showed that positive changes in classroom climate and student-teacher relationships were found to be a benefit that came with the implementation of PBL (Dole et al., 2016b). These positive student-teacher relationships are shown to improve students overall learning, especially for those students who tend to struggle. Another benefit is that student-centered learning approaches, such as PBL, promote more collaboration opportunities for students (Dole et al., 2016b). There are both benefits and challenges to implementing PBL with all students; therefore, when looking to implement this approach with students with special needs, it is vital that each of these be taken into consideration. In one study teachers stated that changing roles to that of a facilitator took some practice because leading discussions and knowing how to push students into more critical thinking is more challenging than simply lecturing (Eisenman & Kofkewith, 2016). Eisenman and Kofkewith (2016) found that the implementation of PBL magnifies the need for the teachers to scaffold the collaborative

work of students. The results of this study show that the facilitators or students past experiences often influence learning opportunities (Eisenman & Kofkewith, 2016).

Not only does the implementation of PBL allow for more individual and smaller group learning, but it also encourages students to learn essential problem-solving and critical thinking skills needed for success both in and out of the classroom. Results of a study using thirty-two fifth grade students, conducted by Zhang et al. (2017) showed that teachers found that students were not always able to locate the relevant information needed to solve the specific problem. When students struggle to find relevant information for solving specific problems, they may lose motivation and engagement, which leads to shallow thinking (Zhang et al., 2017). As a result, one of the key benefits that teachers discovered when implementing PBL was that students critical thinking and problem-solving skills increase; therefore, making sure that they have the proper skills to find relevant information will prevent the possibility of shallow thinking. In addition to fifth-grade learners, PBL also engages special needs learners. In a study on teacher perspectives of implementing PBL, one-hundred pre-service and in-service teachers were given questionnaires and surveys on the benefits of using this method with students with special needs (Hovey & Ferguson, 2014). Hovey and Ferguson (2014) found that PBL is effective for students of all levels and abilities because it engages them in the entire learning process. For example, they have a choice in what and how they learn as well as having a choice in the learning task or project they engage in to solve the specific problem (Hovey & Ferguson, 2014).

When students, especially those with special needs, have a choice in their learning, they are more engaged and often experience more success, which leads to an increased desire to learn. In a quantitative study including 109 elementary and secondary teachers, results showed that teachers perceptions felt that PBL enabled students to apply their knowledge to real-life problems while allowing teachers to take on the role of the facilitator and not simply the educator (Habok & Nagy, 2016). Teachers involved in this study had different experiences with implementing PBL. Through the study, some of the teachers found that they preferred work-based methods, such as PBL, while others preferred a more traditional approach as in individual or demonstrated work (Habok & Nagy, 2016). This study showed that providing a learning environment that is conducive to improving critical thinking skills, such as PBL, brings about more success for both teachers and students (Hovey & Ferguson, 2014; Habok & Nagy, 2016). Results of these studies show that the implementation of PBL in classrooms of all ages and abilities led to more active engagement and success. Through the questionnaires returned from the teachers involved in the study, Habok and Nagy (2016) found that careful planning is essential when implementing PBL, which may result in more time and effort from the teachers in the beginning. While this fact may be a challenge at first, students can get involved in the planning process, taking some of the pressure of planning off the teacher and putting it on the students (Habok & Nagy, 2016). When first implementing PBL, it requires more time and effort by the teachers, but in the end, they found that when including students in the project or problem planning, it teaches them responsibility. Despite the challenges of time and planning, the biggest advantage of PBL is that it has

been developed to cater to the individual needs of differently-abled learners (Habok & Nagy, 2016).

What was still not understood about implementing PBL is the direct impact it has on homeschool students with special needs when used in their daily learning routines. To better understand PBL and its use in the homeschool setting, in this study I explored how the homeschool teacher experiences in the implementation of PBL provides practice in 21st-century skills with their students with special needs. Studies do show that when homeschool teachers implement PBL students develop stronger problem-solving (Netcoh & Bishop, 2017; Zhang et al., 2017), critical thinking (Netcoh & Bishop, 2017; Zhang et al., 2017) and collaboration skills (Eisenman & Kofkewith, 2016). This study expands on current research and further explains the gap.

Social Media and Teachers

Just like with the increased use of social media for personal use, the field of education has seen an increase in the use of various social media sites for instructional use and professional development (Greenhow, Campbell, Galvin, & Askari, 2018). For this study, what homeschool teachers share on social media about their experiences in homeschooling students with special needs was explored in relation to teaching 21st-century skills. Research shows that teachers have turned to a number of social media, sites such as Twitter and Facebook to interact with other educators (Mao, 2014; Reilly, 2017; Trust et al., 2016) and as personal learning networks (PLN) (Trust et al., 2016). Research also shows that teachers have begun using Web 2.0 technologies, like blogs, in order to learn from each other and share ideas (Greenhow & Askari, 2017). Included in

this section of the literature review is a description of homeschool teachers and their use of social media. This section also includes a description of social media as public pedagogy and how teachers use it to reflect, share, connect, and learn.

Homeschool Teachers and Social Media

Connecting with other teachers, both homeschool and classroom, is vital to the success of homeschool teachers, which is why many choose to be actively engaged in various social media platforms. In a qualitative study using four homeschool teachers, Jolly and Matthews (2017) confirmed that blogging was considered a central method of sharing experiences and information online. In this study, findings showed that homeschool teachers use blogging as not only a way to share experiences and information, but also for social interaction with other homeschool teachers with similar interests and experiences (Jolly & Matthews, 2017). Therefore, blogging was found to be motivating for homeschool teachers. Through the interviews conducted during this study, Jolly and Matthews (2017) found that homeschool teachers felt a lot of tension early on in their homeschool career due to insufficient time and resources. The development of Web 2.0 technologies, like blogs, has given homeschool teachers a platform for expressing their tensions, gaining new strategies, and receiving feedback from fellow followers (Jolly & Matthews, 2017). Results from this study also showed that there were thirteen categories of gratification found through the act of blogging for these teachers, they were: "self-expression, entertainment, identity as a parent, social interaction, passing time, information exchange, professional advancement, goals for children, recording life events, maintaining community, intrinsic/extrinsic rewards,

written expression, and need for affection. However, among this particular population of bloggers, the five categories of self-expression, social interaction, information exchange, maintaining community, and recording life events" (Jolly & Matthews, 2017, p. 115). In another qualitative study, in which four homeschool teachers were interviewed, Jolly and Matthews (2018) found that homeschool teachers initially began blogging as a way share resources, activities, and experiences with other homeschool teachers. Results also showed that when reflecting on their blogging the homeschool teachers found that it was also a way for them to keep digital records of pictures, activities, and lesson plans (Jolly & Matthews, 2018). Jolly and Matthews (2017, 2018) also found that homeschool teachers use blogging as a way to reflect and track progress made over time. As do classroom teachers, homeschool teachers begin blogging as a way to connect with others and maintain a sense of community (Jolly & Matthews, 2017; Jolly & Matthews, 2018). Blogging also allows homeschool teachers to focus on the educational goals for them and their students, as well as any successes and challenges they face as both the parent and the teacher (Jolly & Matthews, 2017; Jolly & Matthews, 2018). Bloggers are provided with interactive feedback on their posts and have the freedom to provide feedback on other's posts. This interactive feedback provided on their blog posts is found to be a reason that many homeschool teachers turn to blogging as a way to connect with others (Jolly & Matthews, 2017). Homeschool teachers found the responses to their blog posts motivating and helpful due to the way that blogging allows individuals to connect and interact. Blogs have become important to homeschooling families not only for eliminating feelings of isolation but also for the reviewing and exchange of curriculum

and activities (Jolly & Matthews, 2017). Blogging has shown to give homeschool teachers' feelings of fulfillment through the sharing of experiences and receiving of information from others (Jolly & Matthews, 2017). While Jolly and Matthews focused on homeschool teachers of gifted children, little empirical research has been done on how homeschool teachers of students with other exceptionalities connect with other teachers.

Homeschool teachers have the same social media sites available to them that classroom teachers have. As with classroom teachers, many homeschool teachers are actively involved in Twitter, blogging, Facebook, and others as a way to connect with others, share their experiences and concerns, as well as share and gain ideas. Being actively engaged in social media platforms and Web 2.0 Technologies is a way for teachers to be part of continual personal learning environments. Personal learning environments are important for both homeschool and classroom teachers. In the homeschool environment having a network of other homeschool teachers that one can connect with provides these families with a needed outlet and place to grow. In a literature review, Haworth (2016) found that personal learning environments give, not only individual homeschool families the ability to control and manage their students learning but also homeschool groups the same ability. Along with the hashtags used in blogging, Twitter, Tumblr, Facebook, and other social media platforms allow individuals to follow and connect with others interested in similar topics (Haworth, 2016). Findings from the literature review showed that these platforms also allow teachers to stay up to date on news, trends, and events related to education (Haworth, 2016).

Little research has been done on homeschool teachers and their usage of social media. However, some research has been done on blogging moms in general. Blogs serve as a small group of a larger community, in which readers and bloggers with like interests come together (Petersen, 2014). Petersen (2014) found that with blogging, moms were finally able to find a community of people who have similar interests, concerns, as well as care about the same issues. In the interviews, bloggers stated that connecting through feedback from readers, and in following other bloggers on social media, they were able to develop a close relationship with other moms (Petersen, 2014). Through this study, Petersen (2014) discovered the professionalism that blogging and interacting with other bloggers brought to stay-at-home moms; therefore, allowing them to take on the role of a professional communicator by sharing knowledge and experiences. This type of opportunity to connect with others through commenting individually and in tandem with others helped to eliminate the feelings of isolation (Petersen, 2014). Results from the study showed that blogging helped these moms gain a personal identity through the social interaction, identification, and a sense of achievement of helping others with their writing (Petersen, 2014; Petersen, 2015). In a similar qualitative study, Petersen (2015) states that mommy blogs offer emotional support as well as act as a community in which moms can share experiences and receive validation. Mommy blogs are a place where moms participate with a community of others with like interests and concerns by sharing with their readers the authentic realities of their world by taking away the boundaries of location and age (Petersen, 2015). Another qualitative study on mommy bloggers showed that while previous generations of moms used

interpersonal communication and books to answer questions and stifle anxieties, moms today are more likely to turn to blogging and responding to blogs as a way to seek and offer advice (Steiner & Bronstein, 2017). Steiner and Bronstein (2017) found that blogging offers an emotional release between readers and bloggers through the connection made from feedback. Research shows that blogging has become an important source of connection and support for mothers and helps to eliminate the feelings of isolation (Petersen, 2014; Petersen, 2015; Steiner & Bronstein, 2017). Mom blogging is a way to share everyday experiences and stories from one's personal life (Mäkinen, 2018) but little is known about how homeschool teachers use blogs in reflecting and sharing about their experiences as a mother teacher.

Research shows that parents, both homeschool and non-homeschool, use social media and blogging as a way to connect and share with others of similar interests (Haworth, 2016; Jolly & Matthews, 2017; Jolly & Matthews, 2018; Pettigrew, Archer, & Harrigan, 2016). Although their exploratory qualitative study was not conducted with homeschool teachers, Pettigrew et al. (2016) emailed a survey to 2,234 members of a digital parent group in Australia to discover their motivation behind blogging. Of those 2,234 parents who received the survey of open-ended questions, two-hundred thirty-four responded (Pettigrew et al., 2016). Results from this study showed that the five main reasons that parents blog were: "developing connections with others, experiencing heightened levels of mental stimulation, achieving self-validation, contributing to the welfare of others, and extending skills and abilities" (Pettigrew et al., 2016, p. 1027). Blogging was a way to focus on specific common interests or concerns as well as open

discussions and promoting interaction (Pettigrew et al., 2016). Research shows that individuals turn to social media sites and blogging as a way to connect with others with similar interests (Jolly & Matthews, 2017; Jolly & Matthews, 2018; Pettigrew et al., 2016) and to enhance their psychological wellbeing (Pettigrew et al., 2016). Among each of the studies found on homeschool teachers and parents, it was found that their use of social media or blogs began as a way to make meaningful connections with others (Haworth, 2016; Jolly & Matthews, 2017; Jolly & Matthews, 2018; Pettigrew et al., 2016). Facebook is a popular social media platform that individuals use to connect with family and friends, but it can also be used to connect with others of similar interests and concerns (Kerns, 2016). Kerns (2016) interviewed six homeschool teachers as part of a phenomenological qualitative study and found that they use homeschool Facebook groups as a way to learn about community resources. Homeschool teachers also stated that using social media provides them with not only emotional and social support but also educational supports, such as new pedagogical approaches and curriculum options (Kerns, 2016). These studies found on the use of social media by homeschool teachers provides a small glimpse into the additional opportunities for connecting with others that they provide.

While little research has been done on homeschool teachers experiences with social media, there is evidence these teachers seek opportunities to connect with one another. One way homeschool teachers connect is by seeking out mentors. In a qualitative study, Efford (2016) analyzed data found from one-on-one semi-structured interviews as a way to gain a clearer understanding of the internal discussions of

homeschool teachers. Results from this study showed that many homeschool teachers connect with others through community programs, like co-ops, and by finding mentors. These community programs and mentor relationships provided homeschool teachers and families by providing a sense of community, eliminating feelings of isolation, and finding ways to more effectively meet their needs of students (Efford, 2016). In an anecdotal account, Hulcy (2015) briefly described the importance of the connections between two homeschool teachers through a mentoring relationship. During their mentoring sessions, the two homeschool teachers shared their experiences of homeschooling multiple small children. These discussions showed the newer homeschool teacher that she was not alone, and although it may be overwhelming at times, she has support and helped eliminate feelings of isolation (Hulcy, 2015). And homeschool teachers who are active on social media openly talk about the importance of connecting with other homeschool teachers on their blogs (Anita, 2018; Misty, 2018). Additional connections for homeschool teachers come from joining various support groups either face to face, or virtually.

In a multiple-case study dissertation using ten homeschool teachers and the learning environments used, Sabol (2018) found that when these teachers partnered with co-ops and charter schools, they got the support they needed. Therefore, they felt better prepared to continue to educate their students and did not feel so alone (Sabol, 2018). Homeschool teachers also seek out conference opportunities to connect with other homeschooling teachers. While there are conferences and networks solely for blogging moms, such as Bloggymom network (bloggymoms.com, 2018), and Mom Bloggers Club

(mombloggersclub.com, 2018), there are also networks for blogging homeschool moms, such as iHomeschool Network (mombloggersclub.com), Homeschool Blogging (homeschoolblogging.com, 2018), Secular Homeschool (secularhomeschool.com, 2018), and 2:1 Conference (The 2:1 Conference, 2018). A tool often used by bloggers is called a blog hop, which is an online event, topic-centered where multiple bloggers, post links to their own blog, on a specific topic (Melanie, 2018). Homeschool teachers often use blog hops to share ideas, provide support, and lesson ideas (ihomeschoolnetwork.com, 2018). However, no empirical research has been done to explore the blogging experiences of homeschool teachers, or to take a methodical review of the content they publish related to their teaching experiences and practices and how those help them meet the needs of their homeschool students.

Social Media as Public Pedagogy

Teachers are using social media for more than finding lesson and learning task ideas. Studies show that teachers are using social media and Web 2.0 technologies as another form of professional development or personal learning networks (Reilly, 2017). This type of connecting is also known as public pedagogy (Dennis, 2015). In a study using ethnographic data, Dennis (2015) stated that individuals use blogs as a place to learn from the posts of others and the collaboration that takes place based on their posts. Public pedagogy in regards to bloggers means that there is a reconnect in the educational and political sphere, and both can be located publicly (Biesta, 2014). This type of public pedagogy focuses on resistance to "de-politicized, privatized, and marketized forms of education" and instead create a pedagogy that is built on human togetherness (Dennis,

2015, p. 286). Public pedagogy is a public educative space that allows individuals to collaborate in and through the public (Dennis, 2015). Results from this study showed that success in public domains comes from listening to what is going on and being real, which ultimately leads to the possibility of an alternative future for education (Dennis, 2015). Although many teachers use blogging and Twitter as a way to share and reflect, the opportunities these platforms provide for them to connect with other teachers open doors, they may not otherwise have. As a result, teachers are using these public platforms as a way to reflect, share, and learn (Carpenter et al., 2017).

Reflect. Teachers use social media as public pedagogy for a variety of reasons. The first is that publicly sharing their ideas gave them an opportunity to reflect on their own teaching practices. The importance of reflecting on teaching practice has been well documented in the pre-service (Carpenter, 2015; Reilly, 2017) and in-service (Reilly, 2017; Trust et al., 2016) literature. The globalization and revolution of digital learning influences not only the need for teacher reflection but also how teacher choose to reflect (Benade, 2015). However, the use of social media as a place to do this reflection has not thoroughly been explored. Some research studies do allude to reflection as part of why teachers use social media. In a literature review, Reilly (2017) found that teachers find social media sites, such as Twitter to be supportive and timely while allowing them to engage in self-directed learning and professional development that can happen multiple times throughout each day.

Further, the short posts made in Twitter help teachers to refine their reflective thinking (Reilly, 2017). Research shows that social media expands the professional

learning networks (PLNs) and adds diversity allowing teachers to grow in ways that traditional PLNs do not provide (Carpenter et al., 2017). Twitter is one such social media platform that teachers are using for professional learning and development. Twitter is a microblogging platform that allows users to reflect, share, and ask questions in a short message (Carpenter et al., 2017). Unlike Facebook, it is an "open social network that allows for asymmetrical relationships in which one user follows another but may not be reciprocally followed back" (Carpenter et al., 2017, p. 51).

The use of social media to connect and share requires a certain amount of reflection by teachers so that what is posted or viewed adequately meets their needs. Although reflection takes place for personal and professional growth reasons, not all teachers or school leaders use this method as a way to grow. In a qualitative case study using teachers, principals, and ex-school leaders, Benade (2015) studied the reflective practices of teachers in correlation with their use of 21st-century skills. Findings from this study showed that those taking time to reflect might be doing so more to meet the demands of leaders rather than as a way to grow as a teacher (Benade, 2015). Benade (2015) discovered that the change in pedagogical practices, including the use of digital technologies, appears to be more from changes in policy and practice rather than reflection. The lack of engagement in reflection is because they find it intellectually unsettling and crossing ethical dimensions (Benade, 2015). In a qualitative study, one-hundred sixty educators were surveyed and interviewed to learn about their use of hashtags in Twitter as a method of professional development (Ross, Maninger, LaPrairie, & Sullivan, 2015). Through this study, Ross et al. found that reflection took place

through communication and collaboration with other educators, as well as the feedback obtained through their engagement in social media. Results showed that teachers were shifting their learning and professional growth by seeking alternatives to traditional methods; therefore, leading to the reinforcement of continued collaboration, connection, and reflection (Ross et al., 2015). Time spent reflecting on interactions and posts enhances the learning that takes place from social media.

Reflecting is an essential part of growing as both an individual and a teacher. In a qualitative study, Krutka et al. (2017) found that multiple P-12 teachers stated that the personal learning networks that they were involved in not only supported social growth but helped them to reflect deeply on single questions or columns because they were relevant to issues they were currently facing. The development of an intellectual skill like reflection is a definite cognitive benefit of engaging in social media sites for professional learning because it helps them to see themselves as lifelong learners (Krutka et al., 2017). Through the study, it was found that it is beneficial for teachers to step back from their professional learning engagement in order to reflect on whether or not their professional needs and aims are being met (Krutka et al., 2017). Krutka et al. (2017) discovered that when teachers are purposeful in their activities in professional learning networks, reflect on them, and are intentional in their planning of them, they are more beneficial. Reflecting on their involvement in social media for professional purposes allows them to determine whether or not they are connecting with the right people or too many people; therefore, giving them the option to be mindful and purposeful in their involvement (Trust et al., 2016). "Without encouragement to reflect, it can be easy to

remain unaware of what we do not know or need to better understand" (Krutka et al., 2017, p. 251).

Share and connect. A second reason teachers use social media as public pedagogy is that it provides them with an opportunity to share and connect with teachers around the world. In a review of literature, it was found that Twitter helps teachers and preservice teachers develop their identities as teachers; therefore, improving their practice due to the learning that takes place from one another (Carpenter, 2015; Carpenter et al., 2017; Reilly, 2017). Traditionally, teachers have been limited to communicating and collaborating with those from within the school district in which they work (Carpenter et al., 2017). Social media sites, such as Twitter provide a new platform in which teachers can connect with and learn from one another. Twitter, like other social media sites, provides teachers with immediate feedback as well as asynchronous learning and collaboration. In a review of the literature, Reilly (2017) found that both teachers and preservice teachers collaborate and share their ideas and experiences through social media sites, such as Twitter. Through these types of social media sites teachers are able to communicate and collaborate with others from around the world; therefore, expanding teachers communication and collaboration opportunities (Reilly, 2017). This collaboration allows teachers to share their expertise, develop a sense of community, and be engaged in continuous professional development (Reilly, 2017). Research shows that teachers are finding that Twitter and other social media platforms are helping teachers to grow as professionals as well as build a diverse network of people and resources (Trust et al., 2016).

In a qualitative study, Trust et al. (2016) described social media sites as tools that one can use to connect and communicate with others on topics of interest or concern. In this study, 1,417 educators responded to an online survey regarding professional learning networks. Results from this study showed that unlike traditional professional development days, workshops, or conferences, learning through professional learning networks happens anytime and anywhere with many teachers, not just those within the same school district (Trust et al., 2016). In a mixed methods study, Visser, Evering, and Barrett (2014) explored the use of Twitter by K-12 teachers and found that teachers find it to be not only a valuable tool for professional development but also as another avenue for developing meaningful relationships with other teachers of like interests and experiences. These meaningful relationships help to alleviate the feelings of isolation (Carpenter & Krutka, 2015; Visser et al., 2014). Teachers have stated that Twitter alleviated feelings of isolation because it allows them to connect with others with similar interests that may not otherwise be available (Carpenter & Krutka, 2014; Carpenter & Krutka, 2015). Carpenter and Krutka (2014) also found that the interactions made available with the use of Twitter helped to eliminate the feelings of isolation because teachers are able to connect with colleagues from other districts and regions.

Sharing about their teaching practices publicly allows teachers to make connections with others who may be experiencing the same or similar situations; therefore, benefitting in ways that may not otherwise happen. While there are more traditional methods of professional development, the increased use of social media has provided teachers with a more participatory method of professional development. In a

qualitative study, Twitter usage by high school social studies teachers were explored (Krutka & Carpenter, 2016). Results from this study showed that although Twitter and other social media sites have been found to be useful or beneficial for implementing with students, teachers use Twitter more for professional development use than for class activities (Krutka & Carpenter, 2016). Social studies teachers have discovered that the use of the hashtag, #sschat, along with other social studies terms provided them with experiences that go beyond any they had previously had (Krutka & Carpenter, 2016). Using hashtags allows teachers to find other posts, or others to find their posts when searching for information on a particular topic or theme. The use of hashtags also provides teachers with similar interests and needs the opportunity to share ideas, helpful resources, and a chance to engage in meaningful conversation that they may not get from those with whom they work (Carpenter & Krutka, 2014; Rosenberg, Greenhalgh, Koehler, Hamilton, & Akcaoglu, 2016).

Teachers feel less isolated and more connected to others due to the ability to share their experiences through public forums like blogs and Twitter. Blogging is a way for teachers to connect and collaborate with others from around the world. In blogs, teachers can share ideas and concerns then receive direct and at times, immediate feedback from others. Blogs have become a go-to source for information for many, but for the purpose of this study, the use of blogs by teachers will be explored. A blog can include "writings, images, videos, and other linked media" and can include keywords called tags (Haworth, 2016, p. 361). In researching the use of social media and Web 2.0 technologies, Haworth (2016) found that teachers can use these tags to find blogs that meet their needs or

interests. Results from a qualitative study using homeschool bloggers as the participants showed that these homeschool teacher bloggers found great satisfaction in being able to share their experiences and interact with others (Jolly & Matthews, 2017). Blogging provides homeschool teachers with the social interaction that is often missing when one decides to homeschool due to the fact that face-to-face interaction is often limited (Jolly & Matthews, 2017). Research shows that homeschool teachers often feel they either do not have the time needed to develop and use the resources they have or lack the necessary resources; therefore, blogging gives them a platform in which to share this frustration while also gaining new ideas from their reader's feedback (Jolly & Matthews, 2017). Jolly and Matthews (2017) found that these homeschool teachers found blogging to be motivating.

Learn. The third reason teachers use social media as public pedagogy is that it gives them opportunities to learn. The new opportunities for enhanced professional development that social media sites provide have allowed teachers to learn from and share with many teachers from around the globe, allowing them to gain new perspectives on lessons, topics, teaching methods, and approaches. Twitter and other social media sites provide teachers with a larger pool of colleagues to learn and grow with or from (Carpenter et al., 2017). Through the study of extant data, Carpenter and Krutka (2015) found that Twitter has been used primarily by teachers for professional learning and development. These connections go well beyond the traditional methods of professional learning and development. In a mixed methods study, Carpenter and Krutka (2014) surveyed seven-hundred fifty-five K-16 teachers on how and why they use Twitter as a

means of professional learning. Results from this study showed that the teachers valued the personal nature and immediate responses that allowed questions and concerns to be answered (Carpenter & Krutka, 2014). Findings also showed that gave teachers more opportunities learning through the acquiring and sharing of resources (Carpenter & Krutka, 2014). Professional learning networks, such as Twitter, Facebook, and Pinterest, as well as blogging, has risen to a whole new level through the onset of social media sites. Professional learning networks offer teachers a new platform in which to learn and grow as a professional in regards to their practice and attitude toward teaching and learning (Trust et al., 2016). Active involvement in social media sites by teachers keeps them up to date on current trends in the field of education (Reilly, 2017). With Twitter being a social media site that does not allow for long posts, due to its character limitations for each post, it is a significant source of information and professional development for teachers across the globe (Haworth, 2016; Reilly, 2017).

Results from many studies show that social media is a great platform for informal learning and professional development for individuals around the globe; therefore, more and more are turning to social media for the asynchronous information and connection with others of like interests (Greenhow et al., 2018). Through their literature review, Greenhow et al. found that a variety of social media sites, such as Twitter, Pinterest, and Facebook are reaching, not only across the globe but across professional and personal domains, especially in the field of education. These connections increase the professional development, communication, and collaboration opportunities for teachers (Greenhow et al., 2018). Through their exploration of the literature, Greenhow et al. (2018) found that

the use of social media by teachers helps them to connect their teaching to current events. Results from this study show that teachers value the professional development opportunities that social media provides (Greenhow et al., 2018). About fifty-three percent of the studies Greenhow et al. (2018) explores showed that teachers who used social media for professional development purposes gained more than just disciplinary content from their online learning. Using social media sites for professional learning addresses teachers' emotional needs, "including general encouragement, self-esteem building, meaningful connections to combat isolation, and identity work" (Greenhow et al., 2018, p. 2260). Social media has the potential to transform teachers into connected learners (Ross et al., 2015). The use of social media for professional learning and development provides teachers with the individualization that they need in growing professionally and personally (Greenhow et al., 2018) as well as participate at any time or anyplace; therefore, ensuring that what they are learning is relevant to their needs (Krutka & Carpenter, 2016; Noble, McQuillan, & Littenberg-Tobias, 2016; Visser, Evering, & Barrett, 2014).

Additionally, professional learning networks have been an essential piece of teachers' worlds for several years, and with the development of social media, sites teachers are finding that they open a whole new world of opportunity for professional learning and development. Studies are showing that Twitter has become a professional learning tool that teachers are turning to for answers from and interaction with other teachers (Carpenter, 2015). In a qualitative study with preservice teachers, Carpenter (2015) found that although these preservice teachers experienced several benefits to using

Twitter for professional development, they did not continue to use it due to time restraints. While many of these teachers stopped using Twitter, they stated that they intended to use it again in the future for professional purposes, such as classroom applications (Carpenter, 2015). In a qualitative study, Trust et al. (2016) found that teachers are using social media sites, such as Twitter to cultivate and build their Professional Learning Networks (PLNs) so that they can grow as a teacher. Results from this study showed that through the use of social media sites as PLNs teachers were better able to meet their professional needs through connecting with other teachers with similar experiences (Haworth, 2016; Trust et al., 2016). PLNs offer teachers a professional refuge of sorts; therefore, allowing them the regain their excitement for teaching through the meeting of their pedagogical and emotional needs (Trust et al., 2016). Trust et al. (2016) found that professional learning networks help teachers adapt their personal learning based on the place in which they work, while also providing new opportunities for connecting with other teachers beyond their district. The development of social media sites has opened new doors for professional learning development for teachers.

Teachers use social media as a way to grow professionally. For example, in a qualitative case study, Greenhalgh and Koehler (2017) found that the use of social media is a high- quality form of PD that focuses specifically on participants needs at that moment whether that be related to content or pedagogy. A qualitative study of K-16 teachers who used microblogging services, such as Twitter for professional purposes showed that they found such sites to be more efficient, accessible, and interactive than more traditional forms of professional development (Carpenter & Krutka, 2015). In a

quantitative study on Iranian teachers' familiarity and usage of social media, Rezaei, Tabatab, and Meshkatian (2017) found that social media was viewed positively in regards to using it for continued professional development. Findings showed that social media is the current phenomena not just for personal use, but for professional learning and development by teachers (Rezaei et al., 2017). Like Twitter and other social media sites, blogging allows for immediate feedback and communication with others of similar interests and experiences, giving teachers the motivation and help needed. Although there is evidence of the increased use of social media by teachers in regards to reflecting, sharing, connecting, and learning, it does not come without frustrations or challenges. While social media sites and Web 2.0 technologies are beneficial, research shows that teachers have also found them to be frustrating when other teachers do not see the value in their instructional practice or are unable to use such tools to advance their professional learning and improve their teaching (Greenhow & Askari, 2017). Research also shows that teachers are sometimes resistant to engaging in social media or 21st-century technologies, especially those who are uncomfortable or parents have feelings of inadequacy when it comes to technology (Benade, 2015). Despite these findings, the benefits of using social media for reflecting, connecting, sharing, and learning far outweigh any feelings of frustration or hesitation that teachers may experience.

In summary, while little is known about homeschool teachers' social media practices, or what their publicly shared posts reveal about their homeschool teaching experiences, the literature review on social media revealed a few themes. There were four main themes found in the literature on the experiences of homeschool teachers (a)

feelings of isolation (Petersen, 2014; Petersen, 2015; Steiner & Bronstein, 2017), (b) sharing and connecting (Carpenter et al., 2017; Efford, 2016; Hulcy, 2015), (c) reflecting (Jolly & Matthews, 2017; Jolly & Matthews, 2018; Krutka et al., 2017), and (d) professional and personal development (Greenhow et al., 2018; Haworth, 2016). The literature shows that whether one is a classroom teacher, homeschool teacher, or "mommy blogger" posting experiences publicly on social media has the same benefits for a variety of teachers. Teachers seek a sense of community; therefore, the use of social media platforms allows them to connect with others with whom they have similar interests no matter their geographical location. What has not been explored is the content teachers share on social media, specifically those by homeschool teachers with students with special needs. This study may help increase understanding of how homeschool teachers integrate the teaching of 21st-century skills with their special needs students by examining what they post publicly on social media.

Students With Special Needs

Finding the best strategies, methods, and approaches to use when working with students with special needs can be challenging, especially when it comes to teaching 21st-century skills and homeschooling. The teaching of 21st-century skills with students with special needs is often studied in the classroom setting, but few studies are found in the homeschool classroom. For this study, the 21st-century skills (a) problem-solving and critical thinking, (b) communication and collaboration, and (c) cross-disciplinary knowledge will be explored. Research shows that problem-solving is often taught in the mathematics classroom (Lambert, 2015; Lambert & Sugita, 2016), while communication

and collaboration are taught in multiple subject areas, such as physics and general courses (Duda, 2014; Gothberg et al., 2016; Lambert, 2015; O'Keeffe & Medina, 2016). As an introduction to students with special needs, the following sections include the need for teaching 21st-century skills with students with special needs. This section also includes a description of teachers' experiences, perceptions, and reasons for homeschooling.

Teaching 21st-Century Skills With Students With Special Needs

Students of all ages and abilities need a learning environment that enables them to develop the 21st-century skills necessary for success both in and out of the classroom. Although there are not many studies that show the importance of teaching 21st-century skills to all learners, the following section provides evidence on the needs for developing the appropriate problem-solving and critical thinking skills (Duda, 2014; Lambert & Sugita, 2016), as well as adequate collaboration and communication skills (Duda, 2014; Gothberg et al., 2016; Lambert, 2015; O'Keeffe & Medina, 2016). While all 21st-century skills are important, the focus for this study is on (a) problem solving and critical thinking; (b) communication and collaboration; and (c) cross-disciplinary knowledge.

Students with special needs often struggle with the 21st-century skill problem-solving and critical thinking, but with some support can be successful. In a review of the literature, Lambert and Sugita (2016) found that with consistent implementation of routines that promote the building of problem-solving skills in mathematics classes. Through the literature review, Lambert and Sugita discovered several routines that would help students with special needs. One routine that is beneficial for teachers to use is complex multi-media formats through the multiple forms of presentation because they

encourage students to become engaged in difficult tasks that require deeper levels of thinking (Lambert & Sugita, 2016). Another routine that is helpful for students is giving them a choice in the materials they use to solve problems. This routine allows them to show expression and engagement in ways most beneficial to them (Lambert & Sugita, 2016). Consistent routines are vital to students with special needs because they provide external scaffolding, such as restating word problems and rereading in small chunks, that allow students to complete the learning process effectively (Lambert & Sugita, 2016). Other routines that were found as beneficial are (a) training teachers to provide better support in small group settings to support the development of collaboration and communication, (b) allowing students to practice the strategies they use to share, (c) allowing students to use their notebooks, (d) allowing students to use manipulatives instead of equations, and (e) teachers asking initial and follow-up questions (Lambert & Sugita, 2016). Using a variety of strategies and accommodations will benefit any diverse student population.

Communication and collaboration have been found to be challenging for diverse learners, especially those with special needs. In an ethnographic case study, exploring the various pedagogies used in two special education middle school mathematics classroom, it was found that students learned to make more connections with content and their peers when engaged in a learning environment that focused on collaboration and communication from student-to-student and student-to-teacher (Lambert, 2015). In this case, study teachers worked closely with two students, Ana, and Luis, with a learning disabled (LD) label to improve their communication and collaboration skills. Teachers

encouraged communication and collaboration through discussion-based pedagogy (Lambert, 2015). Students were divided into three groups with varying abilities. Some worked in a small group with the teacher, others worked with the student teacher, while the rest worked independently or without a teacher to solve complex problems (Lambert, 2015). Using a discussion-based pedagogy encouraged an open discussion between students while they worked on the procedural worksheets. When using the discussion-based pedagogy, teachers pushed students to listen and understand their peers and the strategies that each use, but during procedural mathematics, students were simply reminded of what was wanted for the test (Lambert, 2015). During the first semester, there was a balance of both pedagogies used, while during the second semester more a procedural pedagogy was valued (Lambert, 2015). For example, when using the procedural pedagogy, students were given a packet of worksheets and expected to follow along as a group while the teacher controlled the task (Lambert, 2015). The classroom teacher tried to encourage students to make connections between a procedural and conceptual understanding of the mathematics concepts being learned but failed to allow students to work independently or make relevant connections themselves (Lambert, 2015). When Mrs. Marquez was in the classroom, she allowed and encouraged these students to work independently but also freely discuss and work together when needed (Lambert, 2015). As a result, Mrs. Marquez learned that while Ana excelled when using a procedural pedagogy approach, Luis learned better when a conceptual approach was used. As a result, they learned that they were able to effectively problem-solve or communicate even though they had previously been denied opportunities based on their

label (Lambert, 2015). In a review of the literature, O'Keeffe and Medina (2016) discovered that when working with a diverse population of middle school students, the students learned best when provided with a learning environment that promoted active learning and collaboration. Common themes and accommodations that were found in the literature they reviewed: "(a) visual aids, (b) whole group accommodations, (c) modifications, (d) cooperative learning, (e) peer tutoring, (f) instructional scaffolding, (g) social skill instruction, (h) active and applied learning, and (i) alternative assessment" (O'Keeffe & Medina, 2016, p. 75). Providing students with opportunities to engage in collaborative learning encourages the development of the 21st-century learning skill communication and collaboration.

When a learning environment is created that allows students to engage in authentic learning tasks and encourages the development of important 21st-century learning skills, students of all ability levels can excel. Duda (2014), an associate professor of quantum physics, shared his anecdotal experiences of using PBL in an article in the Change: The Magazine of Higher Learning. He felt that students who might have previously been considered low performing were able to engage because they were able to read at their pace and complete tasks in ways that made sense to them; therefore, allowing all students to learn more effectively while building their collaboration and critical thinking skills (Duda, 2014). No special accommodations were made for the lower achieving students, although Duda (2014) found that because they were able to engage in projects and problems based on real-world scenarios they were "tapped in" to what they were learning motivating them to find answers. The project packets developed

provided lecture tutorials with background knowledge and a project that would ”hook” students on abstract concepts they may not otherwise engage in (Duda, 2014). One project from Duda’s (2014) quantum mechanics course was for students to study the puzzling radioactive decay of uranium, while in another course he used the zombie apocalypse as seen in the Walking Dead to get students interested the study and solving of coupled differential equations. Because real-world problems are rarely as clear cut as homework problems, students were given projects that were “ill-defined, open-ended, and required research” that required them to work hard and dig deep to complete (Duda, 2014, p. 44). Although students were able to work independently, the projects encouraged communication and collaboration with their peers to help them solve the problem step-by-step. Effective communication and collaboration is often a challenge for lower achieving students; therefore, providing them with a learning environment in which they can complete tasks at their pace and in ways that they learn best will increase these important 21st-century skills.

The development of essential 21st-century skills is vital for students of all ages and abilities. Hence, it is vital that educators provide opportunities for students to develop these skills and create a learning environment in which they can improve those they have a deficit. In a practitioner journal, Teaching Exceptional Children, Gothberg et al. (2016) discussed the importance of developing the 21st-century skill of communication and collaboration with students with special needs. In the article, the teachers developed a plan for each student, based on interview feedback from teachers gave them that would help them improve the 21st-century skill of communication and

collaboration (Gothberg et al., 2016). Gothberg et al. (2016) found that although one of the two students had high academic skills, he struggled in the 21st-century skill of communication and collaboration. They also discovered that while the second student did not perform as high academically as the other, she too struggled with effectively communicating with her peers (Gothberg et al., 2016). Therefore, for high school students with special needs to successfully transition to life after high school, it is essential to provide them with many opportunities to build the necessary 21st-century skills, such as communication. To help teachers provide students with the accommodations they need to be successful tools such as the Triangulated Gap Analysis Tool were designed to "assist educators, students, and IEP teams to identify and create annual goals that address the gap of skills, including no academic skills, needed to prepare students for post-secondary education, training, employment, and independent living" (Gothberg et al., 2016, p. 345). Tools, such as the Triangulation Gap Analysis Tool also help teachers discover the steps and instructional methods that students need to be successful (Gothberg et al., 2016). Accommodations made for high school students with special needs should include the development of both academic and non-academic skills. For example, Gothberg et al. (2016) stated that providing students with service-learning situations in job exploration courses, part-time jobs, or after school volunteer activities, their students showed improved development in 21st-century skills. Other accommodations made for these two students were the recording of annual goals for each student and the open door policy they had with each student to make sure they were making the necessary steps in improving their communication skills (Gothberg et al.,

2016). These two students were given conversation extenders, conversation exit methods, and encouraged to making eye contact through calm, encouraging interactions with others (Gothberg et al., 2016). Accommodations that help ease students' insecurities while building essential 21st-century learning skills benefits them both academically and non-academically.

Homeschooling Students With Special Needs

The decision to homeschool is not one that is taken lightly. Varying experiences with traditional school settings as well as family situations, leads families to embark on the homeschool journey. Homeschool teachers often feel that they have no choice but to educate their students with special needs. As a result, they have eye-opening experiences and very defined perceptions of their student's educational experiences. The decision to homeschool has shown to be highly beneficial to students with special needs (Cheng et al., 2016; Thomas, 2016). In the following paragraphs, these experiences, perceptions, and reasons for homeschooling students with special needs will be discussed.

Homeschooling is not always an easy task, especially when taking on the responsibility of education a student with special needs. In a qualitative study, Thomas (2016) examined the routines and experiences of homeschool teachers (Thomas, 2016). The results of this study showed that homeschool teachers had very positive experiences throughout their homeschool process (Thomas, 2016). Due to these positive experiences and success of their students from the individualized instruction and immediate teacher feedback, Thomas (2016) found that homeschool teachers were highly motivated to provide a quality education for their student(s). To provide a quality and appropriate

education for their students, homeschool teachers have the responsibility of choosing the best instructional approach and curriculum for their students as well as their daily routines (Thomas, 2017). The results of this qualitative study show that homeschool teachers expressed excitement in being able to plan their academic day around the special needs and interests of their students. Results also showed that these same teachers also experienced the flexibility to incorporate nonacademic learning into each day (Thomas, 2017). The flexibility and freedom that homeschool teachers experience keeps them and their students motivated and engaged (Liberto, 2016; Thomas, 2016, 2017). Although there is a lot of responsibility on parents when homeschooling, research shows both homeschool teachers and students experience excitement and motivation due to the freedom to learn based on their interests while using individualized approaches. In an autoethnographic study, a homeschool teacher explained how her experiences of homeschooling her student with special needs gave her and her student a new outlook or perception of education (Liberto, 2016). Through her study, Liberto (2016), a homeschool teacher and writer, found that student-led, interest-inspired learning promotes learning and emotional well-being resulting in less severe learning difficulties. Traditional learning can often be tiresome, overwhelming, and ineffective resulting in low self-esteem and poor mental health (Liberto, 2016). Therefore, proving that teachers should not use a one-size-fits-all approach to learning, but instead a flexible and student-led learning environment should be provided. Also, Liberto (2016) experienced that through the implementation of authentic and meaningful learning approaches the whole family was able to grow and learn together. This homeschooling teacher's experiences

showed that when using a more flexible, authentic, and individualized learning approach students with special needs felt supported both academically and emotionally (Liberto, 2016). The flexibility and freedom that homeschool teachers experience allow them to create a learning environment in which their student(s) can use and build on their strengths to overcome their challenges while having fun throughout the learning process.

Homeschool teachers' perception is that the decision to homeschool allowed them to provide a more individualized, authentic learning experience for their students, which provide more benefits for those students with special needs (Cheng et al., 2016). Homeschool teachers explained that because they are more familiar with the needs of their student's, they have the flexibility to implement the curriculum and instruction that is most suitable to their student's needs (Cheng et al., 2016). Through interviews and surveys with homeschool teachers, Cheng et al. (2016) learned that the perception of homeschool teachers was that they were better able to serve the academic and social-emotional needs of their student with special needs because the students had the freedom to learn at their own pace. Some homeschool teachers in this study explained that as the teacher, these parents were highly motivated to provide the best education for their student(s) (Cheng et al., 2016). In addition to the amount of time and energy that homeschool teachers invest into their student's education, data show they perceived that by providing one-on-one instruction, increased and immediate teacher feedback, students were more actively engaged in what they were learning (Thomas, 2016). These studies show that the perception of homeschool teachers often changed once success was experienced. Families that choose to homeschool may go into it with fears and

insecurities, but find that the bond that they develop with their student(s) coupled with the success that is experienced makes it worth the time and effort required when choosing to homeschool.

There are a variety of reasons that families choose to homeschool their student(s) with special needs. Some choose to homeschool to make it easier to work around doctors and therapy appointments, while others make the decision based on the mental and emotional health of their student(s). Families have also chosen to homeschool their students with special needs because they felt that the school district they live in was unable or unwilling to effectively educate their student (Neuman & Guterman, 2017). Neuman and Guterman conducted a hermeneutics-phenomenological qualitative study using thirty homeschool teachers in Israel. These homeschool teachers participated in in-depth, semi-structured interviews (Neuman & Guterman, 2017). Interview data show that large class sizes and the lack of opportunity that classroom teachers have to teach to each student's needs, caused parents to feel that it is in their student's best interest to homeschool (Neuman & Guterman, 2017). Some parents with students with special needs have also experienced a lack of desire or willingness by school staff to listen to them concerning the needs of their students (Kendall & Taylor, 2016). In a small-scale qualitative study using interviews, Kendall and Taylor (2016) found that there are a number of homeschool teachers who pulled their students with special needs from the traditional classroom setting due to poor treatment by teachers and other school staff. Not only did the responses from the interviews with homeschool teachers provide detail on their experiences in homeschooling students with special needs, but this study also

discussed a key reason that families choose to homeschool (Kendall & Taylor, 2016). While there are several reasons families decide to homeschool; the most common underlying reason is that they believed that it was the best and most logical option for their family.

With the growing number of students with special needs and the increase of these students being homeschooled, it is vital that homeschool teachers provide them with learning opportunities that promote the development of 21s-century learning skills. Research shows that homeschool teachers believe that they are more familiar with the needs of their student(s); therefore, making it more beneficial for them to homeschool (Cheng et al., 2016). What is still not understood is homeschool teachers experiences in teaching 21st-century skills to their student(s) with special needs. Although more research is still needed, the research so far suggests that students with special needs can and should learn 21st-century skills (Lambert, 2015; Lambert & Sugita, 2016). Literature shows that classroom teachers have had success in working with students with special needs to build the 21st-century skills (a) communication and collaboration (Duda, 2014; Gothberg et al., 2016; Lambert & Sugita, 2016), and (b) problem-solving and critical thinking (Duda, 2014; Lambert & Sugita, 2016), but does not show homeschool teachers experiences in teaching these skills to their students with special needs. To better understand the teaching of 21st-century skills to students with special needs in the homeschool setting, in this study, I explored the experiences of homeschool teachers who teach 21st-century skills to their students with special needs. The empirical research that has been done with homeschool teachers show that they perceive being able to provide

flexible and individualized instruction, their students with special needs experience more success and motivation (Liberto, 2016; Thomas, 2016, 2017) and are more actively engaged (Thomas, 2016). However, what is missing from the literature is how homeschool teachers are integrating 21st-century skills into their homeschooling of students with special needs. To better understand the experiences of homeschool teachers homeschooling students with special needs, in this study, I explored how homeschool teachers' experiences reflect 21st-century skills in their students with special needs.

Summary and Conclusions

In summary, this chapter included a review of research related to the use of PBL by homeschool teachers with students with special needs as well as their professional use of social media. An overview of PBL at the beginning of the chapter shows that PBL is not a new idea in the field of education, whether in homeschool or traditional classrooms. The literature showed that PBL has been referred to using a variety of other terms, such as experiential learning (Haines, 2016; Scogin et al., 2017), active learning (Leo & Puzio, 2016; Mueller et al., 2015; Siew & Mapeala, 2017), or constructivism (Lee & Hannafin, 2016; Toppel, 2015). Research on the use of PBL in homeschool classrooms shows that homeschool teachers often use terms such as STEM (Gann & Carpenter, 2018), individualized or student-directed instruction (Efford & Becker, 2017; Thomas, 2016), real-world learning applications (Liberto, 2016), and literature-based instruction (Gann & Carpenter, 2018; Thomas, 2017) instead of PBL. Social media is often used by teachers both for instructional use and professional development because it helps to reduce

feelings of isolation (Greenhow et al., 2018). To organize current research about the social media posts of homeschool teachers using PBL with their students with special needs, Kereluik et al.'s 21st century learning model provided a framework for a detailed literature review. Specific topics addressed in this literature review include (a) history of PBL, (b) the definition of PBL in relation to this study, (c) PBL and 21st century learning, (d) PBL in homeschool, (e) teacher experiences implementing PBL with students with special needs, (f) social media and homeschool teachers, (g) social media as public pedagogy, (h) teaching 21st-century skills to students with special needs, and (i) homeschooling students with special needs.

Through this literature review, several themes and gaps emerged. First, in a review of current literature related to Kereluik et al.'s (2013) version of the 21st century learning model, which is broken up into three broad categories and six subcategories yielded themes that helped to define PBL. Most of the research done was based on the subcategories of (a) communication and collaboration; (b) problem-solving and critical thinking; and (c) cross-disciplinary knowledge. The teaching of the 21st-century skills (a) communication and collaboration; (b) problem-solving and critical thinking; and (c) cross-disciplinary knowledge is discussed in several studies in regards to public school settings, but little research has been done on teaching these skills in the homeschool classroom to students with special needs. For example, literature shows that classroom teachers have had success in working with students with special needs in building (a) communication and collaboration (Duda, 2014; Gothberg et al., 2016; Lambert & Sugita, 2016) and (b) problem-solving and critical thinking (Duda, 2014; Lambert & Sugita,

2016), but does not show homeschool teachers experiences in teaching these skills to their students with special needs. Therefore, this study was important as it increased understanding regarding a population of teachers and students that had not previously been explored.

Second, the implementation of PBL brings about more opportunities for developing 21st-century learning skills in students. For example, PBL promotes communication and collaboration among students through the sharing of their findings when seeking answers to their questions, along with critical thinking and problem-solving when working through real-world problems (Morrison et al., 2015). When implementing PBL, multiple subjects can be integrated into learning tasks, thereby pulling in the 21st-century learning skill of cross-disciplinary knowledge of Kereluik et al. that is focused on in this study. What is still not understood from the current literature is the impact that implementing PBL has on homeschool students with special needs; therefore, to add understanding to this gap, I explored what homeschool teachers share on social media about their experiences when implementing PBL with students with special needs. This study expands on the current research that shows when implementing PBL homeschool students develop stronger problem-solving (Netcoh & Bishop, 2017; Zhang et al., 2017), critical thinking (Netcoh & Bishop, 2017; Zhang et al., 2017) and collaboration skills (Eisenman & Kofkewith, 2016), which are important 21st-century skills. Since so little empirical research has been done related to homeschool teachers' use of PBL, this study helps fill an important gap in the literature.

Third, the studies found from in the last five years was much higher on teachers implementing PBL with students than on teachers implementing PBL with students with special needs. Although PBL is not new to the field of education, little research is found on how PBL is implemented with students with special needs and even less regarding homeschool teachers' experiences implementing this approach with these students. According to research implementing PBL allows students to be on a more even playing field narrowing the learning gap between students who typically struggle and those who do not (Duda, 2014). While research shows the benefits of implementing PBL, little is still known about the experiences of homeschool teachers and students with this learning approach.

Finally, the literature review revealed information on how the use of social media by teachers impacted them both professionally and personally. Feelings of isolation were eliminated through the connections made and feedback provided when involved in posting on social media (Petersen, 2014, 2015; Steiner & Bronstein, 2017). Social media is also being used as personal learning networks and for professional development (Trust et al., 2016). Due to the connections made on Twitter, Facebook, blogging, and other social media platforms teachers have more ways of sharing concerns, ideas, and experiences (Greenhow & Askari, 2017). Current research also shows that through social social media and blog posts homeschool teachers are able to eliminate feelings of isolation (Petersen, 2014, 2015; Steiner & Bronstein, 2017) due to the sharing and connecting with others with similar interests (Carpenter et al., 2017; Efford, 2016; Hulcy, 2015). Research also shows that engaging in social media sites and blogging causes

teachers to spend more time reflecting (Jolly & Matthews, 2017, 2018; Krutka et al., 2017) and gain more opportunities for professional and personal development (Greenhow et al., 2018; Haworth, 2016). While some research has explored teachers' reasons for blogging (Carpenter et al., 2017), little research uses publicly shared blogs and social media posts as a way to examine teacher practices and experiences. Therefore, this study adds more understanding to the practices and experiences shared through social media and blog posts by homeschool teachers with students with special needs.

In this chapter, a description of the literature search strategy was given, the conceptual framework was discussed, and a detailed literature review of the use of social media by homeschool teachers with students with special needs was provided. In Chapter 3, the research methodology for this study is discussed. An explanation of the research design, rationale, and the role of the researcher is provided. Issues of trustworthiness in relation to credibility, transferability, dependability, and confirmability are also discussed along with a description of ethical procedures.

Chapter 3: Research Method

Introduction

The purpose of this qualitative study was to explore the PBL experiences of homeschool teachers who work with students with special needs and how PBL experiences reflect 21st-century competencies as shared in their blog posts. To do this, publicly available archival data from blog posts of homeschool teachers with students with special needs were examined using content analysis. In Chapter 3, I discuss the research method that was selected for this study. In this chapter, I also discuss the research design, research rationale, and the role of the researcher. I describe the methodology as it relates to participants and instrumentation as well as data collection and data analysis plans. The chapter concludes with a discussion of issues of trustworthiness and ethical considerations related to this qualitative study.

Research Design and Rationale

In this section, I present the research questions for this qualitative study, describe the central phenomenon of the study, and provide a rationale for the chosen methodology. The central and related research questions align with the conceptual framework and literature review of the study.

Central Research Question

How do the experiences of homeschool teachers implementing PBL with students with special needs reflect 21st-century skills?

Related Research Questions

1. How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skill of communication and collaboration?
2. How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skill of problem-solving and critical thinking?
3. How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skill of cross-disciplinary knowledge?

Rationale for Research Design

The research design selected for this study was a content analysis. Mayring (2016) described content analysis as a research approach in which researchers summarize, code, and compare information from other texts and media. In this study, I used deductive-dominant content analysis because I used a deductive mode during the content analysis process (Armat et al., 2018). The deductive-dominant approach is used by researchers when previous findings or theories of a phenomenon being studied exist, which I did by using preexisting categories for research findings (Armat et al., 2018). Therefore, this methodological approach was appropriate for this study due to the use of archival data from homeschool teachers' blog posts and blogs. Certain words and content from the selected blog posts that related to my conceptual framework were identified. Salmons (2016) stated that data, both written and pictures, gathered from archived blog

posts is called extant data. Blog posts were the prime source of data for this study. Salmons (2016) stated that both written information and pictures from blog posts are considered archival, or extant data, making it appropriate for use in content analysis research. In qualitative content analysis research, data are collected from documents, articles, and other texts (Cho & Lee, 2014). In content analysis research, data are coded, and the meaning of information found is described (Cho & Lee, 2014). Use of qualitative content analysis yields a set of priority categories that cover the data instead of a new theory developed by identifying the relations among codes. Therefore, using a content analysis approach was a relevant design for this study because it allowed for the exploration of archival public data that allowed me to see what homeschool teachers are sharing via blogs and whether these experiences aligned with teaching 21st-century skills.

Consideration of Other Designs

Several other designs were considered for this study, including case study, phenomenology, and grounded theory. A case study is defined as the in-depth investigation of a current real-world phenomenon (Yin, 2014). Case study designs analyze data by describing the case and the themes found in the case (Creswell, 2013). While case studies produce abundant data from real situations and people, the purpose of this study was not to examine the experiences of one homeschool teacher or family but rather the posts of several, making this design inappropriate.

I also considered phenomenology. Phenomenology is a qualitative research method that looks at the lived experiences of individuals based on a particular concept or phenomenon (Creswell, 2013). The purpose of this study was to examine the PBL

teaching experiences of homeschool teachers who have students with special needs according to what they share on their blog posts. Rather than interviews, archival data were the sole data source chosen because in content analysis research preexisting public documents are used as the main data source. Therefore, a phenomenology design would not fit with my study because the study would not solely focus on gaining a deeper understanding of one phenomenon (Creswell, 2013).

I also considered a grounded theory design as a research design for this qualitative study. Grounded theory designs develop an extensive theory that explains a particular phenomenon (Cho & Lee, 2014). Creswell (2013) defined the grounded theory design as the discovery of a theory for a particular process or action. Based on this definition, this was not a suitable research design approach because the purpose of the study was not to develop a theory about the use of PBL with homeschool students with special needs. Instead, the purpose of this study was to explore the PBL experiences of homeschool teachers who work with students with special needs as they share on their blogs about how these PBL experiences reflect 21st-century competencies.

Role of the Researcher

As the single researcher for this study, there was the potential risk of bias in regard to data collection and analysis; therefore, I used specific strategies to improve the trustworthiness of this study, which are discussed later in this chapter. Although I am a homeschool teacher, my role as the researcher did not conflict with this study because I used the blog posts of other homeschool teachers, specifically those I do not know personally. To manage and minimize bias throughout the data collection and analysis

process, I looked at posts from an outsiders' perspective. Throughout this process, it was also important that I keep memos. Keeping memos throughout the data analysis process helped the study to maintain credibility because it gave proof to others that I was thorough and honest. Patton (2014) stated that it is vital to remain unbiased and subjective in research; therefore, I needed to provide a degree of similarity between my study and others. As the single researcher, it was important that I linked the results and interpretations to other findings to help establish the fact that information was not made up and biased (Patton, 2014).

Methodology

The methodology section provides details about how the research was conducted for this study. In this methodology section, I share information about inclusion criteria for data and the instruments used to collect data through archived online blog posts. This section also includes the procedures for selecting posts and collecting data.

Participant Selection Logic

In this content analysis study, participation selection logic referred to how the data were selected and how much data was prepared for analysis. Sampling is the process a researcher uses to determine who or what will serve the purpose of the study (Salmons, 2016). For this study, I reviewed and analyzed blog posts of homeschool teachers who have students with special needs and implement elements of PBL. Salmons (2016) stated that in purposeful sampling, which is often used by qualitative researchers, there are two types of purposes the chosen sample should satisfy, empirical and theoretical. Empirical purposes are used to find the data needed to answer a study's

research questions (Salmons, 2016). The sampling strategy for this study was an empirical purpose based on blog posts that met specific criteria that have been made in open and accessible online environments. According to Salmons (2016), these environments are known as public online environments. This strategy was justified because blog posts of homeschool teachers with students with special needs are from these types of online environments. Inclusion criteria for the blogs in this content analysis study first include how a blog was identified as meeting certain criteria to be included for data analysis. For blog sites to meet the inclusion criteria for this study, they had to (a) be written by a homeschool teacher, (b) identify that a student with special needs was being homeschooled, and (c) have a minimum of three posts that referenced teaching and learning that aligned with the fundamentals of PBL made at the beginning, middle, and end of the school year. To accomplish this, I systematically entered various search terms on the blog site to determine if the blog included posts that were related to PBL, homeschool, and special needs. A list of the search terms I used to identify whether a blog was considered for inclusion in this study is listed in Table 3. Once a blog was confirmed to be a homeschool teacher blog and that the teacher instructed a student with special needs, I searched to find posts related to PBL experiences using the search terms in Table 3. A blog must have had a minimum of three posts made at different points throughout the school year related to PBL experiences to be included in the study, but it may have had more. Once I confirmed a blog site met all three criteria, it was considered for inclusion in the study.

Table 3

Search Terms Used for Blog Inclusion Criteria

Inclusion criteria	Search terms
Homeschool	home education, homeschooling, homeschool
Special needs	special education, special needs, learning disability, dyslexia, autistic, reading difficulty
Problem-based learning	active learning, experiential learning, hands-on learning, inquiry-based learning, literature-based learning, project-based learning, STEM, student-directed learning, real-world learning, PBL and special needs, unit studies, problem solving,

In relation to saturation and sample size for this study, 20 blogs of homeschool teachers with students with special needs were read, collected, and analyzed unless more are needed to reach saturation. According to Patton (2014), there are no set rules for minimum sample size in qualitative research. Instead the number of data needed to analyze is determined by (a) what the researcher wants to know, (b) the purpose of the study, (c) what is at stake, (d) what information will be useful, (e) credibility, and (f) what can be done with the allotted time and resources. When a researcher reaches the point where "new" data does not add to what has been gathered already or is counter-productive, saturation has been reached (Saunders et al., 2018). Therefore, saturation of the data was determined to have occurred when the same themes keep reoccurring, and when data is no longer adding to the study (Saunders et al., 2018).

Instrumentation

For this content analysis study, I collected archival data from homeschool teachers with students with special needs blogs. To help keep data organized during the data collection phase, I developed a blog data collection instrument (see Appendix). This data collection instrument is aligned with the research questions, and conceptual framework and experts in education reviewed these instruments to ensure that they align. The archived data collection form was used to collect archival data from the blog posts of homeschool teachers with students with special needs. In that form I collected the (a) blog site title, (b) blog URL, (c) blog post URL, (d) blog site code, (e) blog author code, (f) URLs showing it met the inclusion criteria, (g) URL showing the blog site met at least three PBL fundamentals, (h) date of posts related to PBL, (i) teaching philosophy, and (j) religious affiliation.

I also developed a Blog Data Analysis Instrument to use during the analysis phase. In this form the blog post and author were noted as well as the selected blog post, tweets, and replies. Gathering information from the data collection and analysis instruments helped me to answer my research questions in a several ways. First, these instruments allowed me to see the number of homeschool teachers with students with special needs who post about their experiences implementing PBL. Second, these tools helped me determine which 21st-century skill was focused on in each post. Finally, the data collection and analysis instruments showed what information, aligned to my research questions is being shared by these teachers through their blogs.

Procedures for Recruitment, Participation, and Data Collection

The following sections include an explanation of the blog post selection process and how data were collected.

Recruitment and participation. I did not recruit homeschool teachers or ask them to participate in my study. Data collected for this study was based solely on what teachers have publicly published and what was available for reading in any browser. In regards to participation, see the data collection section below for a detailed description of how blogs were purposefully selected to be included as part of the study.

Data collection. Collection of online archival data included a number of steps. The first step in data collection was to identify blogs of homeschool teachers who instruct students with special needs. Thereby, for blog sites to be used as data, they had to (a) be written by a homeschool teacher and (b) identify that a student with special needs is being homeschooled. A list of search terms was used on each blog site to determine if the blog included posts by homeschool teachers with students with special needs. See Table 3. The second step was to determine whether there were blog posts that fit the third inclusion criteria, which was that the blog site must have a minimum of three posts related to PBL. Once I confirmed that a blog was written by a homeschool teacher with a student with special needs, the blog site was then searched again for posts related to PBL experiences using the various search terms, listed in Table 3. Once a blog site was found to meet all three criteria, it was considered for inclusion in this study. It was not required that the specific blog posts discussing PBL address issues related specifically to their student with special needs.

I kept a cumulative list of blog sites that met all three inclusion criteria, along with how many blog posts each site has that refer to PBL experiences. Once 20 blogs were identified to have met all the criteria, I reviewed the number of PBL posts each site had posted. Blog sites with more PBL posts were given preference for inclusion. Blog sites that have posts spread over various times in the school year were also given preference for inclusion. For example, a homeschool teacher who blogs about PBL experiences during Fall, Winter, and Spring, over several years, was chosen to be included over a blog that had several PBL posts only in the fall of one year. I moved through the cumulative list of blog sites and repeated the steps of identifying sites as needed until I had 50 blog posts about PBL. If 50 posts had not been identified, I would have searched for more blogs that fit the study's inclusion criteria. If still 50 posts had not been found, I would have assumed that I reached saturation related to the content provided by homeschool teachers and would have proceeded with the posts I had.

Once I had 50 blog posts that met all three inclusion criteria, I prepared the data for analysis by copying and pasting each of the blog posts into a Word document. If the blog post elicited comments by outside readers and replies from the author, these were copied and pasted into the Word document and identified as such.

In addition to identifying blog posts, for each homeschool teacher blog included in the study, I identified any microblogging accounts (such as Twitter) that the teacher might use in conjunction with the blog. I searched the homeschool teacher's site to find Tweets the teacher may have made in association with the blog posts included in data analysis. I kept a cumulative list of these microblogging accounts in another Word

document. To prepare these for data analysis, I copied and pasted the initial and reply Tweets into the same Word document as the selected blog posts. Once the data post file was complete, an additional copy of the file was made so that I could code the data multiple times for easy access when checking for intracoder reliability. In intracoder reliability, the sole researcher codes in a consistent manner; whereas with intercoder reliability, two researchers code material independently (Given, 2008). Because I am the sole researcher for this study, I used intracoder reliability. For codes to have a score showing satisfactory agreement, a Kappa score that falls between 0.4 to 0.6 is preferred (MacPhail, Khoza, Able, & Ranganathan, 2016). I used these scores to aid the improvement of my intrarater reliability.

Data Analysis Plan

Data analysis of the archival blog posts included two levels of coding. According to Miles and Huberman (1994), codes are the tags or labels given to units of data. To ensure that these labels are meaningful, they are assigned to chunks of data connected to a specific context (Miles & Huberman, 1994). These tags or labels are the initial step in the data analysis process (DeCuir-Gunby, Marshall, & McCulloch, 2011). Coding is the process between data collection and analysis (Saldana, 2009). A code is a word or phrase found in the data and is a problem-solving technique that researchers link data into categories (Saldana, 2009). Ryan and Bernard (2003) explained that a researcher could develop a priori codes in three ways (a) theory-driven, (b) data-driven, or (c) structural. When codes are developed from existing theory or concepts, they are theory-driven (Ryan & Bernard, 2003). Data-driven a priori codes emerge from the raw data of a study,

while structural codes are grown from the study's research questions (Ryan & Bernard, 2003). Code development is an iterative process; therefore, this study required a repeated examination of raw data from homeschool teachers' blog posts (DeCuir-Gunby et al., 2011).

The first level of coding was done using a priori codes aligned to the conceptual framework. The conceptual proposition for my research originates in Kereluik et al.'s (2013) 21st-century learning framework. In this framework, there are three broad categories (a) foundational knowledge (to know), (b) meta-knowledge (to act), and (c) humanistic knowledge (to value) (Kereluik et al., 2013). Kereluik et al.'s framework is further broken down and include subcategories. The subcategories used in this study were (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge. For the first level of coding, I coded the archival data collected from the selected blog posts from homeschool teachers with students with special needs. As recommended for qualitative studies by Charmaz (2011), I conducted line-by-line coding for all the prepared data using a priori codes predetermined based on Kereluik et al.'s (2013) 21st-century learning theory as from the literature. See Table 4. Notes were also kept in the side margin showing my reflections of the research. The frequency in which each a priori code was used was noted in my reflections and was used to help me answer my research questions. Codes and text examples were copied and pasted into a codebook. According to Krippendorff (2013), these analyzing processes are vital to the coding process when using a content analysis methodological design. Table 4 shows the a priori codes for the first level of coding for this study.

Table 4

A Priori Codes Used for Data Analysis

21st-century skills	A priori codes	Based on literature
Communication & collaboration	Sharing	Carpenter (2015), Carpenter & Krutka (2015), Carpenter et al. (2017), Efford (2016), Hulcy (2015), Krutka & Carpenter (2016), O'Keeffe & Medina (2016), Reilly (2017), Trust et al. (2016), and Visser et al. (2014)
	Connecting	Carpenter et al. (2017), Efford (2016), Hulcy (2015)
Problem-solving & critical thinking	Reflection	Aizikovitsh-Udi and Cheng (2015), Chua et al., (2016), Pandiangan et al., (2017).
	Real problems to solve	Duda (2014), Hill (2014), Larmer et al., (2015a), Lopes, et al., (2017).
	Encourage multiple solutions	Duda (2014)
	Creating inquiry environments and supports	Lopes et al. (2017), Siew and Mapeala (2017)
Cross-disciplinary knowledge	Cross-discipline content	Crist et al. (2017), Habok & Nagy (2016), Hill (2014), Hsu & Lee (2015), O'Keeffe & Medina (2016), and Zhang, Wong, Chan, & Chiu (2014)

After completing round one of level one coding, I took a two-week break from coding data before going back through the data for another round of coding, since returning to the data, again and again, helped me to keep my interpretations true and corroborated (Pyett, 2003). Returning to the data after taking a two-week break helped me to view the data with "fresh" eyes to see if I needed to revise any of the level one codes or add any others. After this two-week break, the same blog posts were recoded to check for intracoder reliability (Burla et al., 2008; Given, 2008; Merriam & Tisdall, 2016). Recoding of data allows for the combining of, adding, or deleting of codes based on the rearranging and reclassifying of data (Saldana, 2009). Once I completed both rounds of level one coding, I compared and reconciled the differences by checking the representativeness of the data (Thomas & Magilvy, 2011) found by double coding (Elo et al., 2014). Double coding, or conducting two rounds of coding, allowed me to assess the quality of the matrix organization (Elo et al., 2014). When extra text segments were coded, or text segments were coded differently in the two rounds of coding, these text segments were reconciled by putting data side-by-side to determine which codes needed to be removed or combined. According to Schreier (2012), if my code definitions are clear, and there is no overlap, the two rounds of coding should produce the same results.

It was important that throughout this process that I, as the sole researcher, made sure that the data accurately represented the information from the homeschool teachers' blogs (Polit & Beck, 2012), while also being careful not to over-interpret the data (Elo & Kyngäs, 2008).

In the second level of coding, I analyzed the archival data transcripts based on

Merriam and Tisdall's (2016) recommendation to constantly compare similarities and differences among the level one codes and therefore, created the best categories of codes from the blog posts that were grouped together in level one coding. Merriam and Tisdall (2016) refer to this coding process as axial coding. Axial coding of the archival data included making notes of reflection in the sidebar as I read through the data, which helped me keep track of themes and meanings found across the data based on the a priori codes formed before this step in the analysis process (Merriam & Tisdall, 2016). Throughout this process, I continued to update the codebook (DeCuir-Gunby et al., 2011). Text segments from blog posts chosen during a priori coding were grouped together by the 21st-century skill they reflect so that they were ready for the second level of coding. This separation in the second level of coding allowed for recurring patterns and themes to be determined (Saldana, 2009). Recurring themes or patterns found during level two coding were then reviewed and analyzed. The literature review for this study was referred to for help interpreting the findings of this study. Two rounds of coding allowed me to assess the quality of the matrix organization (Elo et al., 2014). According to Schreier (2012) if my code definitions are clear and there is no overlap, the two rounds of coding should produce the same results.

Issues of Trustworthiness

Providing evidence of trustworthiness for qualitative research is important because the goal of the researcher is to increase the reader's understanding of a specific phenomenon. Patton (2014) explained that "credibility is an analog to internal validity, transferability is an analog to external validity, dependability is an analog to reliability,

and confirmability is an analog to subjectivity" (p. 684). Therefore, if a researcher does not take the proper actions to establish trustworthiness in a study, then the credibility of the study will be a problem (Patton, 2014). For a viable study to be produced, the researcher must consider the credibility, transferability, dependability, and confirmability. In content analysis research, written materials are analyzed and put into categories that have similar meanings and represent both explicit and inferred communication (Cho & Lee, 2014). Cho and Lee (2014) explained that content analysis research is used to examine many kinds of communication materials; therefore, researchers are often engaged in data collection without making direct contact with the person whose writings are being examined. In the following sections, the plan for increasing the trustworthiness of this study concerning credibility, transferability, dependability, and confirmability is described.

Credibility

Credibility deals with the focus of the research and refers to the confidence in how well the data address the intended focus (Polit & Beck, 2012). Thus, the researcher should put a lot of thought into how to collect the most suitable data for content analysis. The strategy to ensure the trustworthiness of content analysis starts by choosing the best data collection method to answer the research questions of interest. According to Cho and Lee (2014), credibility is the truth value of a study. To increase the credibility of a study, the data triangulation strategy (Cho & Lee, 2014) and intracoder reliability (Given, 2008) coding can be used. The goal of intracoder reliability is to produce codes that allow the researcher to develop accurate and credible themes and theories; therefore,

providing accurate material to analyze (Given, 2008). During intracoder reliability, the coder will refine the codes based on the frequency in which they are found in the data by either combining codes to create a new code or simply eliminating the code (Given, 2008). This process is done through multiple readings of the data to ensure credibility.

Merriam and Tisdall (2016) define credibility as the agreement between the findings of the study and reality. Credible qualitative studies produce findings that are clear and coherent (Miles, Huberman, & Saldana, 2014). Therefore, the following strategies are recommended to researchers to improve the credibility of their study: (a) data triangulation from multiple sources, (b) member checks, (c) saturation in data collection, (d) a search for discrepancies in data, and (e) peer review (Merriam & Tisdall, 2016), of which, a number was implemented in this study. I ensured the credibility of this study in a number of ways. Triangulation takes place through observation and the review of documents to minimize researcher bias (Cho & Lee, 2014). I used data triangulation to improve the credibility of this study by selecting blogs that met the inclusion criteria. The selected homeschool teachers who blog more often based on the inclusion criteria were given preference. Saturation of data indicates that no further data collection or analysis is necessary (Saunders et al., 2018). According to Saunders et al. (2018) in deductive research, saturation refers to the "extent to which pre-determined codes or themes are adequately represented in the data" (p. 1898). Therefore, my data selection criteria helped to ensure saturation of the data as well as the number of blog posts included in the study.

I also used intracoder reliability to further ensure credibility by taking a two-week break between the reading and analyzing of data as a way to look more purposefully through the data for any variations (Burla et al., 2008; Merriam & Tisdall, 2016). Darawsheh (2014) found that reflexivity helps to ensure the credibility of a study because it improves the transparency of the researcher's role. The credibility of the study was further improved through keeping my biases, dispositions, and assumptions of the phenomenon being studied in check. Finally, I used the strategy of reflexivity by making notes in the side margins of the Word document containing the selected blog posts of homeschool teachers with students with special needs. These notes helped to eliminate and prevent any biases, dispositions, and assumptions that were acknowledged as data were coded and interpreted. This strategy helped me to remain reflective so that I was able to keep my biases, dispositions, and assumptions in check throughout my research (Darawsheh, 2014; Guillemin & Gillam, 2004).

Transferability

The transferability of a study is its applicability to the field (Cho & Lee, 2014). Cho and Lee (2014) explained that to facilitate the transferability of a study, the researcher provides background and a detailed description of the phenomenon being studied. Transferability can be further defined as the way that the findings of one study can be easily applied to another (Merriam & Tisdall, 2016). To enhance the transferability of a study, Merriam and Tisdall (2016) explained that researchers should provide rich, thick descriptions of the setting, participants, and results of a study so that readers can more easily relate its applicability to other situations. Diversity of sample

size will also help to increase transferability of the study's findings (Miles et al., 2014); therefore, it was essential that I provide a detailed description of the blog posts used in this study.

Blog posts were the content of the data for this study and the findings so that readers may apply the results to other situations. To ensure transferability in this study, I provided text segment samples of the blog posts published by homeschool teachers with students with special needs. A description of the blog authors or at least a description of what they publicly share about themselves was provided to help provide transferability of the data. Paraphrased quotes from blog posts were also used to help provide transferability. To further increase the transferability of this study, I reported the sampling limitations. I also used variation in my sampling by choosing different blog authors but whose blogs still met the inclusion criteria.

Dependability

The reliability, or dependability, of a study, is its consistency and is used to evaluate its trustworthiness (Cho & Lee, 2014; Merriam & Tisdall, 2016). Ravitch and Carl (2016) stated that dependability in a study means that the researcher has a solid argument for the way the data is being collected and the data is consistent with that argument; therefore, making the data dependable because they answer the research questions. To ensure dependability in this study, I made sure the data adequately answered my research questions (Ravitch & Carl, 2016). Merriam and Tisdall (2016) explained that the dependability of a study is stronger when data collection methods are consistent for all participants and therefore, strengthen the study results. To help ensure

dependability in a study, Merriam and Tisdall (2016) recommended that researchers use strategies, such (a) triangulation, (b) peer review, (c) researcher reflexivity, and (d) an audit trail. To ensure the dependability of this study, I used intracoder reliability by reading the blogs multiple times with a two-week break in between the first and second reading. Through this process, I was able to determine better what coding procedures to use as well as identify common themes. I spent time reflecting on findings during the data collection and analysis process to dissipate any biases or assumptions of the sharing of homeschool teachers' experiences through blog posts. I also used data triangulation by comparing multiple blog posts of homeschool teachers with students with special needs (Ravitch & Carl, 2016).

As a way to further ensure dependability, I used researcher reflexivity by keeping notes in the sidebar of the Word documents in which the selected blog posts were kept. These notes helped me to explore further my beliefs, assumptions, and biases about the experiences that homeschool teachers with students with special needs are sharing in their blogs. To further add to the dependability of this study, I kept an audit trail, which included reflections, questions, and decisions made throughout the study. In qualitative research, dependability can be "enhanced via an audit trail that includes all records, notes on methodology, and documents produced and corrected during the research procedure" (Cho & Lee, 2014, p. 15). To develop a study that has dependability, it is vital that each document is saved, logical, and traceable (Patton, 2014). The appendices include the data collection instrument.

Confirmability

When providing confirmability of a study, the researchers clarify their stance on the investigation of the phenomenon so that readers can gain a better understanding of the interpreted results of the data (Merriam & Tisdall, 2016). Confirmability for this study was provided through a researchers' reflective journal that was used to reflect on any questions or concerns that arose during data collection and analysis. Reflexivity is the critical reflection of the way that a researcher develops knowledge from their research process (Guillemin & Gillam, 2004). Self-reflection, or reflexivity, in research causes the researcher to be more in tune with their actions, feelings, and perceptions throughout the study (Anderson, 2008; Hughes, 2014), as well as how their research may affect participants and how they as the researcher may respond in various situations (Guillemin & Gillam, 2004). According to Darawsheh (2014), there are several main outcomes of reflexivity in qualitative research: (a) the researcher keeps the study aligned to the research question, (b) the methodological stance, in regards to data analysis and interpretation remained clear, (c) credible data is produced, and (d) reflexivity allows the researcher to take full advantage of their subjectivity and, as a result, produce an in-depth examination and analysis of the data collected. Reflexivity not only helps in conducting rigorous research but also helps the researcher remain ethical in their research (Guillemin & Gillam, 2004).

According to Miles et al. (2014), there are three different strategies to use as a way to enhance the confirmability of a study: (a) provide a clear, detailed description of the methods and procedures used in the study, (b) show how conclusions and data align,

and (c) document how you as the researcher examined and addressed assumptions, values, and biases throughout the study. To ensure confirmability for this study, it was imperative that careful documentation was kept of the data collection and analysis strategies as well as reporting the findings from the study in a way that is clear to all readers. Therefore, to provide confirmability of this study, I provided comments in the Word documents containing the selected blog posts as a way to reflect on my biases throughout the data collection and analysis process. Intracoder reliability was also used to help ensure credibility with a two-week break between each reading and analyzing of homeschool teachers with students with special needs blog posts (Burla et al., 2008). An audit trail describing the data collection and analysis process is provided along with the study results.

Ethical Procedures

The ethics of the researcher determine the trustworthiness of a qualitative study because they are the primary data collector and analyzer. According to Merriam and Tisdall (2016), it is the responsibility of the researcher to conduct a study that is as ethical as possible so that the credibility and reliability of the study are strengthened. Therefore, it was my responsibility as the researcher to conduct this study as ethically as possible to strengthen the credibility and reliability of the research, since the trustworthiness of the data is directly tied to those who are collecting and analyzing data (Merriam & Tisdall, 2016). It was essential that I revealed the purpose of the study in a way that was ethical along with maintaining the privacy of the homeschool teachers whose blog posts I used as data (Merriam & Tisdall, 2016).

To meet ethical guidelines for this content analysis study, I submitted an application to the Institutional Review Board (IRB) at Walden University for permission to begin collecting data for this study (IRB Approval no. 04-12-19-0376630). Because I conducted a qualitative content analysis study, I did not need to seek consent of any participants since I was not going to talk to participants; therefore, no described treatment of participants was needed. By using pre-existing, public data, there was not an issue with participants backing out of the study. Although I used public data, I addressed any ethical concerns by using pseudonyms to replace the names of those who made the blog posts, as well as those who responded. Even though all the data for this study were publicly available, I used pseudonyms for the teachers and their blogs. This data is kept in a digital file, that is saved on a password-protected computer, where I am the only one with access, and it will be deleted five years after the study is complete. The practice of reflexivity throughout this study kept me sensitive to what and how results were presented (Guillemin & Gillam, 2004); therefore, ensuring that ethical procedures were followed and a study was produced that was not only ethical but also credible and reliable.

Summary

In this chapter, a description of the research method was provided, along with the research design and rationale, the role of the researcher, the methodology, and the issues of trustworthiness and ethical procedures. Details of participant selection, data collection instruments, and the data analysis plan were also discussed. In Chapter 4, I discuss the

setting of the study along with the demographics of the selected homeschool teachers. The data collection and analysis processes are explained and study results described.

Chapter 4: Results

Introduction

The purpose of this qualitative study was to explore the PBL experiences of homeschool teachers who work with students with special needs and how PBL experiences reflect 21st century competencies. To accomplish this purpose, I explored the blog posts of homeschool teachers with students with special needs in relation to their use of PBL.

The research questions for this study were:

Central Research Question

How do the experiences of homeschool teachers implementing PBL with students with special needs reflect 21st-century skills?

Related Research Questions

1. How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skill of communication and collaboration?
2. How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skill of problem-solving and critical thinking?
3. How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skill of cross-disciplinary knowledge?

In this chapter, I present the results of this qualitative content analysis study. It includes a description of the research setting. I then explain the data collection and analysis processes and provide evidence of trustworthiness. This chapter ends with a description of the results and a summary.

Setting

This qualitative content analysis study was completed through a public search of blog posts from 20 homeschool teachers who work with students with special needs. I chose blog posts from three different times in the school year, and posts were purposefully selected if the writing referenced use of PBL strategies. By collecting data publicly available via search engines, none of the information was marked as private by any of the blog authors. I followed the blog site and blog post search process described in Chapter 3 with no changes made to that process.

Demographics

To collect demographic information on each homeschool blogging teacher, I started at the "about me" page of each blog and looked for what type of special needs they served. I also searched their blogs for the number of students they homeschooled, as well as any details of which teaching philosophy the teacher most identified with. Sometimes demographic information was not provided on the "about me" page but was embedded with other blog posts. Some did not state their religious affiliation, teaching philosophy, or the special need that they taught. For cases such as these that did not state their religious affiliation or teaching philosophy, I recorded them as "undeclared." For cases where they did not state the special need that they taught, I recorded them as "not

specified." Although the data were accessible to the public, I gave the authors' identities and blog sites pseudonyms. For example, pseudonyms used for the 20 blog authors included the word "Blog" along with a letter A-T. In reporting demographics, I determined that homeschool teachers who had four or more than four children would receive the designation +4, rather than the actual number for confidentiality purposes.

Table 5

Homeschool Teacher Blogger Demographics

Blog letter	Philosophy of homeschooling	Number of homeschooled children	Identified special needs	Religious affiliation
A	Charlotte Mason	3	Gifted	Christian
B	Lit Unit Studies	1	Twice exceptional	Christian
C	Lit Unit Studies	4+	Not specified	Undeclared
D	Undeclared	4+	Twice exceptional	Christian
E	Lit Unit Studies	2	Not specified	Undeclared
F	Lit Unit Studies	3	SPD	Undeclared
G	Montessori Method	4+	Autistic	Christian
H	Undeclared	4+	Reading disability	Christian
I	Unschooling	3	Not specified	Undeclared
J	Waldorf-Holistic	4+	Not specified	Undeclared
K	Unschooling	4+	Hearing impaired	Undeclared
L	Interest-Led	3	Not specified	Undeclared
M	Charlotte Mason	4+	Not specified	Undeclared
N	Lit Unit Studies	2	Autistic	Christian
O	Lit Unit Studies	4+	ADHD	Christian
P	Lit Unit Studies	3	Twice exceptional	Christian
Q	Lit Unit Studies	2	ADHD	Secular
R	Lit Unit Studies	4+	Autistic	Christian
S	Lit Unit Studies	2	Twice exceptional	Secular
T	Lit Unit Studies	4+	Not specified	Christian

Note. Sensory Processing Disorder (SPD); Attention Deficit Hyperactivity Disorder (ADHD)

Data Collection

The data collection process presented in Chapter 3 was followed with a few exceptions. As previously described, a minimum of three blog posts from each of the 20

teachers was selected as they referenced the use of PBL strategies. To begin data collection, I had to identify that a blog met my three inclusion criteria: (a) be written by a homeschool teacher, (b) identify that a student with special needs is being homeschooled, and (c) have a minimum of three posts that reference teaching and learning that align with the fundamentals of PBL posted at least 2 months apart. I started by using the search terms found in Table 3 in public search engines. When blogs came up that met the first criteria written by a homeschool teacher, I read through the "about me" page to see if they had a student with special needs. Once I determined that a blog was written by a homeschool teacher with a student with special needs, I used search terms from Table 3 to find posts related to PBL experiences.

Once I found a blog site that had at least three posts referencing PBL activities, I next had to determine that the posts were published at three different times of the year, with at least 2 months between posts. Some teachers published blog posts with a date publicly visible. For those posts without published dates, I had to find other ways to establish the blogs earliest post date. First, I tried searching for the teacher's publicly accessible Twitter posts. By searching Twitter, I was often able to determine the blog post published date. For those teachers who did not use Twitter, sometimes the blog post was shared by other homeschool teachers, and this provided me with the date I needed. However, there were some blog posts for which I still needed dates. For these, I had to use a Mozilla browser, visit the blog post, then right-click on any text and click on view page source, and finally click on general. By clicking on the general tab, I was able to find the publication dates that I needed (see Stephens, 2019).

When a blog site was confirmed to have met all three criteria, I added it to the blog data collection instrument and saved it as a private Word document on a password locked computer (see the template I used in Appendix). This blog data collection instrument served as an audit trail, which helped me to make sure that I had a record of my data collection and decision-making process; although some may argue that audit trails do not enhance the credibility of a study, I chose to use one to keep adequate documentation of the data (see Cutcliffe & McKenna, 2004; Merriam & Tisdall, 2016). After further reading of the selected blog posts, I found that some did not meet all three criteria and therefore could not be used as data sources. As recommended by Cho and Lee (2014), this was noted in my blog data collection instrument. The blog data collection instrument is also where I assigned a pseudonym for each blog author and site. As I found blog posts, I recorded the blog post URL and recorded which PBL fundamentals I identified for each post. Some homeschool teacher blogs had more than three posts related to PBL activities, and I included these in data collection. I collected between three and nine blog posts from each of the 20 homeschool teacher blogs. Originally, I downloaded 87 blog posts. Table 6 shows the total number of blog posts for each blog that I downloaded and prepared for data analysis.

Table 6

Number of Blog Posts Collected from each Homeschool Teacher Blog

Blog	Number of blog posts downloaded for analysis
Blog A	9
Blog B	5
Blog C	4
Blog D	5
Blog E	6
Blog F	6
Blog G	3
Blog H	3
Blog I	3
Blog J	4
Blog K	3
Blog L	5
Blog M	5
Blog N	4
Blog O	4
Blog P	5
Blog Q	3
Blog R	3
Blog S	3
Blog T	4

Originally, I had planned on collecting blog post replies and posts from teachers' microblogging accounts, such as Twitter; however, when reviewing these data sources neither provided any additional information not already available in the blog post. The Twitter accounts used in conjunction with their blog usually only provided the link and title of the blog post. The replies to the blog posts were often "thanks for this post" and "I love this idea and can't wait to try it." The homeschool teacher's blog post replies were often short comments such as "thank you for reading my post" or "I'm glad you enjoyed it." Therefore, analysis of these data would not have provided additional insight,

and I did not collect or analyze these data sources. Due to this reduction of data sources, I chose to increase the number of blog posts collected from the proposed 50 to 87 to ensure I had data saturation to answer my research questions. Because the failure to reach data saturation can affect the credibility and validity of a study, rich and thick data descriptions must be obtained to most efficiently answer the research questions (Fusch & Ness, 2015), and having more data to analyze provided more opportunities for me to make these types of analyses. It is not about the amount of data collected but rather the depth of data that a researcher collects (Fusch & Ness, 2015); therefore, increasing the use of one data source to add depth to the data was vital when the other proposed data sources provided no new data. A total of 87 blog posts were identified as meeting the study criteria and included for data analysis.

Level One Data Analysis

For Level One data analysis, I used a priori codes that I organized in the codebook developed during the proposal process. In this first level of coding, the a priori codes were theory-driven (see Ryan & Bernard, 2003). These a priori codes aligned with my conceptual framework and the literature related to 21st-century skills. Table 4 shows the a priori codes, or theory based codes, that I used during the data analysis process and the literature on which the codes were based. The codebook, which included definitions, inclusion, and exclusion criteria, as well as sample quotes for each code (see DeCuir-Gunby et al., 2011). I copied and pasted all 87 blog post narratives into the coding software, Dedoose. I also entered the following descriptors for each blog author *blog*

code, teaching philosophy, special need, number of students being homeschooled, and religious affiliation.

Once data were prepared in Dedoose, I began level one data analysis. I read through each post and began determining the text excerpts and assigning codes to the excerpts based on the a priori codes in my code book. I identified the text excerpts in each blog post by language that described a single idea. I only coded text excerpts that related to my a priori codes. Throughout the level one coding process, I referred back to my codebook to make sure I was consistently coding excerpts that aligned with descriptors determined by the literature. During this level of coding, I refined the codebook by providing clarification on inclusion and exclusion criteria. When I finished round one coding of all of the data once, I took a two-week break before doing another round of coding to make sure that my interpretations were true as recommended by Pyett (2003). During the second round of coding, I found that some codes that were assigned during the first round did not match the codes assigned during the second round. Although this difference in code assignments only happened a few times, I went back through the data to reconcile differences, update the codebook, to ensure intracoder reliability.

Intracoder Reliability

I coded data twice then calculated an intracoder reliability score. Once both rounds of level one coding were complete, I used Dedoose to check for intrarater reliability and to calculate a Cohen's Kappa score. Dedoose calculated both a single "pooled" score for all of the blogs, but also individual scores for each of the codes. When

looking at the individual scores for each code, I found that three out of the seven a priori codes had a Kappa score lower than 0.4. I used the preferred Kappa score of 0.4 to 0.6 to ensure satisfactory agreement of codes and to aid the improvement of my intrarater reliability (MacPhail et al., 2016). To determine why these scores were low, I went back to the data and reviewed my codebook. I determined that mismatches were mostly when an excerpt was coded with more than one code either in the first round and not the second, or vice versa. To ensure that the codes added in round two were applied consistently, I read through the data again and made adjustments to the codes assigned. Once this was completed, I went back to Dedoose and recalculated the Kappa score and got a final score of 0.46 showing satisfactory agreement between coding sessions and therefore, providing intrarater reliability between both rounds of coding.

Level Two Data Analysis

In Level Two coding, I analyzed the blog data through constant comparison of the similarities and differences among the Level One codes as recommended by Merriam and Tisdall (2016). Throughout this level, I made notes in Dedoose concerning any questions I had and any new themes that arose. As recommended by DeCuir-Gunby et al. (2011), I added to the codebook to show the new codes that were coming out of the data. Recoding the data allowed me to combine, delete, and add codes based on the rearranging and reclassifying of data (Saldana, 2009). Text excerpts from the blog posts with the same themes and codes were easily available in Dedoose by clicking on the specific code. Recurring patterns and themes found in this level of coding were used to analyze the data

further. These patterns and themes allowed me to develop emergent, or data-driven codes, which emerged from the raw data used for the study (Ryan & Bernard, 2003).

Evidence of Trustworthiness

Providing trustworthiness in a study is vital to the validity and credibility of the study. Patton (2014) stated that if the researcher does not engage in the proper actions to ensure trustworthiness, then credibility will be a problem. Trustworthiness is found in the credibility of a study when the best data collection method for that type of study is used. To further ensure the trustworthiness of a study, researchers must be consistent in their methods and strategies (Cho & Lee, 2014; Merriam & Tisdall, 2016). In this section, I provided the credibility, transferability, dependability, and confirmability of this study.

Credibility

The credibility of a study is provided when there is an agreement between the findings of a study and reality (Merriam & Tisdall, 2016). As stated in Chapter 3, to increase the credibility of this study, I used data triangulation and intracoder reliability in the coding process. Data triangulation took place through multiple reviews of documents kept, such as the researcher journal and blog posts (Cho & Lee, 2014). I also used data triangulation when pulling blog posts from three different times of the year. Credibility was improved through data triangulation because the triangulation process helped to ensure that each blog and blog post selected met the inclusion criteria. Intracoder reliability helped to ensure credibility through the multiple readings of the data because it allowed me to look more purposefully at the data for any variations (Burla et al., 2008;

Merriam & Tisdall, 2016). This step brought credibility to my study by providing agreement between rounds of coding. I also used reflexivity to ensure credibility by keeping researcher notes throughout the coding process (Darawsheh, 2014),

Transferability

The transferability of a study is the way that its findings can be applied to another (Merriam & Tisdall, 2016) and the diversity or variation in sampling (Miles et al., 2014). Transferability of this study was confirmed through the use of twenty different blog authors whose blogs met all three inclusion criteria. While coded text excerpts from blog posts helped to answer the research questions, findings from this study may not be transferable to all homeschool situations because of the sample size. The findings from this study may not be transferable to all homeschool situations, because not all homeschool teachers teach students with special needs. However, some confidence of transferability may occur because there is an increase in the number of families who are choosing to homeschool both atypical students and students with special needs (AIR, 2016; Day, 2019).

Dependability

Dependability of a study is the consistency with which a researcher collects data (Cho & Lee, 2014; Merriam & Tisdall, 2016) and ensures that it answers the research questions (Ravitch & Carl, 2016). Following the inclusion criteria for each blog site provided consistency in my data collection process; therefore, adding dependability to my study. Using the constant comparative method also helped provide dependability. The

development of the codebook, along with two levels of coding brought dependability to my study.

Confirmability

Miles et al. (2014) stated that to bring confirmability to a study, the researcher must keep careful documentation. Confirmability was addressed in this study by keeping an audit trail, showing reflexivity through the use of a researcher journal, and confirming intracoder reliability. The audit trail ensured that careful documentation was kept during the data collection phase. Intracoder reliability and reflexivity were addressed during the data analysis process and provided confirmability for this study. Intracoder reliability was figured after two rounds of coding during level one and showed consistency in the codes assigned to text excerpts from each blog post. A researcher journal was kept throughout the data analysis process and helped me to keep my biases and assumptions in check; therefore, also providing confirmability to this study.

Results

In this section I describe the codes that came from the data collected to answer the central research question: How do the experiences of homeschool teachers implementing PBL with students with special needs reflect 21st-century skills? This chapter is organized by the 21st-century skill from the related research questions to show how each were answered.

A total of 390 codes were assigned to 283 text excerpts. The 21st-century skill of Communication and Collaboration produced 80 codes or 20.5% of all the data coded (See Table 7). Problem Solving and Critical Thinking was assigned to the most data, with 227

excerpts or 58.2% of the codes. And Cross Disciplinary Content had 83, or 21.3% of the total codes. See Table 7.

Table 7

Level 1 Code Frequency and Percentage for 21st-Century Skills

21st -century skill	Frequency	Percentage
Communication and collaboration	80	20.5%
Problem solving and critical thinking	227	58.2%
Cross-disciplinary content	83	21.3%
Total	390	100%

The a priori code frequency and percentage for each of the three 21st-century skills are provided in Table 8.

Table 8

Frequency (and Percentage) of All a Priori Level 1 Codes

21st -century skill	Level 1	Frequency percentage
Communication and collaboration		
	Sharing	66 (16.9%)
	Connecting	14 (3.6%)
Problem solving and critical thinking		
	Reflection	39 (10%)
	Encourage multiple solutions	11 (2.8%)
	Real problems to solve	53 (13.6%)
	Creating inquiry environments and supports	124 (31.8%)
Cross-disciplinary content		
	Cross-discipline content	83 (21.3%)
Total		390 (100%)

The data collected to answer the research questions were all publicly available data found on homeschool teacher blogs. While I coded text word-for-word from the blogs, for data reporting in this results section, I am reporting paraphrased ideas from the blogs posts, not exact quotes. I did this for ethical reasons, to protect the blog author's

identities. Roberts (2015) stated that even when using publicly available data in research, the "subjects" used should be treated as human subjects and great care taken to prevent others from locating their identities. Paraphrased ideas should protect them from being able to be identified in a search engine query.

Communication and Collaboration

Communication and collaboration is the 21st-century skill addressed in RQ 1. Of the three 21st-century skills examined as part of the study, this category had the fewest number of codes. The 21st-century skill of communication and collaboration represented 80 of the total number of 390 total excerpts coded for all three 21st-century skills or 20.5% of all codes. During level 1 coding, 80 text excerpts were assigned to two a priori codes of either *sharing* (66 coded excerpts) or *connecting* (14 coded excerpts), see Table 8. The total frequency of codes for sharing and connecting by teaching philosophy are shown in Table 9, with percentages calculated in this one 21st-century skill. For sharing, 20 codes out of 66 (30.3%) came from blog posts authors associated with the Charlotte Mason philosophy, while the blog posts authors associated with the Montessori philosophy showed zero out of 66. For connecting, three out of 14 (21.4%) came from blog posts authors associated with both the Charlotte Mason and unschooling philosophies, whereas, except for those associated with a literature-unit study philosophy mentioned connecting eight out of 14 (57.1%) times in their posts. Two codes out of a total of 66 (3%) came from blog posts authors associated with interest-led philosophy, while the blog authors associated with the unschooling, Waldorf-Holistic, and undeclared philosophies showed one code each, out of 66 (1.5%). For those blog posts authors

associated with the Charlotte Mason teaching philosophy, showed 20 codes out of 66 (30.3%).

The code connecting, included the least number of codes for the skill of communication and collaboration, only 14 out of the 390 total codes (3.6%), see Table 8, or 14 out of 80 (17.5%) codes for this skill. For connecting, eight codes out of a total of 14 (57.1%) came from blog posts authors who were associated with the literature-unit studies philosophy, while the blog posts authors associated with the Charlotte Mason and unschooling philosophies both had three codes out of 14 (21.4%). See Table 9. The rest of the teaching philosophies from this skill show zero codes out of 14, see Table 9. For the 21st-century skill of communication and collaboration, sharing was the most commonly used and those teachers associated with the literature-unit studies teaching philosophy used both sharing and connecting more than those associated with the other identified teaching philosophies.

Table 9

Level 1 Code Frequency for Communication and Collaboration by Teaching Philosophy (Percentages in Parenthesis)

Teaching philosophy	Sharing (n = 66)	Connecting (n = 14)
Charlotte Mason	20 (30.3%)	3 (21.4%)
Literature –Unit Studies	41 (62.1%)	8 (57.1%)
Montessori	0 (0%)	0 (0%)
Unschooling	1 (1.5%)	3 (21.4%)
Waldorf-Holistic Approach	1 (1.5%)	0 (0%)
Undeclared	1 (1.5%)	0 (0%)
Interest-Led	2 (3%)	0 (0%)

When looking for the a priori code sharing in each blog post it was necessary that the homeschool teacher discussed ways that their students shared their findings, ideas,

and work with others either f2f or online. When searching for excerpts in relation to this code I had to make sure that the students were indeed sharing their findings, ideas, and work not sharing about their experiences with being homeschooled or sharing their interests. Looking for posts that talked about giving students a chance to connect with others had to include students working with others, either f2f or online, to solve a specific problem not connecting for social time.

During level two coding, I used a data-driven method of analysis to examine the 80 coded text excerpts coded with this skill in level 1, and coded them for emergent themes, or codes. As noted in Table 10, the emergent codes for the a priori code, sharing, were *visual sharing* and *verbal sharing*. Table 10 shows the total number of codes for each of these emergent codes in relation to the special needs identified from the homeschool teacher blogs. For visual sharing, 11 codes out of 24 (45.8%) came from blog posts authors who taught students who were gifted, while those blog authors who had at least one student that was twice exceptional showed six codes out of 24 (25%). For verbal sharing, 13 codes out of 24 (23.2%) came from blog posts authors that taught students who were gifted. Again, the total codes for those with students who were twice exceptional were some of the next highest with 14 codes out of 24 (25%).

Table 10 also shows the total number of codes the emergent codes associated with the a priori code, connecting. The emergent codes were collaborate/work together and connecting with an expert. For collaborate/work together, two codes out of 12 (16.7%) came from blog posts authors who had students with a sensory processing disorder, while those homeschool teachers with students with no specified special need showed eight

codes out of 12 (66.7%). A small number of codes were found for the emergent code, connecting with an expert. For both collaborate/work together and connecting with an expert, one code out of 12 (8.3%) and three (33.3%), respectively, were from teachers who had at least one student who had ADHD. Those teachers with students who were gifted also showed one code out of 12 (8.3%) and three (33.3%) respectively.

Table 10

Code Frequency for 21st-Century Skill of Communication and Collaboration (Percentages in Parenthesis)

	Sharing		Connecting	
Special need	Visual sharing (*n* = 24)	Verbal sharing (*n* = 56)	Collaborate/ work together (*n* = 12)	Connecting with an expert (*n* = 3)
ADHD	2 (8.3%)	8 (14.3%)	1 (8.3%)	1 (33.3%)
Autistic	0 (0%)	5 (8.9%)	0 (0%)	0 (0%)
Gifted	11 (45.8%)	13 (23.2%)	1 (8.3%)	1 (33.3%)
Hearing impaired	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Reading disability	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sensory processing	0 (0%)	0 (0%)	2 (16.7%)	0 (0%)
Twice exceptional	6 (25%)	14 (25%)	0 (0%)	0 (0%)
Not specified	5 (20.8%)	16 (28.6%)	8 (66.7%)	1 (33.3%)
Behavior disorder	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Sharing. For the a priori code of sharing, the data led to the following emergent codes, visual sharing and verbal sharing. These emergent codes described the method students used to share what they had learned and the verbal and visual sharing options that homeschool teachers were giving their students. Data showed that students were more involved in verbal sharing activities than visual sharing. For the emergent code of visual sharing, teachers were sharing a variety of methods they used to have their students share what they had learned in a visual way. For example, Teacher A often had her students complete projects. At the end of this particular unit, her student chose to develop a PowerPoint presentation showing what he learned concerning the war they had

been studying in history, as well as important events and people from that war. Once the student completed the PowerPoint the student was going to post it on the YouTube channel. The text excerpt from Teacher A is a good example of the emergent code visual sharing because the student was constructing and publishing digital media to share visually to a virtual audience. While some teachers had students share visual projects using technology, others had students share visually by creating habitats. For example, Teacher B, had her students create a reptile habitat. In developing the reptile habitat, her students had to show that they had a clear understanding of where the reptiles were found and the various climates and terrains they needed to survive. This paraphrased text excerpt from Teacher B is another good example of the emergent code visual sharing because the students not only had to be able to explain what they had learned about reptile habitats, they had to create one for a f2f audience. While Teacher B had her students share visual projects by creating reptile habitats, others had their students share visually through putting together display boards. Another example of visual sharing is when Teacher A gave her students the option of creating a display board showing a variety of different details on what they learned about the life of pioneers. This paraphrased text excerpt is a good example of visual sharing because students shared their learning through pictures and text on a display board.

The second emergent code for sharing, was verbal sharing. For the emergent code of verbal sharing, teachers shared a variety of methods they used to have their students share what they had learned verbally, such as oral presentations and informal discussions. For example, Teacher D had her students design and build boats. Once their

boats were dry, the students tested them out. The teacher then engaged students in a discussion related to topics, such as the best and worst parts of their designs, what design worked best, and how they could improve their boat design the next time. This text excerpt from Teacher D is a good example of the emergent code verbal sharing because the students were required to verbally share with each other what they had learned throughout the boat designing process. While some teachers had their students share about their projects verbally through informal discussions, others had their students share verbally through a more formal oral report. For example, during a Viking unit study, Teacher A had her students choose a famous Viking to research and give an oral report. This text excerpt is a good example of the emergent code verbal sharing because the students were asked to verbally share with their family what they had learned about the Viking that they chose to research.

Connecting. For the a priori code of connecting, the data led to the emergent codes *collaborate/work together* and *connecting with an expert.* These methods of connecting described the different approaches that these homeschool teachers used to provide students with various ways of connecting with others. For the emergent code of collaborate/work together, teachers shared a variety of methods they used to allow students to collaborate with their siblings or others to complete a specific project or task. For example, Teacher I and her students decided to raise chickens. Getting chickens meant they had to either build or buy a coop, since they had a limited amount of money that could be spent, they decided to make one using available materials that met their skill level. This text excerpts is a good example of the emergent code collaborate/work

together because the chicken coop project required that they work together to come up with the best design for their coop. Teacher C also shared more generally about ways that she provides her students practice in collaboration related to solving problems. For instance, when her students come to her with a problem, she asks them questions and encourages them to brainstorm ways they can solve the problem together. In another example, Teacher C shared a real-life story of how her students had applied collaboration skills with some friends to solve a problem. Her students and their friends needed to get home from the park when one of them fell off their bike and could not ride home. She explained how the kids worked together to come up with the solution of two riding the bus home and the other two would ride their bikes home. These text excerpts were good examples of collaborate/work together because they showed how these students worked amongst themselves to solve the problem they were facing.

For the emergent code of connecting with an expert, teachers shared ways that they provided their students with opportunities to connect with an expert on a specific interest. Such opportunities included connections such as meeting with computer shop owners or beekeepers to learn more on that specific topic. For example, Teacher Q shared how her and her students took a beekeeping class in which they were able to ask questions. She stated that the beekeeper who taught the class provided all of them with his contact information in case they had more questions later. This experience shared by Teacher Q is a good example of the emergent code connecting with an expert because students were directly engaged with an expert on beekeeping by taking the class. While Teacher Q gave her students the opportunity to connect with an expert through taking a

class, Teacher M shared a less formal way for her students to connect with an expert. Teacher M shared how she connected her students with a friend who was knowledgeable about nature to go with them on nature walks. She explained how this helps connect students with experts who may have information and passion outside what they may not know. This text excerpt is a good example of connecting with an expert because students are given the opportunity to connect with another adult in a f2f environment to work through any questions or problems they may have.

Problem Solving and Critical Thinking

Problem solving and critical thinking is the 21st-century skill addressed in RQ 2. During level one coding, I coded 227 excerpts from 87 blog posts with the four a priori codes of either *reflection, real problems to solve, encourage multiple solutions,* or *creating inquiry environments and supports.* The total number of codes coded for this 21st-century skill was 227/390 or 58%, see Table 7. Data showed that the 21st-century skill of problem-solving and critical thinking was most evident in the blog posts of homeschool teachers with students with special needs than the other two 21st-century skills focused on in this study. The reflection code was assigned to 39 text excerpts, encourage multiple solutions was assigned to 11, real problems to solve was assigned to 53, and the code creating inquiry environments and supports was assigned to 124, for a total of 227 codes for the 21st-century skill, problem-solving and critical thinking.

The code reflection included 39 out of the 390 total codes (10%) compared to all of the other level one codes, see Table 8. The total frequency of level one codes, compared to others in this skill organized by teaching philosophy, are shown in Table 11.

Two codes out of 39 (5.1%) came from blog posts authors associated with both the Waldorf-Holistic and interest-led philosophies, while the blog authors associated with the Charlotte Mason philosophy also showed two codes out of 39 (5.1%). The code encouraging multiple solutions included the least number of codes of any in this study, including this skill, only 11 out of the 390 (2.8%) total codes, see Table 8. For encourage multiple solutions, two codes out of 11 (18.2%) came from blog posts authors associated with the undeclared philosophy, while the blog posts authors associated with the literature-unit studies philosophy showed seven codes out of 11 (63.6%). See Table 8. The code, real problems to solve, occurred 53 out of the 390 total codes across all codes (13.6%, See Table 8), and 53/227 for this specific skill (23.3%), see Table 11. For real problems to solve, seven codes out of 53 (13.2%) came from blog posts authors associated with the unschooling philosophy, while the blog posts authors associated with the interest-led and Montessori philosophies showed zero codes out of 53. See Table 11. Therefore, showing that out of all the teaching philosophies represented by the selected excerpts, those using the Montessori and interest-led philosophies were the only ones to not mention this a priori code in their posts. Creating inquiry environments and supports is the final code for problem solving and critical thinking, and occurred the most out of all the a priori codes, 124/390 (31.8%, see Table 11), and 124/227 (54.6%) for this specific skill. For creating inquiry environments and supports, 34 codes out of 124 (27.4%) came from blog posts authors associated with the Charlotte Mason philosophy, while those associated with the literature-unit studies philosophy showed the next highest number of codes with 70 out of 124 (56.5%). See Table 11. Among all the teaching

philosophies used in the selected blogs, the code creating inquiry environments and supports was the most commonly used.

Table 11

Level 1 Code Frequency for Problem Solving and Critical Thinking by Teaching Philosophy (Percentages in Parenthesis)

Teaching philosophy	Reflection (*n* = 39)	Encourage multiple solutions (*n* = 11)	Real problem to solve (*n* = 53)	Creating inquiry environments and supports (*n* = 124)
Charlotte Mason	2 (5.1%)	1 (9.1%)	4 (7.5%)	34 (27.4%)
Literature –Unit Studies	14 (35.9%)	7 (63.6%)	37 (69.8%)	70 (56.5%)
Montessori	6 (32.1%)	0 (0%)	0 (0%)	5 (4%)
Unschooling	5 (12.8%)	1 (9.1%)	7 (13.2%)	4 (3.2%)
Waldorf-Holistic Approach	2 (5.1%)	0 (0%)	1 (1.9%)	2 (1.6%)
Undeclared	8 (20.5%)	2 (18.2%)	4 (7.5%)	6 (4.8%)
Interest-Led	2 (5.1%)	0 (0%)	0 (0%)	3 (2.5%)

When looking for posts relating to the a priori code reflection, I searched for instances where teachers were sharing how they encouraged students to spend time reflecting on prior knowledge to solve the current problem. See Table 12. Looking for posts that discussed ways that teachers were encouraging multiple solutions included students being given the freedom to learn on their own with no one right solution; therefore, requiring students to use higher order thinking skills. Posts that shared how teachers provided students with authentic problems to solve led to the a priori code real problems to solve. The last a priori code for problem-solving and critical thinking was creating inquiry environments and solutions. When looking for posts relating to this a priori code, it was necessary that the teacher shared how they created a classroom environment where students were able to choose which task to complete to show their understanding of the content learned.

During level two coding I used a data-driven method of analysis using text excerpts coded by this 21st-century skill and looked for emergent themes or data-driven codes. As noted in Table 12, the emergent codes for the a priori code, reflection, were *ask questions* and *apply what is learned.* Table 12 shows number of codes for each of these emergent codes in relation to the special needs identified from the homeschool teacher blogs. For ask questions, four codes out of 19 (21.1%) came from blog posts authors that taught students with a reading disability, while those teachers who taught at least one student with a sensory processing disorder showed two codes out of 19 (10.5%), which was the next highest number of codes for this emergent code. For apply what is learned, three codes out of 20 (15%) came from blog posts authors with students with either a sensory processing disorder or hearing impairment. As noted in Table 12, the emergent codes for the a priori code, encourage multiple solutions, were *failure is okay* and *no set procedure.* For no set procedure, one code out of 11 (5%) came from blog posts authors who taught students who were gifted, while two codes out of 11 (18.2%) came from blog post authors with students who were twice exceptional. For failure is okay, three codes out of 4 (75%) came from blog authors who taught students with a sensory processing disorder, while one code out of 4 (25%) came from a post made by a blog author who did not specify the special needs that she taught.

Table 12

Level 2 Code Frequency for Reflection and Encourage Multiple Solutions (Percentages in Parenthesis)

	Reflection		Encourage multiple solutions	
Special need	Ask questions (n = 19)	Apply what is learned to solve a problem (n = 20)	No set procedure (n = 11)	Failure is okay (n = 4)
ADHD	1 (5.3%)	1 (5%)	1 (9.1%)	0 (0%)
Autistic	2 (10.5%)	6 (30%)	0 (0%)	0 (0%)
Gifted	0 (0%)	1 (5%)	1 (9.1%)	0 (0%)
Hearing impaired	1 (5.3%)	3 (15%)	0 (0%)	0 (0%)
Reading disability	4 (21.1%)	0 (0%)	0 (0%)	0 (0%)
Sensory processing	2 (10.5%)	3 (15%)	4 (36.4%)	3 (75%)
Twice exceptional	7 (36.8%)	0 (0%)	2 (18.2%)	0 (0%)
Not specified	2 (10.5%)	6 (30%)	3 (27.3%)	1 (25%)
Behavior disorder	0 (0%)	0 (0%)	0 (0%)	0 (0%)

As Table 13 shows, the data-driven emergent codes for the a priori code real problems to solve found during level 2 coding were *mathematical problem solving, life skill problem solving, STEM challenges to solve,* and *simple problem to solve.* Table 13 shows the total number of codes for each of these emergent codes in relation to the special needs identified from the selected homeschool teachers' blogs. For mathematical problem solving, one code out of 16 (6.3%) were from blog posts authors who had either a student with ADHD or sensory processing disorder. When looking at the emergent code life skill problem solving, I found that two codes out of 22 (9.1%) came from blog posts authors who taught students with autism, while 10 codes out 22 (45.5%) came from blog posts authors who had not specified what special needs they taught. This data shows that the emergent code, life skill problem solving is the most used in this a priori code of real problems to solve. For STEM challenges to solve, seven codes out of 14 (50%) were from blog posts authors who taught students with a sensory processing disorder, whereas, those posts from blog posts authors who taught students with a hearing impairment

showed results of seven codes out of 65.8 (10.6%). For simple problem to solve, two codes out of four (50%) came from blog posts authors who did not specify what special need(s) they taught, while one code out of four (25%) were from blog posts authors who taught students who were twice exceptional.

Table 13

Level 2 Code Frequency Real Problems to Solve (Percentages in Parenthesis)

	Real problems to solve			
Special need	Mathematical problem solving (n = 16)	Life skill problem solving (n = 22)	STEM challenges to solve (n = 14)	Simple problem to solve (n = 4)
ADHD	2 (12.5%)	5 (22.7%)	0 (0%)	0 (0%)
Autistic	1 (6.3%)	2 (9.1%)	0 (0%)	0 (0%)
Gifted	2 (12.5%)	2 (9.1%)	0 (0%)	0 (0%)
Hearing impaired	3 (18.8%)	0 (0%)	1 (7.1%)	0 (0%)
Reading disability	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sensory processing	1 (6.3%)	0 (0%)	7 (50%)	1 (25%)
Twice exceptional	1 (6.3%)	3 (13.6%)	5 (35.7%)	1 (25%)
Behavior disorder	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Not specified	6 (37.5%)	10 (45.5%)	1 (7.1%)	2 (50%)

As noted in Table 14, the data-driven emergent codes for creating inquiry environments and supports were *assessment choice, curious classroom setup, open-ended assignments,* and *student-driven topics*. Table 14 shows the total number of codes for each of these emergent codes in relation to the special needs identified from the selected homeschool teachers' blogs. For assessment choice, five codes out of five (100%) came from blog posts authors who taught students who were gifted, while no other blog post author made reference to this emergent code; therefore, showing zero codes out of five for all other identified special need. For curious classroom setup showed eight codes out of 59 (13.6%) from blog posts authors who taught students with ADHD. Whereas, 10 codes out of 59 (16.9%) came from blog posts authors who taught students who were

gifted. For open-ended assignments, four codes out of 29 (13.8%) came from blog posts authors who taught students who were gifted, while only seven codes out of 29 (24.1%) were from those who taught students who were twice exceptional. For student-driven topics, 11 codes out of 47 (23.4%) came from blog posts authors who taught students who were gifted, while four codes out of 47 (8.5%) were from those who taught students who were autistic.

Table 14

Level 2 Code Frequency Creating Inquiry Environments & Supports (Percentages in Parenthesis)

	Creating inquiry environments & supports			
Special need	Assessment choice (n = 5)	Curious classroom setup (n = 59)	Open-ended assignments (n = 29)	Student-driven topics (n = 47)
ADHD	0 (0%)	8 (13.6%)	2 (6.9%)	2 (8.5%)
Autistic	0 (0%)	5 (8.5%)	1 (3.4%)	4 (8.5%)
Gifted	5 (100%)	10 (16.9%)	4 (13.8%)	11 (23.4%)
Hearing impaired	0 (0%)	0 (0%)	1 (3.4%)	0 (0%)
Reading disability	0 (0%)	1 (1.7%)	0 (0%)	0 (0%)
Sensory processing	0 (0%)	2 (3.4%)	4 (13.8%)	0 (0%)
Twice exceptional	0 (0%)	12 (20.3%)	7 (24.1%)	12 (25.5%)
Behavior disorder	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Not specified	0 (0%)	21 (35.6%)	10 (34.5%)	18 (38.3%)

Reflection. The emergent codes for the a priori code reflection was used when teachers described how students used different methods of reflection to find answers to the problem. For the a priori code, reflection the two emergent codes were ask questions and apply what is learned to solve a problem. For the emergent code of ask questions, teachers shared how they developed activities that required students to ask questions to either establish a connection between the problem and their prior knowledge or to find answers to a specific problem. For example, Teacher D shared that as part of a unit study on birds they went to a bird sanctuary so that her student could ask questions. In another

post, this same teacher shared how she encourages her students to ask questions and seek out answers in order to find a solution to the problem. She shared that it is important to let them know that scientists ask questions and seek answers, which is how they learn. She also encouraged readers to learn alongside your students. For example, when they find something they have questions about, such as a shed insect skin, bring it inside so that questions can be asked and it can be studied together. These experiences shared by Teacher D are good examples of the emergent code ask questions because students were given opportunities to ask questions and shown different types of questions to ask. Teacher S teaches her students to ask questions in order to find answers by asking questions herself. She stated that it is good for students to hear adults modeling how to ask good questions. This experience shared by Teacher S is a good example of the emergent code ask questions because she shows her students that it is okay to not know something and that no matter-the age, one will always have questions.

The second emergent code in the a priori code of reflection, was apply what is learned to solve a problem. Teachers shared how they provided students with activities that encouraged them to use what they had already learned to solve a current problem or set of problems. For example, Teacher M shared more generally about how students could choose a type of pet to learn about and adopt, then go to an adoption center and adopt that type of pet so that they could apply what they learned about that pet and how to care for it. This text excerpt is a good example of apply what is learned to solve a problem because students are required to take the knowledge they gained when researching that particular animal and apply it to ensure that the pet had adopted all they

needed to survive. In another post, Teacher J shared about how by learning about helping the environment and how small changes can make a difference, to her students continuing to apply what they had learned to make more changes by adding one new green piece a week. This experience is a good example of this emergent code because it shows how students were applying what they had learned about going green through continuing to add new ways of helping the environment each week. Teacher F shared how her students used what they had learned about making boats from a different STEM activity where they made foil boats to make LEGO boats. This is a good example of apply what you learned to solve a problem because the students were able to use what they had learned about what did or did not work when making the foil boats, such as what shape and design of boat was best activity when making these new boats.

Encourage multiple solutions. The next a priori code for the 21st-century skill problem solving and critical thinking was encourage multiple solutions. Data led to the emergent codes, *no set procedure* and *failure is okay.* These emergent codes describe how students are encouraged to look for and try a variety of methods when searching for answers to a problem. For the emergent code no set procedure, teachers shared activities or tasks that they presented to their students that allowed them to use their creativity and prior knowledge to find answers. When presented with these assignments, students were not given a set procedure and there was no right answer. For example, Teacher O shared how during a unit study on Little House on the Prairie she gave her students the opportunity to set up a bartering system because Pa traded furs for supplies. They were not given specific procedures to use, nor was there just one right way to do it; therefore,

this was a good example of no set procedure where the students set up the rules and parameters of developing a system where no money is exchanged. In another history based unit, Teacher E shared how she gave her students the opportunity to create historically-based weapons and armor using duct tape. Although there were certain types of weapons and armor used during the time they were studying, students were allowed to create their own versions. Therefore, this is a good example because they were not given one set instructions to follow to make the weapons or armor, nor were they instructed that they had to look a certain way. While some teachers used projects tied to unit studies, others used real-life problems or scenarios. Teacher D shared how she encouraged her students to think about solutions to problems they may face while hiking. For example, she had them think about what they would do if their pants ripped at the seat while out on the trial but gave them no set procedure to use if it happened. This is a good example of this emergent code because the pants could be temporarily fixed in multiple ways.

For the emergent code failure is okay , teachers shared how they encouraged students to find the answers they were seeking through trial and error. For example, Teacher F shared that when making LEGO boats one student went with a more traditional style, while her oldest got a little more creative because he wanted it to be more aerodynamic. Teacher F also shared about another STEM activity that she used with her students where they designed a robot but the challenge was to make the eyes light up. These experiences are good examples of failure is okay because teachers are framing STEM activities that allow students to use trial and error in their projects, which encourage students to keep working through the problem until they find the best solution.

While some teachers gave STEM related projects for students to do to learn that making mistakes is okay, others let their students practice with real-life situations. Teacher C shared how she talked with her students and gives them different options to solving a problem when they are struggling, but also gives them opportunities to practice problem solving skills in small situations so that they are prepared for bigger challenges. This experience shared by Teacher C is a good example of failure is okay because she provides her students with a chance to make mistakes but also encouraged them to keep trying until they solved the problem.

Real problems to solve. When reading back through those excerpts coded with the a priori code real problems to solve, the data led to the emergent codes mathematical problem solving, life skill problem solving, STEM challenges to solve, and simple problem to solve. For the emergent code mathematical problem solving, teachers shared how they developed activities for their students where they were required to use mathematical methods to solve a specific problem, such as budget planning and scaled drawings. For example, Teacher E shared how she had her students use blueprints and chalk to make a scaled footprint of a medieval castle. This is a good example of this emergent code because it required students to use mathematical skills to make the drawing. In another post, Teacher E shared that on Pi Day she had her students use a Buffon's needle estimate Pi for themselves. Although this is an old geometric problem, it was a good example of mathematical problem solving because students learned how to solve Pi. While Teacher E used math lessons in a unit study, Teacher B shared how she provided mathematical problem- solving opportunities based on her student's interests.

In her post Teacher B shared how her student wanted to buy a specialized filtration system for their reptile tank. Even though the current one was fine, it would not allow the student to get the smallest levels of measurement that they wanted. This text excerpt is a good example of STEM challenges to solve because students were involved in an activity that required them to have an understanding of measurements as well as the science behind creating the best tank setup. Some teachers shared how they used money to teach mathematical problem solving. For example, Teacher K shared how her and her student were out longer than they had planned and needed a snack to hold them over until they got home, but they only had ten dollars to spend. Her student had to determine what they could buy. The student chose nachos, which were seven dollars and then did the math to see if they had enough left to buy a cupcake. This text excerpt is a good example because the student had to use subtraction to determine what or how much could be bought. Teacher A also used money to teach mathematical problem solving by teaching budgeting and couponing. She shared how it is important for students to learn appropriate use of money and suggested teaching them to save for a certain item they want or to help create a grocery list based on how much is available to spend that week. These are good examples of mathematical problem solving because they required students to calculate how much money they have and either how much they can spend on groceries or how much more they need to save for the item they want. Teacher N also shared how she uses real-life scenarios for teaching and strengthening mathematical problem- solving skills by having her student calculate the volume of an aquarium. While some teachers used money and real-life situations, others used STEM activities.

For example, Teacher F shared how using varying weights of pumpkins and altering how hard they pulled the pumpkin back was able to introduce various math concepts used with catapults. This text excerpt is a good example of mathematical problem solving because students had to figure out how the weight of a pumpkin changed how hard they had to pull back for it to hit the target.

The emergent code life skill problem solving, involved teachers sharing how they presented students with activities that enabled them to develop necessary life skills such as, cooking, camping, as well as social and independent living skills. For example, Teacher E shared how as family they prepared a medieval feast. This activity required that students learn what goes into planning a meal, which makes it a good example of life skill problem solving because it is a skill they need to live independently when they are older. Teacher C shared a real-life story of how her students applied life skill problem solving with each other to solve a problem. One student was rollerblading and while the other was walking, when the one rollerblading got a blister on one foot and needed to figure out a solution to get back home. Teacher C explained that her students decided that they would each wear shoe and one rollerblade home so that the foot with the blister did not get worse. This text excerpt was a good example of life skill problem solving because it showed how these students had to work through the real-life problem they were facing and find a way to solve the issue. Teacher D shared ways that she provides her students with practice life skill problem solving. For instance, they practiced shelter making and had to figure out how to best absorb it reflect heat depending on the setting.

This text excerpt was a good example of life skill problem solving because students had to work through a problem they could easily face out on their own.

The third emergent code that emerged from the data found in those excerpts coded with the a priori code real problems to solve was STEM challenges to solve. For this emergent code, teachers shared how they used STEM based activities with students to help in the development of the 21st-century skill of problem-solving. STEM challenges allowed students to solve a problem in the context of science, technology, engineering, and/or math. For example, Teacher D shared a paper plate maze STEM challenge that she did with her students, in which they were to make a marble maze using materials from around the house. In this challenge, the students were to brainstorm, make blueprints and prototypes, make necessary changes, and then test their design. This text excerpt is a good example of STEM challenges to solve because it required students to use multiple STEM pieces to complete the project. While Teacher D shared a more simplistic STEM challenge, Teacher B shared how every couple of months her student would build computers from scratch. With each computer built, the designs increased in difficulty. This text excerpt is a good example of STEM challenges to solve because it involved a student solving the problem of finding the build of computer that worked appropriately and met the needs of the user. In another post on STEM project, Teacher F shared how she had her students make a penguin that would light up out of connective dough. In this activity the students could design their penguin to look however they wanted it to, but learned that if the connective dough touched too much it would not work. Therefore, this text excerpt is a good example of STEM challenge problem to

solve because students were required to solve the problem of getting the penguin to light up using various aspects of science, engineering, and math. In an activity a little less technologically involved, Teacher K shared how her and her student were building a tower together with Duplo blocks when the top section kept falling off each time another piece was added. The student discovered that this kept happening because the tower was uneven and had more gravity on one side making it a simple lesson on Newtonian physics. This text excerpt is a good example of STEM challenges to solve because it showed how the student had to use simple engineering or scientific facts to make the tower stand tall.

The final code that emerged from the data in relation to this a priori code was simple problem to solve. Data did not produce many codes on this particular emergent code. For this emergent code, teachers shared how they presented students with a problem that had one specific solution that they had to find. These activities simply helped confirm something that students had learned. For example, Teacher C shared about a science experiment that they did in which they had to hypothesize about what color would come out as an end result. In another example, Teacher C shared how she had her students guess what item was in a plastic egg based on the sound it made. These text excerpts are good examples of simple problem to solve because they can simply ask for the answer or open the egg. Teacher F shared more generally how she could have her students use the simple directions given to create a pumpkin catapult. This text excerpt is a good example of simple problem to solve because the students can follow the directions given rather than trying to figure out how to make a catapult on their own.

Creating inquiry environments and supports. For the a priori code of creating inquiry environments and supports, the data led to the emergent codes of *assessment choice, curious classroom setup, open-ended assignments,* and *student-driven topics.* These methods of creating inquiry environments and supports described the different approaches that these homeschool teachers used to provide students with a classroom environment in which they have the freedom to choose the task to complete that shows their understanding of content learned. For the emergent code of assessment choice, teachers shared a variety of methods they used to allow students to their understanding of what was learned without taking a traditional test. For example, Teacher A shared how instead of giving her students a cumulative final in chemistry, she had them put together a presentation with the only requirement being that they made it clear they understood the main concept from every chapter studied. This text excerpt is a good example of assessment choice because the teacher allowed her students to choose what to do to show their understanding of what they had learned in chemistry that school year. Teacher A also shared that at the end of unit studies she would have her students complete several different projects to show what they had learned. Although students were given projects to complete this text excerpt is a good example of assessment choice because they were able to choose what to show in the project and how to complete it to show what they had learned.

For the emergent code of curious classroom setup, teachers shared a variety of ways they setup the "classroom" to pique their students' interest in a topic. For example, Teacher F shared more generally how to design a classroom space that promotes

discovery and will pique students interests in various topics. In one text excerpt she suggested that before designing this space, the student's interests, goals, and understandings should be considered so that their natural curiosities are guided. This text excerpt is a good example of curious classroom setup because it explained how to create a learning space that meets students' needs. Teacher C shared how before beginning a unit study on the Solar System, how she sparked an interest in her students by taking them to Space and Science Center because there is an area with several hands-on activities that the students can do. As part of this unit study, Teacher C included a study on Earth, which included several science experiments, such as Making Groundwater and How Folds Mountains are Made to continue to pique their interest and answer any questions they had about the Earth. These text excerpts are good examples of curious classroom setup because students are exposed to a variety of activities and learning spaces that would encourage their interest in the Solar System and the Earth. In another post related to science topics, Teacher A shared project ideas that she provided her students with as a way to spark an interest in various science topics. For instance, she allowed them to choose to create a salt dough map to show their understanding of landforms, make a YouTube video that would explain scientific concepts behind a specific experiment, or make an arachnid out of play dough showing all the parts. This text excerpt is a good example of curious classroom setup because students are encouraged to try the experiments to gain a better understanding of those specific science concepts. Teacher T shared in a more general way how to provide students with a learning environment that piques their interest in a topic. For example, she stated that

they should be provided all the resources, tools, books, and anything else that they would need to promote their interest in STEM related learning. This text excerpt is a good example of curious classroom setup because she provided students with the tools and resources necessary to encourage this type of STEM learning, while further developing their understanding of various STEM concepts.

For the emergent code of open-ended assignments, teachers shared a variety of methods they used to expose their student to ideas but still allowed them to decide how or what to learn. For example, Teacher Q shared how one day when they were outside, they saw a caterpillar and her student was curious what kind it was and what kind of butterfly it would become so the teacher encouraged the student to research to find out. This text excerpt is a good example of open-ended assignments because by being outside and engaged in nature the student was exposed to ideas but was not told what to observe for further study. Teacher B also shared how she engaged her students in open-ended assignments by exposing them to various ideas but still allowing them to choose what to learn about. For instance, during an Animals of the World Geography unit she had her students write down all of their favorite animals on a post-it notes, then research those animals. Like Teacher B, Teacher A gave her students a general topic to research but her students were able to choose the specific slave they researched and what authentic costume to create. These text excerpts are good examples of open-ended assignments because although there were certain things they had to find in their research they were free to choose exactly what to study. Teacher A also shared more generally about ways she provides her students with opportunities to engage in open-ended assignments. For

example, she gives her students a list of projects to choose from and has them choose 10 that includes a mix of hard/easy, research/creative, and writing/non-writing. This text excerpt is a good example of open-ended assignments because students are given a choice in what projects to complete to show content knowledge.

For the emergent code of student-driven topics, teachers shared how they provided students with a variety of manipulatives or resources but still allowed students to choose which direction the unit went. For example, Teacher R shared how she used to projects to make history hands-on. They had a designated project day where her student could choose what to make related to what they had been studying, such as buildings and pottery. This text excerpt is a good example of student-driven topics because it showed how students were given ideas but were not told exactly what to do or how to do it. In another post based on a history unit Teacher A shared how she had her students choose a famous figure from the Civil War, then prepare a file folder biography of that person. They were able to choose what to include and how to include the information they learned; therefore, this text excerpt is a good example of student-driven topics. Teacher A also shared more generally about ways that she provides her students opportunities to engage in topics of their choice. For instance, she challenges them to find a worthy cause that they would like to support, then come up with a plan to do so. This text excerpt is a good example of student-driven topics because students are given the resources they need but are allowed to choose what kind of project to complete to raise money for the cause they want to support.

Cross-Disciplinary Knowledge

Cross-disciplinary knowledge is the 21st-century skill addressed in RQ 3. This skill had 83 out of 390 total codes (21.3%) across all the 21st-century skills. See Table 8. During level one coding, a total of 83 codes from 87 blog posts were assigned the a priori code *cross-discipline content*. The total frequency of codes, by teaching philosophy for the cross-disciplinary knowledge 21st-century skill are shown in Table 13. The blog posts authors using the literature-unit studies philosophy showed 51 codes out of a total of 83 (61.4%), while18 codes out of a total of 83 (21.7%) came from those associated with the Charlotte Mason philosophy. Those blog authors who were described as undeclared showed one code out of 83 (1.2%) for this a priori code of cross-discipline content.

For those blog posts authors associated with the literature-unit studies teaching philosophy, results showed 51 codes out of a total of 83 (61.4%), while 18 codes out of a total of 83 (21.7%) came from blog posts authors associated with the Charlotte Mason philosophy. See Table 15. Six codes out of 83 (7.2%) came from blog posts authors associated with the interest-led teaching philosophy, while those blog authors associated with the unschooling and Waldorf-Holistic philosophies showed three codes out of 83 (3.6%), see Table 15. For those blog posts authors associated with the Montessori and undeclared teaching philosophies, showed one code out of 83 (1.2%). For the 21st-century skill cross-discipline content, like with the skill of communication and collaboration, those teachers associated with the literature-unit studies teaching philosophy used this skill the most.

Table 15

Level 1 Code Frequency for Cross-Disciplinary Knowledge by Teaching Philosophy (Percentages in Parenthesis)

Teaching philosophy	Cross-discipline content (n = 83)
Charlotte Mason	18 (21.7%)
Literature –Unit Studies	51 (61.4%)
Montessori	1 (1.2%)
Unschooling	3 (3.6%)
Waldorf-Holistic Approach	3 (3.6%)
Undeclared	1 (1.2%)
Interest-Led	6 (7.2%)

When looking for the a priori code cross-discipline content in each blog post it was necessary that the homeschool teacher shared ways that their students were engaged in activities that required them to use skills or knowledge from across multiple disciplines to find solutions to a problem or set of problems. Text excerpts in relation to this code could simply involve students finding and reading texts that related to science or history. Others may share how they used art projects to show what their student(s) had completed to show understanding of topics in history.

During level two coding, it was clear that cross-discipline content could be divided into those activities that integrated language arts (LA) skills and those that did not. Level two coding resulted in four emergent themes of cross content with LA, and four emergent themes of cross content not related to language arts. Tables 16 and 17 show the frequencies level two codes for cross-discipline content in relation to the special needs. For those emergent themes related language arts, the following emerged *history/LA, math/LA, art/LA, and science/LA*. For history/LA, 13 codes out of 34

(38.2%) came from blog posts authors who taught students who were gifted, while only three codes out of 34 (8.8%) came from those who taught students who were twice exceptional. For math/LA, three codes out of three (100%) came from those blog posts authors who had not identified the special need of their student(s). For art/LA, one code out of three (33.3%) came from blog posts authors who taught students with autism, while two codes out of three (66.7%) came from those who had not specified the special need of their student(s). For science/LA, three codes out of 25 (12%) came from blog posts authors who taught students who were ADHD. Those blog posts authors who taught students with autism showed the same, three codes out of 25 (12%).

For those not related to language arts I found the emergent themes *history/art, math/science, science/art,* and *science/history.* For history/art, nine codes out of 19 (47.4%) came from blog posts authors who taught students who were gifted, while 1 out of 19 (5.3%) were from those who taught at least one student with autism. For math/science, four codes out of nine (44.4%) came from blog posts authors who taught students who were twice exceptional, whereas only one code out of nine (11.1%) were from those who taught students with autism. The science/art emergent theme showed low code counts as well. Those blog posts authors who taught students with ADHD showed two codes out of 10 (20%), while three out of 10 (30%) were from those blog posts authors who did not specify the special need of their student. For science/history, six codes out of eight (75%) came from blog posts authors who taught students who were twice exceptional, while the other two codes out of eight (25%) were from blog posts authors who had not specified the special need of their student(s).

Table 16

Level 2 Code Frequency for Cross-Disciplinary Knowledge of Language Arts (Percentages in Parenthesis)

	Cross-discipline content			
Special Need	History/LA (n = 34)	Math/LA (n = 3)	Art/LA (n = 3)	Science/LA (n = 25)
ADHD	4 (11.8%)	0 (0%)	0 (0%)	3 (12%)
Autistic	3 (8.8%)	0 (0%)	1 (33.3%)	3 (12%)
Gifted	13 (38.2%)	0 (0%)	0 (0%)	0 (0%)
Hearing impaired	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Reading disability	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sensory processing	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Twice exceptional	3 (8.8%)	0 (0%)	0 (0%)	11 (44%)
Not specified	11 (32.4%)	3 (100%)	2 (66.7%)	8 (32%)
Behavior disorder	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 17

Level 2 Code Frequency for Cross-Disciplinary Knowledge not Language Arts (Percentages in Parenthesis)

	Cross-discipline content			
Special Need	History/Art (n = 19)	Math/Science (n = 9)	Science/Art (n = 10)	Science/History (n = 8)
ADHD	3 (15.8%)	1 (11.1%)	2 (20%)	0 (0%)
Autistic	1 (5.3%)	1 (11.7%)	1 (10%)	0 (0%)
Gifted	9 (47.4%)	0 (0%)	0 (0%)	0 (0%)
Hearing impaired	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Reading disability	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sensory processing	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Twice exceptional	0 (0%)	4 (44.4%)	4 (40%)	6 (75%)
Not specified	6 (31.6%)	3 (33.3%)	3 (30%)	2 (25%)
Behavior disorder	0 (0%)	0 (0%)	0 (0%)	0 (0%)

For the a priori code of cross-discipline content, the data led to the following emergent themes related to LA, history/LA, math/LA, art/LA, and science/LA. These emergent themes described the ways teachers used knowledge from LA along with history, math, art, or science to solve a problem or set of problems. For the emergent theme history/LA, teachers shared a variety of ways students used knowledge from both

LA and history to complete a task or solve a problem. For example, Teacher A shared how during a history unit on Vikings she incorporated reading and writing by researching what Vikings were like then writing a summary on their findings. This text excerpt is a good example of history/LA because students took a topic that was history related and practiced writing, a LA skill. Teacher S shared more generally about ways that she provides her students with opportunities to use knowledge from multiple disciplines to complete a task. For instance, she used the book Lord of the Rings to launch into both literary analysis and medieval British literature activities. This text excerpt is a good example of history/LA because the students are using a classic fantasy story to learn necessary literary analysis skills, as well as gain knowledge of medieval history. Similarly, Teacher O used a fantasy series to teach history and LA concepts. For instance, her students read one of the Magic Tree House books that gave facts about ancient India, the Taj Mahal, elephants, and cobras. Because there were several cases where bad sentence structure was noticed, she also used it to teach about sentence fragments and run-on sentences. This text excerpt is a good example of history/LA because by reading the book students were able to learn about important historical topic, build their reading and comprehension skills, as well as engage in lessons on important literacy concepts. While some teachers use a fantasy type text to build both history and LA skills, others use documentaries on selected time periods to incorporate LA activities, such as writing and grammar. Teacher R shared how she used a documentary on Napoleon to cover history, grammar, and writing assignments for her student. This text excerpt is a good example of history/LA because the student was required to apply what

they had learned about Napoleon to the grammar and writing assignments they were given.

For the emergent theme math/LA, teachers shared a variety of ways they incorporated LA concepts into math lessons. For example, Teacher E shared how using the numbers of Pi as an inspiration teacher could have their students write a story. Teacher E also shared more generally about how there are several books about Pi and other math concepts that could be used to increase reading skills while also giving more understanding of various math concepts. These text excerpts are good examples of math/LA because they engaged students in reading and writing activities while also learning about Pi or other math related topics. Math and LA concepts can be taught simultaneously to any age group, while Teacher E shared ideas for older students Teacher J shared how she incorporated both subjects for her early grade school students. For instance, Teacher J shared how she used the book, The Gnome's Gemstone to introduce numbers 1-12, as well as addition, subtraction, multiplication, and division. Each lesson built on the previous lesson and was a great read aloud that added some fun to what they were learning. This text excerpt is a good example of math/LA because students were engaged in listening to the story while learning basic math skills.

For the emergent theme art/LA, teachers shared various ways they used both art and LA in different activities and projects. For example, Teacher E had her students do research on fashions from the Middle Ages and then make their own clothing to wear from that time period. Since knowing how to research is an important LA skill, this text excerpt is a good example of art/LA because students were required to research the

fashions of that time period then create their own. During a history unit on the Vikings, Teacher A had her students research the swords and shields used by the Vikings use a sturdy material of their choice to make their own. This text excerpt is a good example of art/LA because it again helps students build adequate research skills and make a creation to match their learning. Teacher R shared more generally how books can be paired with crafts. This text excerpt is a good example of art/LA because it shows another way that reading can be used in conjunction with art activities. While some teachers used books or research along with art activities, some also incorporated writing skills into art activities. For example, Teacher L shared how her students like to create invitations using their favorite Spielgaben set. This text excerpt is a good example of art/LA because in creating the invitations students are practicing their writing skills, while also getting to draw, paint, or color.

For the emergent theme science/LA, teachers shared a variety of ways they engaged students in activities or projects that included both science and LA topics or concepts. For example, Teacher P shared how during a study on climates and biomes, her student decided to write a graphic novel that illustrated the differences between several different biomes and included the weather, flora, and fauna for each. This text excerpt is a good example of science/LA because the student was engaged in a writing activity that was focused on the science topic of biomes. Teacher T also shared how she had her students write and draw pictures about what they learned in regards to nature in a Nature Journal. Teacher N shared more generally about how science and LA can be woven together after looking at rock formations. For instance, Teacher N shared the idea

of having students complete a creative writing activity on rock formations. These text excerpts are good examples of science/LA because students were involved in writing assignments that were based on their findings in nature. Teacher S shared how after her and her students spent some time observing nature and wildlife, they went inside to research what they had seen. They focused their research on a caterpillar. This text excerpt is a good example of science/LA because students were involved in research on a caterpillar they had seen during their observation. While some teachers shared about science related research and writing assignments, others shared how they used books to inspire science projects. For example, Teacher E shared how after having students read the book, The Secret Garden, they could make their own terrarium. This text excerpt is a good example of science/LA because students are to first read the book, which helps improve reading and comprehension skills, then create a terrarium from what they learned.

For those not related to language arts I found the emergent themes history/art, math/science, science/art, and science/history. For the emergent theme history/art, teachers shared a variety of methods in which they used both history and art in projects and activities. For example, in a unity study on Vikings, Teacher A shared how they learned that a Viking warship was called a longship, then she had her students draw and label each part. During another part of this Viking unit, Teacher A shared how one of the projects that students could choose was to research Viking clothing, then either draw pictures of what they saw using descriptions or make their own Viking clothing. These text excerpts are good examples of history/art because students were taking what they

learned from the history of Vikings and applying it to drawing or other creative art related projects. Teacher R also shared how she engaged her students in a drawing activity by having her students draw the flag of each country that they studied. While some teachers incorporated art through drawing activities, others had their students make actual historical objects. For instance, Teacher E shared that when studying WWII instead of having students just read about the types of planes that were used having them make one makes history more exciting. This is a good example of history/art because students were able to make history hands-on by making their own WWII plane. Other teachers took art a step further by including technology. For example, Teacher E shared how students could build in the Middle Ages part of the Minecraft game. Because so many parts of every field are done via technology this text excerpt is a good example of history/art because not only will students learn about the Middle Ages but will also gain important 21st-century skills related to technology.

For the emergent theme math/science, teachers shared a variety of methods in which they used both math and science in projects and activities. For example, during a science unit study on apples, Teacher J shared that after students learned about the various kinds of apples, she had them ask each family member what their favorite kind of apple was, then create a bar graph showing the results. This text excerpt is a good example of math/science because after students learned about the different kinds of apples they took a survey and put the results into a bar graph, which is an essential math skill for students to learn. Teacher J also more generally shared how in that same unit they could bake an apple pie together which would incorporate fractions and

measurement. This text excerpt is a good example of math/science because after students have learned about apples, they can apply math concepts, such as fractions and measurement to make a delicious treat. While some teachers shared ways to use both math and science with younger students, Teacher B shared how she used it with her older student. For instance, Teacher B shared how her oldest built their first computer with help, but later moved on to master an executive function exercise planning of a computer build for a friend. This step led to later include more math, such as budget spreadsheets for new builds and the analysis of cost vs. performance for each computer build. This text excerpt is a good example of math/science because the student is using math skills to complete a real-life science, STEM related project.

For the emergent theme science/art, teachers shared a variety of methods in which they used both science and art in projects and activities. For example, Teacher P shared how during a study of friction a spontaneous art project emerged. In this project, her students first timed how quickly marbles rolled down plain paper, then dotted the paper with paint and rolled the same marbles down to compare the difference in time the paint made. This text excerpt is a good example of science/art because students were not only engaged in a science experiment on friction but included a fun art activity by adding paint. Teacher P also shared how when her students were studying paramecium it led to them creating paramecium stuffed animals out of felt. This text excerpt is a good example of science/art because students were inspired by something, they learned in science to complete an art related project. After learning about tectonic plates and volcanoes, Teacher P shared how her oldest student decided to paint a volcano in

watercolors, take a picture of it, then upload it to an editing program to label its parts. This text excerpt is a good example of science/art because the student was involved in painting a volcano and labeling it to show understanding of what had been studied in science. Teacher B shared how during a unit study of owls her student learned to draw an owl using chalk pastels. In another bird related unit, Teacher Q shared how her student took a sketchbook to the local raptor center and zoo the birds they had studied in their habitats. The text excerpts are good examples of science/art because students were required to draw birds they had studied both in and outside of their natural habitat. While most teachers share about art activities in relation to drawing or painting, others shared about experiments that incorporated art concepts. For instance, Teacher C shared how they added a color mixing twist to the basic baking soda and vinegar chemical reaction to see what happened. This text excerpt is a good example of science/art because while learning about the chemical reaction between baking soda and vinegar they were able to get a brief art lesson on mixing colors.

For the emergent theme science/history, teachers shared a variety of methods in which they used both science history in projects and activities. For example, Teacher A had her students figure out how the design of the Vikings longship allowed it to be so fast. This text excerpt is a good example of science/history because while students were learning about the Vikings and their warship, they were also engaged in finding the science behind the speed of the ship. Science can easily be incorporated into map work and the study of countries. For instance, Teacher B shared how because her student was very interested in reptiles, they incorporated it into their map work and learned where

different reptiles could be found. In another post, Teacher B shared how during a unit on birds they used a map and located the habitats of exotic birds. These text excerpts are good examples of science/history because students were learning about animals they were interested in along with where around the world they could be found, which resulted in stronger map skills.

Co-occurrence

Co-occurrence refers to instances where codes for a single text excerpt overlap. The data showed there were 35 times that the a priori code cross-discipline content and creating inquiry environments and supports were assigned to the same excerpt. The combination of the a priori codes, sharing and creating inquiry environments and supports co-occurred 20 times while sharing and cross-discipline content co-occurred 27 times. Creating inquiry environments and supports co-occurred with real problems to solve 19 times. Data also showed that the a priori code, creating inquiry environments and supports was found to be used the most by itself as well as in conjunction with other a priori codes.

Discrepant Data

Discrepant data are data that vary, do not agree, or challenge the data found in the study (Merriam & Tisdall, 2016). When analyzing the data there was no data found that varied, disagreed, or challenged what had been found. Therefore, in this study there was no discrepant data.

Summary

In summary, the blog posts shared by homeschool teachers with students with special needs as they related to their experiences in using PBL showed that their experiences reflected the development of the 21st-century skills (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge. My first related research question related to the 21st-century skill, communication and collaboration. Results showed that more homeschool teachers emphasized the skill of communication, both visually and verbally than the collaboration piece of this particular 21st-century skill. For sharing, the results showed 66 codes out of a total of 390 (16.9%). These findings show that the skill, communication and collaboration were in fact, reflected in what homeschool teachers with students with special needs share publicly. My second related research question focused on the 21st-century skill, problem-solving and critical thinking. While results showed that more homeschool teachers were sharing how they create inquiry environments and supports than the other codes, there was still evidence of the other codes that teachers shared about that reflected the use of the 21st-century skill, problem-solving and critical thinking. For the 21st-century skill of problem-solving and critical thinking, 124 codes out of a total of 390 (31.8%) were from the a priori code of creating inquiry environments and supports. My third related research question focused on 21st-century skill, cross-disciplinary knowledge. Results showed that the eight emergent themes found in this skill could be divided into those related to an LA focus, and those that did not. Results from level one a priori code, cross-discipline content, showed 83 codes out of a total of 390 (21.3%);

therefore, showing that the use of the skill, cross-disciplinary knowledge is reflected in what homeschool teachers with students with special needs share publicly. Chapter 5 will provide further interpretations of the findings, any limitations and implications of this study, as well as recommendations for future studies on homeschool teachers with students with special needs.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this qualitative study was to explore the PBL experiences of homeschool teachers who work with students with special needs and how PBL experiences reflect 21st-century competencies. The methodological approach used in this qualitative study was deductive-dominant content analysis. Mayring (2016) stated that when using this approach, the researcher summarizes, codes, and compares the content of various texts. The deductive-dominant qualitative content analysis method was appropriate for this study because a deductive mode was used during the data analysis process (Armat et al., 2018). Using this approach allowed me to identify certain words and content from selected archival blog posts that matched my conceptual framework, thereby gaining more of an understanding of homeschool teachers' experiences in using PBL with their students with special needs. These posts were collected and analyzed to answer my research questions. This study was conducted based on a gap in research, as well as to gain knowledge on how the publicly shared experiences of homeschool teachers with students with special needs who used PBL reflected the 21st-century skills (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge.

Central Research Question

How do the experiences of homeschool teachers implementing PBL with students with special needs reflect 21st-century skills?

The key findings show that the blog posts of homeschool teachers with students with special needs who implemented PBL do indeed reflect the 21st-century skills (a) communication and collaboration; (b) problem-solving and critical thinking; and (c) cross-disciplinary knowledge. For the 21st-century skill communication and collaboration, the themes that arose were sharing and connecting. Upon further analysis of the data, the theme sharing was split into two emergent themes, visual and verbal. The data also led to the emergent themes of connecting with an expert and collaborate/work together for connecting. For the 21st-century skill problem-solving and critical thinking, the themes that arose were reflection, encourage multiple solutions, real problems to solve, and creating inquiry environments and supports. Again, further analysis showed emergent themes in each. For reflection, ask questions and apply what is learned to solve a problem emerged. For encourage multiple solutions, the emergent subthemes were no set procedure and failure is okay. -For real problems to solve, the emergent subthemes were mathematical problem solving, life skill problem solving, STEM challenges to solve, and simple problem to solve. For creating inquiry environments and supports, assessment choice, curious classroom setup, open-ended assignments, and student-driven topics emerged as subthemes. For the 21st-century skill cross-disciplinary knowledge, the themes that arose were split into two categories, those that included LA and those that did not.

Interpretation of the Findings

The blog posts of homeschool teachers with students with special needs who implemented PBL were viewed through Kereluik et al.'s (2013) 21st-century learning

model to see if they reflected 21st-century skills. It was important that I avoid generalizations because they can cause readers to draw inaccurate conclusions about the study results. Some of the findings from the current study confirm, disconfirm, or extend the findings from the literature. I interpreted these results by research question.

Research Question 1

Research Question 1 was: *How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skills of communication and collaboration?*

Findings from this study show that the blog posts of homeschool teachers with students with special needs who implement PBL reflect the 21st-century skill communication and collaboration in a number of ways. The data show that like classroom teachers, homeschool teachers who implemented PBL provide students with opportunities to share their learning, both verbally and visually. As part of PBL projects, students in traditional classrooms often communicate visually (Crist et al., 2017) and verbally (Aydin, 2016; Keshwani & Adams, 2017). Data from this study showed that homeschool students also receive practice using these skills. The findings of this study extend what current literature shows because homeschool teachers gave their students opportunities to share what they had learned, showing that homeschool students were being given opportunities similar to classroom students to improve their communication skills while working on PBL activities.

In relation to collaboration, studies showed that some homeschool teachers encourage collaboration like their classroom teacher counterparts (Gann & Carpenter,

2018; Longo, 2016). This study showed that homeschool teachers provided collaboration in similar ways to classroom teachers. While classroom students work with others in their class during PBL activities (Gann & Carpenter, 2018), homeschool students often worked with siblings. Compared to the other 21st-century skills examined in this study, communication and collaboration emerged the least. This data may confirm that homeschool teachers of students with special needs struggle, like their classroom teacher counterparts (Opitz, Wittich, Hasel-Weide, & Nuhrenborger, 2018), to find opportunities for students with special needs to practice collaboration skills. Although STEM activities often promote collaboration (Gann & Carpenter, 2018) and several homeschool teachers shared about their STEM experiences, the collaboration piece was often missing from the experiences shared in the selected blog posts. Because this study did not produce much data on how students were collaborating with others, this may mean that homeschool teachers either do not see the importance of building this skill or they are just not sharing about it in their blog posts.

Research Question 2

Research Question 2 was: *How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skills of problem-solving and critical thinking?*

Data from this study show that homeschool teachers with students with special needs who implement PBL are providing their students' opportunities to practice the 21st-century skills of problem-solving and critical thinking. Out of all three 21st-century skills focused on in this study, problem-solving and critical thinking was the most

prevalent. Table 7 shows that the codes from these skills made up 58% of the total codes, whereas communication and collaboration and cross-disciplinary knowledge each made up about 21% of the total codes. The a priori codes reflection ~~reflections~~, creating inquiry environments and supports, encourage multiple solutions, and real problems to solve, were all found in the data collected from the selected blog posts.

The a priori code creating inquiry environments and supports under the problem-solving and critical thinking skills was found more than any other code in this study. This is a significant finding of this study because it shows that creating inquiry environments is a pedagogical strength that homeschool teachers may have. Literature shows that when implementing the PBL approach, teachers are better able to meet the needs of diverse learners when they can set up the classroom in a way that sparks and encourages students to engage in meaningful activities that are of interest to them (Netcoh & Bishop, 2017). In this code, the emergent codes assessment choice, curious classroom setup, open-ended assignments, and student-driven topics were found. Data showed that the emergent code of curious classroom setup and student-driven topics were coded the most times in this a priori code. Data showed that homeschool teachers excelled at transforming their homes into environments where their students could explore topics they enjoyed and that teachers often gave students experiences outside the home that aligned with students' curiosity. This data supports previous research showing that homeschool teachers use a variety of strategies including individualized instruction, self-directed learning, (Gann & Carpenter, 2018) responsive pedagogy (Tilhou, 2019), and differentiated instruction (Francis, 2018). While homeschooling models have been

explored (Tilhou, 2019), little research has been done on the differences in homeschooling philosophies. However, it is likely that the various philosophies represented by the homeschool teachers in this study (see Table 5) have a common factor that the teachers who employ them seek to provide student-centered learning, while they may go about it in different ways. It is possible that homeschool teachers are able to allow students' curiosity and learning preferences to determine curricular topics and how students share what they have learned, more than a traditional classroom teacher would be able to do, simply because they have fewer students. This should be explored further in future research. Assessment choice and open-ended assignments allow students to decide on how they learn and how they show what they learn. While these were codes that emerged, they emerged in smaller numbers compared to others for this a priori code.

It should be noted that teachers who taught gifted or twice-exceptional students seemed to give students more choice. Additionally, teachers who had not specified the nature of the special need of their student also had higher occurrences of open-ended assignments. Literature shows that by giving students a voice and a choice in their learning they become more interested (Larmer & Mergendoller, 2010) and are more willing to learn (Duda, 2014; Larmer et al., 2015a; Sahin & Top, 2015) and is a common pedagogical practice with gifted students (Chandra Handa, 2019; Jolly & Matthews, 2017; Kula, 2018) but also with students with special needs (Duda, 2014).

The other a priori codes show that homeschool teachers provide their students with real problems to solve, encourage reflection, and encourage multiple solutions as a way to develop the 21st-century skills of problem-solving and critical thinking. The a

priori code real problems to solve was the next highest code used with this 21st-century skill. In this code, the emergent codes mathematical problem solving, life skill problem solving, STEM challenges to solve, and simple problem to solve were found. While each of these emergent codes was used multiple times, findings show that the selected homeschool teachers most often used the emergent code of life skill problem-solving. This may mean that because they teach students with special needs, they felt that when it came to the 21st-century skill of problem-solving and critical thinking, more focus was needed on making sure the student developed adequate social and independent living skills. Existing research shows that students often struggle less when they are provided with a learning environment that promotes authentic learning, is catered to their needs (Liberty & English, 2016), and allows them to learn at their own pace (Thomas, 2016). My study confirmed that homeschool teachers are providing such authentic experiences with their special needs students. Although data from this study did not show a high number of homeschool teachers sharing about their experiences using STEM, it is being used by some homeschool teachers, confirming previous research that shows it gives students freedom to learn and explore (Efford & Becker, 2017) and leads to improvement in the 21st-century skills, problem-solving, critical thinking, communication, and collaboration (Efford & Becker, 2017; Hall & Miro, 2016; Hwang et al., 2015).

From the a priori code, reflection the emergent codes ask questions and apply what is learned to solve a problem were found. Both of these emergent codes were used almost equally. The emergent code, ask questions was used more by homeschool teachers with students who were twice exceptional, while the emergent code, apply what

is learned to solve a problem was used most by those homeschool teachers who taught students with autism and those who had not specified the special need they taught. This may mean that homeschool teachers with students with special needs are understanding the need for providing time for reflection and are working to incorporate it more into their learning activities. Francis (2018) found that although the homeschool teachers she studied leaned toward more traditional teaching and learning strategies, they still saw the need for and provided their students with learning tasks that are interesting and relevant to them. Studies of classroom teachers show that encouraging students to think about and ask higher-level questions, think deeply about what they are learning, and engage in group discussions effectively builds 21st-century skills, specifically critical thinking (Ata Akturk et al., 2017; Martin et al., 2015). Data from my study confirms that homeschool teachers try to include similar opportunities for student reflection. Literature shows that when teachers pique students' interest but allow flexibility, students become driven to expand their knowledge further and as a result ask questions (Dole et al., 2016b; Hung, 2016; Larmer & Mergendoller, 2010). However, this study extends knowledge in this area by showing that homeschool teachers are providing reflection opportunities for students with special needs.

Another a priori code used for the 21st-century skill for problem-solving and critical thinking, albeit not as strong as other themes, was encourage multiple solutions. In this a priori code, the emergent codes of failure is okay, and no set procedure was found. While there were some homeschool teachers with students with special needs who encouraged this type of learning, it seems that more focus was put on providing

students with real problems to solve and creating inquiry environments and supports. This may mean that their students with special needs struggle with not having specific guidelines to follow and need specific tasks that have a clear answer. This may also mean that students with special needs do not excel by learning through trial and error or that the selected homeschool teachers are not sharing much about their experiences on this matter. However, more research is needed to understand the reasons homeschool teachers make decisions regarding 21st-century skill building. Classroom teachers found that when students had to come up with ways to solve a problem, they were able to excel because they felt the freedom to learn and make mistakes (Duda, 2014). STEM activities are a great way for students to learn through trial and error. Although results from this study do not show high numbers for this code, research shows that lower performing students show higher growth rates than their atypical counterparts when teachers implement STEM PBL (Han, Capraro, & Capraro, 2015). Research shows that STEM programs aligned to the Montessori philosophy, encourages learning to happen more organically, primarily because students are taught to solve meaningful community and global problems in relation to their interests and prior knowledge (Livstrom, Szostkowski, & Roehrig, 2019). Research also shows that STEM learning, like PBL, encourages students to explore their curiosities around different topics, therefore, encouraging them to try new strategies and learn through mistakes (Gann & Carpenter, 2018). Therefore, this study extends previous research to the population of homeschool students with special needs.

What was interesting about the findings from the emergent codes, failure is okay and STEM challenges to solve was that they had the most codes from teachers who taught students with a sensory processing disorder, 75% and 50% respectively. See Tables 12 and 13. This may mean that teachers of students with sensory processing disorders are finding success when their students are engaged in learning that is hands-on and conducive to trial and error. However, more research is needed. Studies show that students with sensory needs learn best when put in a learning environment that best meets their learning needs and allows them to direct their learning (Al-Oaryouti, Nachabe, & Leeder, 2017). In relation to problem-solving and critical thinking, classroom teachers who implement PBL have experienced success in further developing the problem-solving and critical thinking of their students with special needs (Duda, 2014; Lambert & Sugita, 2016), therefore, this study extends the understanding to homeschool teachers with students with special. Liberto (2016), a homeschool teacher, found that by creating a PBL environment for her students, they were able to overcome many of their learning challenges, and as a result, have fun learning. My study provides details of the experiences homeschool teachers are using to provide students opportunities to practice in this skill; therefore, extending current literature.

Research Question 3

Research Question 3 was: *How do publicly shared experiences of homeschool teachers implementing PBL with students with special needs reflect the 21st-century skills of cross-disciplinary knowledge?*

Data from this study show that homeschool teachers are providing opportunities for their students with special needs to practice the 21st-century skill, cross-disciplinary knowledge. Data showed that the homeschool teachers who applied a literature-unit teaching philosophy shared more about cross-discipline content than any other teaching philosophy identified in this study. This may mean that this type of teaching philosophy provides more opportunities for homeschool teachers to use multiple subjects at the same time. Research shows that like homeschool teachers, classroom teachers are finding more ways to incorporate related literature when teaching multiple subjects. For example, Brugar and Whitlock (2019) found that when given the freedom to do so, fifth-grade teachers purposefully chose texts that allowed them to integrate LA into their history instruction. Another study showed that classroom teachers incorporated various types of literature into their combined history and geology lessons (Dolphin et al., 2018). Homeschool teachers appear to integrate ideas across many different content areas.

This study further supports previous research that showed classroom teachers often teach communication and collaboration skills in multiple subject areas (Duda, 2014; Gothberg et al., 2016; Lambert, 2015; O'Keeffe & Medina, 2016). An interesting finding from this study was that more of the selected homeschool teachers shared about their experiences with cross-discipline content with using LA in conjunction with another content area. History was the next most used content area. Data showed that history was shared more in homeschool teachers blog posts when taught in conjunction with LA. In a review of the literature on the 21st-century skill, cross-disciplinary knowledge, high school students were often engaged in activities that crossed the content areas of either

LA and history or science and math (DiCamillo, 2015; Chung et al., 2017; English & King, 2015). The literature showed that students engaged in units combing historical topics and LA concepts were able to develop better their writing and communication skills of the topic they were studying, it also showed that students were more actively engaged (Moyer, 2016). Results from my study confirm the current literature showing that homeschool teachers also are developing the 21st-century skills of communication and collaboration while teaching multiple disciplines.

The co-occurrence, or overlap, of the two a priori codes cross-discipline content and creating inquiry environments and supports, show that this 21st-century skill often goes with the teaching of multiple content areas. Research has been done, about cross-discipline content (Boggs, Wilson, Ackland, Danna, & Grant, 2016) and creating student-directed learning environments (DeMink-Carthew & Olofson, 2017; Livstrom et al., 2019) by classroom teachers, but results from my study indicate that there may need to be more exploration of this in the homeschool setting, particularly in relation to supporting students with special needs. Findings from this study show that 20% of all codes showed that homeschool teachers taught using multiple disciplines. This skill might be more challenging for classroom teachers to teach because they have less control of how and what they teach. Whereas, homeschool teachers do not always divide their school day by subjects, but instead have the flexibility to incorporate multiple subjects when teaching a specific topic.

Conceptual Framework

The conceptual framework for this study was Kereluik et al.'s (2013) 21st-century learning model. Three skills were selected from the model for this study due to how they are associated with skills students build in PBL environments. One conclusion that came from the data related to the conceptual framework of this study was that homeschool teachers with students with special needs are sharing publicly about their experiences of providing their students with opportunities to develop 21st-century skills. Literature shows that classroom teachers found that the development of the 21st-century skill, cross-disciplinary knowledge was important for students with special needs and PBL is an effective way to incorporate this skill (Habok & Nagy, 2016; Zhang et al., 2014). The findings from this study confirm that like classroom teachers, homeschool teachers with students with special needs are also providing opportunities for their students to build these skills. Literature shows that when implementing PBL students have more opportunities to engage in real-life, meaning learning and as a result (a) problem-solving and critical thinking and (b) communication and collaboration skills are further developed (Lee et al., 2014; Scogin et al., 2017). Although findings from this study show that more homeschool teachers shared about their experiences with providing their students with opportunities to develop their problem-solving and critical thinking skills further, the selected blog posts showed evidence of the use of each of the selected 21st-century skills. This indicated that the skills chosen from Kereluik et al.'s (2013) 21st-century learning model were reflected in the blog posts of homeschool teachers with students with special needs.

Limitations of the Study

The limitations of this study are related to the research design. For this study, I used a qualitative deductive-dominant content analysis design, which brought about a couple of limitations. In this research design, researchers use previous findings or theories of the phenomenon that they are studying (Armat et al., 2018). Graneheim et al. (2017) stated that one limitation to this research design is the ability of the researcher to show how and why codes and themes were chosen logically. I used a priori codes related to the 21st century framework. Homeschool teachers may be implementing other 21st-century skills that were not included as part of this study. This is a limitation because if a researcher cannot show how codes were assigned, then there is an increased risk of producing a study that is not credible (Graneheim et al., 2017). However, I used a codebook (as suggested by DeCuir-Gunby et al., 2011) to ensure constant application of codes to my data.

Another limitation of this study is related to the limitation of time. With me being the only researcher for this study, I knew that it would take a significant amount of time to read and analyze the selected blog posts thoroughly. Therefore, it was necessary that I set a timeframe in which to have the data collected and analyzed so that the study was completed in a timely manner. According to Burla et al. (2008), the time taken to ensure intracoder reliability could have been a limitation, but through careful planning and setting a timeframe, I was able to avoid this limitation.

I did not use human participants in my study. Instead, I used archival blog data found using public online search engines. As a result, the third limitation is related to

sampling. I used 20 blog sites of homeschool teachers with students with special needs, which is not a large sample size, therefore, reducing the transferability of the study results. To help, I increase the transferability of this study. I used a variety of different blog authors whose blogs met all three of the inclusion criteria. From each of the selected blog authors, several blog posts were used as data to also help add variation in my sampling. According to Hargittai (2018), sociodemographic factors can have a significant impact on a study when big data, such as when social media data are used. Individuals with a higher socioeconomic status are often on more social media platforms and Web 2.0 technologies, which may indicate that the data gathered is from those who are more privileged (Hargittai, 2018). This fact may be a limitation to this study because the homeschool teachers selected were all bloggers and may fall into a higher socioeconomic group; therefore, meaning that they can provide their students with more opportunities than someone who is not as privileged. It is also possible that the similar demographic of being an individual who publicly shares about their homeschool classroom experiences include a specific personality that is not necessarily representative of the homeschool teacher population.

Recommendations

Recommendations for further research are based on study results and limitations of the study. The first recommendation is related to the finding that not many homeschool teachers with students with special needs share about their experiences with implementing PBL and how these posts reflect 21st-century skills. Therefore, more research needs to be done about what homeschool teachers with students with special

needs are sharing publicly about their experiences with implementing PBL and how these posts reflect 21st-century skills, so that deeper understanding on this phenomenon is gained. Furthermore, since this study focused only on three 21st-century skills, it is recommended that others studies be done looking at other 21st-century skills.

The second recommendation is related to the study finding of why more homeschool teachers use sharing (communication) than connecting (collaboration) in relation to the 21st-century skill communication and collaboration. Therefore, more research needs to be done about whether homeschool teachers with students with special needs are not providing more opportunities for their students to collaborate with others, either other homeschoolers or their siblings, so that deeper understanding may be had on how more opportunities for collaboration can be provided to homeschool students. Or if they are providing equal opportunities for communication and collaboration, research needs to be done to find out why they are not sharing more about the collaboration piece of this 21st-century skill. Interviews with homeschool teachers might provide additional insights into why they choose to teach certain skills with their students with special needs and to determine if skills not blogged about were also being taught.

The last recommendation is related to the limitations of this study. This study was done with multiple posts from 20 blog sites of homeschool teachers with students with special needs. While I used ten blog posts from one teacher's blog site, only three may have been used from another; therefore, future research could focus on equalizing the number of blog posts per homeschool teacher. Equalizing the number of blog posts would provide a more even review of what is being analyzed removing a single teacher’s

preferences from the final analysis. I also recommend that the number of posts used should be further equalized by the type of identified disabilities from the selected homeschool teacher blog sites. Additionally, because activities used to teach skills change to meet the age and ability of each student, an analysis done by student age might provide additional insights of how 21st-century skills are being taught to homeschool children with special needs.

Implications

This study will contribute to positive social change in several ways. First, at the individual level, findings from this study contribute to positive social change by showing that homeschool teachers who implement PBL with their students with special needs, provide opportunities for the development of the 21st-century skills, (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge. Results show that homeschool teachers are able to focus on specific skills and, as a result, more purposefully seek out the best ways to develop these skills for their students. Therefore, this study may provide homeschool teachers with a deeper understanding of how a more authentic learning approach, such as how PBL contributes to the active engagement and success of students, specifically those with special needs.

The second contribution that this study makes to positive social change is in relation to improved professional practice in the larger homeschooling community concerning the implementation of PBL with students with special needs. By finding what they are sharing on social media in regards to implementing PBL and 21st-century skills, I was able to provide evidence that homeschool teachers are using methods aligned with

the PBL approach and providing their students with special needs opportunities to practice 21st-century skills. This increased understanding may lead to more homeschool teachers with students with special needs purposefully designing individualized instruction targeting 21st-century skills for their students with special needs. While not all homeschool teachers refer to what they are doing as PBL, this study shows that they are implementing various teaching methods used in PBL and results may encourage others in the homeschool community to implement these strategies as well.

The last contribution and implications of this study are related to larger societal implications. The findings from this study show that homeschool teachers are providing opportunities for their students with special needs to practice important 21st-century skills in the PBL teaching they receive at home. If homeschool teachers have success and are able to provide individualized, authentic learning in a context where students have voice and choice and apply their learning to real-world problems, their students with special needs will likely become contributing members of society.

Conclusion

Over the last several years there has been about a 62% increase in the number of students being homeschooled (Russell, 2017), with the majority of these being students with special needs (Cook et al., 2013). Therefore, with so little known about what homeschool teachers with students with special needs are doing in relation to the implementation of PBL and whether or not students are learning 21st-century skills, more research was needed. The key finding for this qualitative content analysis study was that homeschool teachers with students with special needs are sharing implementing PBL

activities that reflect the 21st-century skills (a) communication and collaboration, (b) problem-solving and critical thinking, and (c) cross-disciplinary knowledge. The first main finding from this study was in relation to the 21st-century skills, communication and collaboration. This finding indicates that homeschool teachers succeed at providing their students with opportunities to share their findings, but need to incorporate more opportunities for them to collaborate with others. The second main finding was in relation to the 21st-century skills, problem-solving and critical thinking. Homeschool teachers succeed at creating inquiry environments and supports for their special need students by providing curious classroom setups, allow for student-driven topics, offering open-ended assignments, and giving students assessment choice. In relation to the 21st-century skills, cross-disciplinary knowledge, findings indicate that the selected homeschool teachers implemented activities and assignments that required students to use knowledge from across multiple disciplines. These findings show that homeschool teachers are providing their students with special needs with opportunities to practice 21st-century skills related to PBL. Before this study, there were questions as to whether or not homeschooled students with special needs were being given opportunities to practice 21st-century skills. This study showed that homeschool students with special needs are getting a lot of practice with essential 21st-century skills.

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Appendix: Blog Data Collection Instrument

Blog

Blog Title:
Blog Homepage URL:
Blog Site Code: Blog
Blog Author Code: Teacher
Teaching Philosophy:
Religious Affiliation:
Number of Students Homeschooled:
Special Needs Taught:

Criteria #1: Written by homeschool teacher: URL:
Criteria #2: Student with special needs is being homeschooled: URL:
Criteria #3: minimum 3 posts that reference T&L aligned to PBL fundamentals (URLs below)

PBL Fundamental: (date of post)
#1: URL to individual blog post (not homepage):

PBL Fundamental: (date of post)
#2: URL to individual blog post:

PBL Fundamental: (date of post)
#3: URL to individual blog post:

Additional Blog posts related to PBL (include the PBL fundamental that it aligns with)

PBL Fundamental:
#4: URL to individual blog post (not homepage):

PBL Fundamental:
#5: URL to individual blog post:

PBL Fundamental:
#6: URL to individual blog post: