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Teacher Perceptions of Technology-Enhanced, Collaborative, Project-Based Learning on Students in Mixed-Ability Classrooms

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Abstract

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MA, University of Montana, 2006

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Dissertation Submitted in Partial Fulfillment

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Abstract

The skill of collaboration is fundamental for every student as a future participant of a global society. Students with learning disabilities feel excluded amongst peers in a traditional classroom setting, specifically elementary students with learning disabilities in the area of collaboration. The overall purpose of this basic qualitative study was to explore elementary teacher perceptions of how students in mixed-ability classrooms collaborate using technology in a project-based learning (PBL) environment. Vygotsky's social constructivism theory informed this study by providing a framework for learning in social groups, specifically collaborative learning practices in a PBL environment. The research question in this study explored elementary teacher perceptions of using technology-based discussions to promote collaboration amongst students in mixed-ability classrooms in a PBL environment. Purposeful, snowball sampling was used to select nine teachers for interviews following a standardized, open-ended interview protocol. The resulting data were analyzed using inductive means to explore recurring patterns and emerging themes. The four major themes that emerged from the research were student preparation for collaboration, benefits and difficulties with collaboration, technology can increase student collaboration, and virtual collaboration has consequences and problems. Participants perceived technology as belonging in the elementary classroom when used to help students of mixed abilities collaborate in a PBL environment. The findings of this study could lead to positive social change by providing information to potentially help teachers meet the collaborative learning needs of all students in their inclusive classrooms, ultimately increasing all students' abilities to work collaboratively.

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Dedication

I dedicate my dissertation work to my family, whose love and support throughout this entire process has been what has fueled my fire to never give up. To my loving parents, Jim and Wendy, and my husband, Nick, and three beautiful children, Landon, Jory, and Marin, thank you for everything. You are my world.

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Chapter 1: Introduction to the Study

The traditional approach to education can create students who are not prepared to enter the world outside of a schoolroom, specifically elementary-aged students in mixed-ability classrooms in the area of collaboration (Schleicher, 2018). A challenge in an inclusive setting is students with learning disabilities often do not feel included amongst peers (Stiefel et al., 2018). Inhibited in participating actively, low-status students are often underestimated, and high-status peers ignore their efforts (Le et al., 2018). Furthermore, according to the Partnership for 21st Century Skills, the skill of collaboration is fundamental for students as future participants of a global society (Plucker et al., 2016). Learning and collaborating with peers regardless of ability is the right of every student (Kozleski, 2020). This is a social justice issue, and well-planned collaborative practices could address this concern; therefore, schools should require educators who design learning with the diversity of all students in mind (Kozleski, 2020). This is critical for all children but especially for students whose learning needs have been marginalized throughout history (Waitoller, 2020).

To combat the failure of a traditional approach to instruction, some teachers have begun to change how they teach by incorporating skills, such as collaboration, in real-world, hands-on approaches to instruction (Rabacal et al., 2018). This instructional approach is promoted in project-based learning (PBL) classrooms servicing students of varying abilities (Halverson, 2018). In a PBL classroom, students work collaboratively with peers to complete a real-world project that requires them to think critically, persevere through challenges, and communicate with their group members and a public

audience (Junisbayeva, 2020; La Prad & Hyde, 2017). Previous research findings have indicated that PBL is a unique opportunity to engage both struggling students and high-achieving students in the regular classroom simultaneously (Council, 2018), specifically in elementary schools (Smith & Pastor, 2016). However, researchers have also suggested that collaboration, while being a benefit of PBL, poses a significant challenge (Aksela & Haatainen, 2019; Alharbi et al., 2018).

However, advances in technology have created opportunities for students to collaborate in new capacities. Research showed that online discussion boards increase participation and interaction amongst elementary students (Zheng & Warschauer, 2015) as well as statistically improved academic achievement linked to one-to-one technology (Bailey, 2018). However, without the understanding of how teachers perceive technologies, such as online discussion forums, and best practices for use in promoting collaboration with students through project work, such as PBL, data on how to best serve students in mixed-ability classrooms will remain unclear in the future, thus establishing the problem this study addressed. Additional research was needed to explore technology-enhanced collaboration within PBL by examining teacher perceptions of how these collaborative practices, such as discussion forums and group projects, influence students with learning disabilities. This research has the potential to affect positive social change by lending insights to technology-supported collaborative strategies that teachers can use to better instruct students both with learning disabilities and those without learning disabilities.

In this chapter, I examine the background of the study, problem, purpose, research questions, the theoretical framework, and the nature of the study. This chapter also includes a discussion of the definitions used in this study, assumptions, scope and delimitations, and limitations. Finally, I provide the significance of the study and the social implications of this research.

Background

For teachers to fully educate all students in an inclusive setting that will prepare students for the 21st century, they need specific pedagogical knowledge. In a quantitative study, Cornoldi et al. (2018) discovered that teachers, in general, have positive attitudes regarding students with learning disabilities in the general education setting but feel support, training, and strategies for intervention are needed to best support these students. These strategies include collaboration strategies to help students of all abilities work together to solve problems and complete projects. Aksela and Haatainen (2019) found that while collaboration is a critical component to PBL, it is also one of the most difficult aspects to incorporate into PBL.

According to Dukuzumuremyi and Siklander (2018), the use of technology such as laptops can increase collaboration amongst pupils, and further research showed that the use of technology coupled with PBL can create environments in which students of all abilities, specifically students with learning disabilities, achieve both socially and academically (Baser et al., 2017; Rhim & Lancet, 2018; Terrazas-Arellanes et al., 2018). Furthermore, research has also shown that online discussion forums can increase participation and interactions amongst elementary students (Zheng & Warschauer, 2015).

However, a review of current literature resulted in no studies that provide insights into teacher perceptions of technology-enhanced collaboration on students with learning disabilities in inclusive settings. Research has shown technology use in collaboration is beneficial (Dukuzumuremyi & Siklander, 2018; Zheng & Warschauer, 2015) and PBL increases both the academic and social skills of all types of learners (Baser et al., 2017; Rhim, & Lancet, 2018; Terrazas-Arellanes et al., 2018); yet, a gap in the literature exists regarding the understanding of teacher perceptions of technology use to support collaboration within PBL for students of mixed abilities. Recent research (i.e., Aliyyah et al., 2020; Hebebci et al., 2020) supported the need to study online practices for all learners, providing further evidence that this gap exists. I conducted the current study to explore teacher perceptions regarding how to use technology to increase collaboration with students with learning disabilities. The findings could also be used to create professional development that would enhance teacher understanding of technology-enhanced collaborative discussions in a PBL environment.

Problem Statement

The problem addressed in this study is elementary teacher perceptions of students with mixed abilities feeling excluded amongst peers in a traditional classroom setting in the area of collaboration (see Schleicher, 2018). Students who have learning difficulties often do not feel comfortable participating in groups actively and are underestimated by group members (Le et al., 2018). These students struggle to equally participate, work through disagreements, and remain on task to complete the project at hand (Forslund Frykedal & Hammar Chiriac, 2018). Furthermore, according to the Partnership for 21st

Century Skills, the skill of collaboration is fundamental for students as future participants of a global society (Plucker et al., 2016). To combat this issue, innovative curriculum such as PBL requiring students to engage in real-world, hands-on problems working collaboratively with peers has found success with students with and without learning disabilities (Carrabba & Farmer, 2018).

In the fast-paced digital world, many teachers using PBL have adapted by embracing technological tools to aid collaboration and communication as well as to gain access to an abundance of knowledge and viewpoints (Tlhoaele et al., 2016). These tools include the use of online discussion boards, wikis, and blogs that allow students to collaborate on assignments and projects. Collaborative projects provide students the opportunity to learn from and with each other using asynchronous communication technology (Tlhoaele et al., 2016). Technology-enhanced collaboration with mixed-ability pupils was especially effective with primary age students working collaboratively on laptops (Dukuzumuremyi & Siklander, 2018), and collaboration further increased when applications such as Google Docs were utilized (Falloon, 2015).

According to Hebebci et al. (2020), the recent global COVID-19 pandemic that forced instruction online around the world revealed challenges in collaborative practices online among other difficulties. Understanding what teachers using these tools find challenging and beneficial to help students of multiple abilities may provide insights into the field of education. Little is currently known about teacher perceptions of how technology-enhanced collaboration within PBL can influence students of mixed ability working collaboratively. Aliyyah et al. (2020) examined primary teacher perceptions of

teaching during the COVID-19 pandemic and discovered challenges in online curriculum design, student motivation, and assessment, concluding that there was a need for future research to understand the learning needs of students from diverse backgrounds, including students with learning disabilities. Examining teacher perceptions of the influences of technology-enhanced PBL on students with mixed abilities will help to contribute to filling a gap in the research, adding to the body of knowledge that supports learning for all students.

In a search of current literature, I found a lack of research that focused on teacher perceptions of students with learning disabilities engaging in PBL while navigating a collaborative environment in online discussions and group work. Due to the limited research on the challenges within PBL and collaboration between students with and without disabilities, additional research was needed.

Purpose of the Study

The overall purpose of this basic qualitative study was to explore elementary teacher perceptions of how students with mixed abilities collaborate using technology in a PBL environment. By exploring teacher perceptions, I revealed insights into the influences of technology-enhanced collaborative discussions among students of all learning abilities.

Research Questions

The following research question and related subquestions guided this study:

RQ: What are elementary teacher perceptions of using technology-based discussions to promote collaboration amongst students with mixed abilities in a PBL environment?

Subquestion 1: How do elementary teachers perceive interactions in online discussions have enhanced students' self-efficacy in mixed-ability classrooms?

Subquestion 2: How do elementary teachers view technology-based collaborative discussions in terms of how the strengths of group members have been utilized to scaffold other group members' learning during PBL?

Theoretical Framework for the Study

Vygotsky (1978) argued that as a human product, knowledge is socially and culturally constructed. Vygotsky's social constructivism theory encompasses the idea that knowledge leads to further cognitive development and the need for collaboration for learning. Social constructivism is used to explain that individuals construct knowledge through interactions with their environment and other individuals as well as the idea that every individual's knowledge construction is unique (Perkins, 1991; Vygotsky, 1978). I will provide a more detailed explanation of Vygotsky's theory in Chapter 2. This theory informed the current study by providing a framework and lens through which to view learning in social groups, specifically collaborative learning practices in a PBL environment. This theory also relates to the overall research question of the study

examining elementary teacher perceptions of using technology-enhanced collaboration in a PBL environment.

Nature of the Study

A qualitative approach was suitable for this study because of the exploratory nature of the research that sought to explore the perceptions of elementary teachers instructing students of mixed abilities in an environment that includes technology-enhanced collaboration within PBL. Using a basic qualitative design, I collected data from interviews with teachers and analyzed it using inductive means to find recurring patterns and emerging themes (see Merriam, 2002; Merriam & Tisdell, 2016; Ravitch & Carl, 2016).

The research problem was embedded within the setting and population of this study, which helped to determine sample size (see Merriam & Tisdell, 2016). Based on a review of current literature (i.e., Constantine et al., 2017; Doyle-Jones, 2019; McGrath & Hughes, 2018), I determined that a smaller number of participants was appropriate for this study. Therefore, the participants were nine elementary teachers from multiple schools who used online discussions during group project work with students of all abilities. These participants were selected through purposeful sampling, specifically snowball or chain sampling. I used a standardized, open-ended interview protocol to collect the data and in vivo coding, or literal coding, following the suggestion of Saldaña (2016), to capture and analyze the unique perspectives of the participants.

Definitions

Collaboration: This transpires when small groups of students work together to achieve a goal, such as the completion of a project or discussion. True collaboration exists when every group member actively participates, provides and receives feedback from instructors and peers, and make decisions as a team without the authoritative role of a teacher (Forslund Frykedal & Hammar Chiriac, 2018).

Learning disabilities: Students identified with learning disabilities are defined using the Individuals with Disabilities Act (2004) definition that states, specific learning disabilities encompass a disorder in one or more of the basic psychological processes affecting students understanding of language and mathematics.

Mixed-ability classroom: Students with different abilities learn together in the same classroom for various subjects (Pourdana & Shahpouri Rad, 2017). This includes students both high and low achieving, students with differing learning styles and preferences, and students with varying degrees of learning readiness.

Online collaboration: Students participate in synchronous and asynchronous activities and discussions with peers and instructors using technology (Constantine et al., 2017).

Online collaborative discussions: An opportunity for students to engage in practices that involve students working together to achieve a goal through technological resources. These tools can include but are not limited to Google Docs, discussion forums or discussion boards, SeeSaw, and wikis (Zheng & Warschauer, 2015).

Problem-based learning: This approach differs slightly from PBL and is self-directed learning that allows for teamwork and collaboration as students work to solve a problem posed by an instructor (Savery, 2015). According to Savery (2015), problem-based learning puts students at the center of the learning model much like high-quality PBL.

PBL: An instructional strategy that incorporates real-world problems posed to students that requires them to work together to find solutions and communicate learning (Carrabba & Farmer, 2018). Students have a significant voice as they choose much of the content studied and the nature of the project that will culminate the learning journey. Students engage in a collaborative activity that will culminate in a completed project, presentation, or performance. The definition of PBL that was used in this study is real-world and personally meaningful projects and group collaborative components. Bell (2010) and Ejsing-Dunn and Skovbjerg (2016) reiterated the importance of using projects to invigorate and encourage innovation among students and found that, ultimately, students learn through production.

Assumptions

I made four assumptions concerning this study. The first assumption was that participants would answer interview questions through a virtual forum, openly and honestly. Before, during, and after the interviews, the participants' confidentiality was maintained, and participants were informed that they could withdraw from the process at any time without consequence. The second assumption was that the criteria chosen for inclusion in this study were appropriate in that participants had experience working with

elementary students with and without learning disabilities in a PBL environment using technology-enhanced collaboration practices. The third assumption was that through the snowball sampling strategy, participants were accurately identified and willing to participate due to the significance of the study. The final assumption was that that the role of qualitative research is to gain perceptions of an individual's experience and the process of this research was subjective to both my biases and participants' interpretations of the subject.

Scope and Delimitations

The scope of this basic qualitative study encompassed elementary teacher perceptions regarding technology-enhanced collaboration in PBL environments. Research has shown technology use in collaboration is beneficial (Dukuzumuremyi & Siklander, 2018; Zheng & Warschauer, 2015) and PBL increases both academic and social skills of all types of learners (Baser et al., 2017; Rhim & Lancet, 2018; Terrazas-Arellanes et al., 2018); however, a gap in the literature exists regarding the understanding of teacher perceptions of technology use to support collaboration within PBL for students with mixed abilities. Therefore, to be included in the study as participants, instructors needed to teach within inclusive settings working with both students designated as having learning disabilities and students without. When determining the appropriate sample size in a basic qualitative study, a range of participants is recommended with reaching data saturation being the goal (Fusch & Ness, 2015; Marshall et al., 2019). My research problem was embedded within the setting and population of this study, which helped to determine sample size (see Merriam & Tisdell, 2016). The goal was to interview nine to

12 teachers at a minimum or until data saturation was reached. This study was delimited by the accessibility of participants who were identified through the sampling strategy and able to participate. In addition to the availability of participants, access to digital tools to conduct virtual interviews was also a delimitation of this study. All these components combined to ensure that the purpose, methodology, framework, and rationale remained aligned.

While Vygotsky's (1978) theory of social constructivism was ultimately used to frame this research, I also considered theories of Dewey (1938). Dewey stated that children should learn in a social setting that is developmentally appropriate and the experience should include ties to real-world applications. Dewey also believed that students should be at the center of educational experiences and drive instruction. While Dewey's theories supported this study, ultimately the emphasis of this research that was placed on the collaborative components within a PBL environment led to the use of Vygotsky's theory instead.

Finally, the nature of qualitative research makes transferability implausible; however, to assess the extent to which findings may be true of people in other settings, similar projects employing the same methods but conducted in different environments could well be of great value (Shenton, 2004). Because the inclusion criteria determined who was included in the study, it also impacted transferability. I recruited and included participants from across the country in order to gather a wide variety of possible perceptions of technology-enhanced collaborative practices, including varying perceptions of experiences and geographical representation. The data were analyzed to

provide external validity to the research, helping to ensure trustworthiness by providing rich descriptions of both the setting and participants (see Ravitch & Carl, 2016).

Limitations

Several factors had the potential to limit this study. A potential limitation included researcher bias. I have personally used online discussion platforms, such as Google Classroom, in my PBL classroom and have seen the benefits of this collaborative technology. However, with the use of bracketing (see Tufford & Newman, 2012), the negative effects of my biases and/or preconceptions were mitigated. Using a reflective journal to record my thoughts throughout the research process helped to ensure the transparency of my research (see Ortlipp, 2008). Furthermore, a small sample size of nine participants also created limitations for this study. In Chapter 3, I will explain in detail how I structured the study to reduce these biases.

Significance

This study addressed a gap in the research regarding technology-enhanced PBL for elementary students with mixed abilities as they navigate collaborative group work using online discussions, thus making an original contribution to the field. Although there is a robust body of knowledge surrounding student collaboration and PBL (i.e., Aksela & Haatainen, 2019; Easley et al., 2018; Lee et al., 2015), I found no extant research regarding teacher perceptions of student collaboration that is inclusive of all students' abilities using online collaborative tools. The results of the study might be used to create professional development that would enhance a teacher's understanding of online discussion forums or other collaborative technologies in a PBL environment.

Furthermore, the findings of this study may provide educators with information regarding how to use technology to increase collaboration with students of mixed abilities.

This study was innovative because it focused on a traditional approach to learning, group collaboration, in a new way via blended learning in online discussions and collaborative group work. Utilizing collaboration with digital tools to promote the role of everyone throughout group projects is new and different (Baser et al., 2017). In this study, I used teacher perceptions to navigate and explore these innovative practices.

The findings of this study could result in positive social change by providing information regarding teacher perceptions of how PBL and technology can be used to enhance collaboration in an inclusive setting. This information could potentially help teachers meet the collaborative learning needs of all students in their inclusive classrooms, ultimately increasing all students' abilities to work collaboratively, which would directly impact their academic achievement.

Summary

In this chapter, I introduced this qualitative study exploring the perceptions of elementary teachers on technology-enhanced PBL learning to aid in the collaboration of students with mixed abilities. The background section included a summary of the scope of the study topic and the gap in the extant research that focused on technology-enhanced collaboration with students designated as mixed abilities. This was followed by explanations of the problem this study addressed and Vygotsky's (1978) social constructivism theory that was used as the theoretical foundation of this research. I

described the basic qualitative nature of this study as well as key terms, assumptions, scope and delimitations, limitations, and the significance of the study.

In Chapter 2, I will provide an in-depth look at social constructivism and a review of the current literature regarding the phenomenon under study. The literature review will include a synthesis of extant research on PBL, PBL and students with learning disabilities, collaboration, collaboration with students with mixed abilities, and collaboration and technology.

Chapter 2: Literature Review

The problem addressed in this study is elementary teacher perceptions of students with mixed abilities feeling excluded amongst peers in a traditional classroom setting in the area of collaboration (see Schleicher, 2018). To combat this issue, many teachers began using PBL with students of multiple abilities (Carrabba & Farmer, 2018) but often found that although collaboration is incorporated into PBL, it also poses a significant challenge (Aksela & Haatainen, 2019; Alharbi et al., 2018). Using various technology platforms, such as online discussion boards to promote collaboration in group work, some teachers are addressing this challenge (Tlhoaele et al., 2016). However, limited research exists regarding teacher perceptions of PBL in inclusive settings coupled with technology tools to aid collaboration. Without the understanding of how teachers perceive these collaborative technologies and best practices for use in promoting collaboration, determining how to best serve students with learning disabilities will remain unclear in the future.

I begin the chapter with a description of the literature search strategy before moving on to the theoretical foundations grounding the research, including an exploration of the tenets of Vygotsky's constructivism theory. This chapter is a discussion of key concepts in the literature pertaining to this study. In the literature review, I examined PBL as it pertains to group collaboration. The literature review also include an exploration of research on technological platforms that aid students during collaborative projects, such as online discussion boards and shared online documents. A discussion of best practices

for instructing students with learning disabilities in inclusive settings is also included in the review.

Literature Search Strategy

To search for the literature used for this review, I accessed the following databases and search engines through the Walden University Library: ERIC, EBSCO, Science Direct, Education Source, and Google Scholar. The primary search term I used was *project-based learning.* I also used abbreviations of this term, including *PBL* and *PjBL*. The following associated phrases were also used: *challenges/barriers to PBL*, *project method teaching*, *collaboration, and PBL*, *PBL, and students with learning disabilities*, and *technology-enhanced PBL*. To fully understand collaboration within PBL, I also needed an in-depth look into collaborative learning strategies for elementary students using the search terms of g*roup work*, *collaboration*, *collaboration and elementary grades*, *collaborative learning*, *collaborative technologies*, *computer-supported collaborative learning (CSCL)*, and *21st-century skills*. Finally, I searched for instructional practices suited for students with learning disabilities using the following search terms: *inclusion*, *inclusive settings*, *group work with multiple student abilities*, *varying abilities in the classroom*, *multiple ability learners and group work*, and *best practice for students with learning disabilities*. I narrowed my focus to elementary students using terms of *elementary students, elementary grades,* and *K-5 students*. As I engaged in the continuous process to narrow the focus of the research relevant to my topic, I also combined terms the terms of *PBL, varying abilities, and technology; PBL,*

group collaboration, and technology; and *group work, technology, and students of mixed- ability* in one search.

I used a search engine not typically associated with my field of study, Science Direct, which typically is focused on the sciences and medical fields but also includes the technical fields. Therefore, I focused on technology within this search engine by using the terms *technology, project-based learning, and students of mixed ability.* This expanded my research to include sources outside of those found in a typical search in an educational database.

To narrow the scope of the sources accessed, I limited my searches to sources from peer-reviewed journals published between 2015–2020. However, in the case of the theoretical framework, I used sources published before 2014 because they are considered seminal works.

Theoretical Foundations

Vygotsky's work, specifically on social development and how it relates to education, has become the foundation of much research in the past decades. The Soviet psychologist established the principle that students acquire knowledge of everyday concepts differently than they may acquire school-related concepts, and these "academic concepts" are formed during the student's learning of concepts during the school day (Vygotsky, 1994, p. 359). According to Vygotsky (1978), learning during the school day and learning everyday concepts is quite different because the academic concepts occur specifically during the teaching and learning process. The relationship that a child develops between peers and adults helps to form their development (Vygotsky, 1978).

Vygotsky (1981) viewed these social interactions as preceding individual development, stating, “It is through others that we develop into ourselves” (p. 161). I used Vygotsky’s social constructivism theory to frame this study.

Social Constructivism Theory

Constructivism in general explains that individuals construct knowledge through interactions with their environment, and each individual’s knowledge construction is different (Perkins, 1991; Piaget, 1969; Vygotsky, 1978). According to the tenets of constructivism, knowledge is constructed based on prior conceptions interwoven with new conceptions (Vygotsky, 1978). Vygotsky (1978) argued that knowledge as a human product is socially and culturally constructed, and development cannot be separated from its social context. This collectivist approach stands in sharp contrast to Western theorists like Inhelder and Piaget (1958) who argued that learning is both individualistic and biologically developmental (Powell & Kalina, 2009). According to Inhelder and Piaget, assimilation and accommodation require an active learner, not a passive one, because problem-solving skills cannot be taught, they must be discovered. Assimilation involves using one’s schema to deal with a new object or situation, and accommodation occurs when the existing schema does not work and needs to be changed to deal with a new object or situation.

However, Vygotsky’s social constructivism theory, when coupled with Piaget’s cognitive constructivism theory (Inhelder & Piaget, 1958) can work together to explain PBL. PBL classrooms are student centered around collaborative projects where the teacher acts as a guide through the learning, increasing student engagement and academic

performance (Han et al., 2015). Therefore, these two theories can be combined to support the notion of active, hands-on learning in collaborative social settings.

Vygotsky (1978) defined social constructivism as a sociological theory of knowledge that applies the theory of constructivism to social situations. In a brief overview, Vygotsky specified social constructivism had three components. The first indicated that both knowledge and the act of knowing stem from social interactions. The second component indicated that learning between individuals precedes learning within an individual with the assistance of a more knowledgeable member of a cultural group. This is often referred to as the more knowledgeable other (MKO) and zone of proximal development (ZPD). The third component included the idea of language mediating the experience, transforming the mental processes. In essence, Vygotsky (1987) claimed that social language occurs first to communicate with others but then to understand; therefore, language plays a central role in mental development.

When examining the MKO, students are paired with an individual who has more understanding, comprehension, or subject expertise than the learner (Vygotsky, 1978). ZPD is defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). According to Vygotsky (1978), by combining these components, students can learn more effectively than if learning were to take place solely

by the individual. In the following sections, I provide a more in-depth examination of the three components within social constructivism.

Social Interactions

In the social constructivism theory, Vygotsky (1978) emphasized the necessary role of collaboration or working with others as the key to making meaning. Vygotsky indicated that the role of social interaction in the development of cognition is the very basis of this theory. Studying young children learning from their parents and family members, Vygotsky determined that a child's development cannot be separated from the social context. While continuing these studies, Vygotsky examined various groupings of students within an educational setting, including groups made up of multiple students of mixed ability, as well as groups that included interactions solely between the teacher and the student. Within these various social environments, Vygotsky concluded that students are more motivated to learn and more apt to make meaning. With the opportunity to work collaboratively based on these factors, students will inevitably learn more.

Vygotsky (1978) suggested that groups needed to include learners of weaker abilities and learners with higher abilities, often referred to as mixed-ability or heterogeneous grouping. However, in these groups, several dynamics evolve within individual student personalities. Vygotsky acknowledged that without these differences in group members, who may encourage a difference in views and perceptions, learning may not exist otherwise or progress at the same rate. Knowledge comes from these social interactions and students need an introduction to how to operate in these groups (Vygotsky, 1978). Acknowledging the social component of learning is critical to

understanding how groups of children from different backgrounds, skill levels, and social groups can still come together and learn from each other increasing both cognition and psychosocial development (Vygotsky, 1978). Therefore, it is within these dynamic social situations that students benefit the most.

ZPD

To expound upon and relate the social dimensions to the psychological functions concretely, Vygotsky (1978) developed the concept of the ZPD. As stated, ZPD is the distance between the level in which a student can do the work or task independently and the level they can complete the task with the help from a peer and/or teacher who is more capable (Vygotsky, 1978). Vygotsky (1978) defined three concepts within his model of social constructivism. These included *the zone of actual development* where the student actually and currently is developmentally. In this zone, the student can perform tasks or think through problems independently, without the help of an adult. The zone includes skills that have been mastered and are a part of the child's acquired skills. The stage that a child reaches next in the learning process is *the zone of potential development*, where the student potentially should or could be. For instance, this zone could include a goal set for learning, or a future goal for acquiring a new skill, thus defining a child's potential development. Finally, the ZPD is the amount of assistance required for a student to move from the zone of actual development to the zone of potential development or the distance between what the child has mastered and what they still need to achieve. This zone is the link between the first two zones defined.

Vygotsky (1978) defined the ZPD as functions that have not yet matured but are in the process of maturation. The ZPD provides educators with a tool through which the development of a child can be understood, and by using this method, educators will know where a child is independently or what skills have matured and what skills are still forming and may need assistance to fully develop (Vygotsky, 1978). It is within this zone that students often rely on a more knowledgeable peer to help through the learning process.

MKO

Vygotsky's (1978) MKO is temporary support given to a student when they cannot solve a problem independently. Vygotsky defined this more capable peer as not a permanent fixture for a student but rather a support system put in place to ensure the student can reach independence. The key idea of this support system is that it is temporary. Vygotsky's (1987) description of the teaching and learning system within the child's ZPD leads "the child to carry out activities that force him to rise above himself" (p. 213). The nature of the scaffolding support provided by an MKO makes learning flexible for students and tailored to their individual needs at any given moment. Technological innovations, such as online discussions and Google Docs, can propel learning forward for students of all abilities because it provides a scaffold or MKO for students to express themselves and participate in the learning process in an online forum. Furthermore, it is important to understand that the MKO is not necessarily a teacher or peer providing support to the less capable student (Vygotsky, 1978). The level of support is adjusted to support students at their current needs, providing just enough support to

allow the student to solve the problem without enabling the student. The MKO does not do for the child what they can do for themselves; instead, the MKO fosters a support system to help the child reach the zone of potential development, a zone that they may otherwise fail to reach independently or within an expected timeframe. The idea of the MKO coupled with a child's ZPD provides a framework for flexible learner supports during group collaboration.

Language and Social Interactions

The final component of Vygotsky's social constructivism theory is the role of language in mental development. For much of Vygotsky's (1978) professional life, the psychologist worked with students who had learning delays or disabilities. Through research, Vygotsky (1978) discovered that language allows subjects to plan, coordinate, and provide feedback through external speech as well as mediate social activity. Furthermore, Vygotsky (1987) claimed that speech is also a tool that can be used internally by the child during the discourse of inner dialogue. These are the thoughts and inner speech that occurs when a child is problem solving, both independently and in social groups. Vygotsky examined both types of language, internal and external, that occur during group collaboration.

Taking the approach of investigating both internal mental activity and external activity provided Vygotsky with a stance that varied greatly from other modern authors. By examining the features unique to human productive labor activity, where individuals use and manipulate tools, Vygotsky (1987) discovered that social nature developed under the conditions of cooperation and social interaction. Vygotsky viewed the world of

objects or tools found within a social or cultural group to connect people within the activity and through social interaction. Vygotsky's sociocultural theory of the development of the mind explains that first, a child develops on the social plane and then on the psychological plane. This is also true regarding attention, memory, decision-making skills, and the formation of concepts (Vygotsky, 1981).

Vygotsky used this concept of social learning with the assessment and instruction of school-aged children. Providing the opportunity for students to work together in social groups arouses a variety of processes that can operate only when the "child is working in cooperation with peers in his environment" (Vygotsky, 1978, p. 90). Using the idea of ZPD, Vygotsky claimed that "the only good learning is that which is in advance of development" (1978, p. 89), and the upper limits are set by the current state of development and his or her intellectual potential (1987, p. 209). Vygotsky (1978) also believed that for the child to get the most out of the learning experience the learning should be "incorporated into a task that is necessary and relevant for life" (p. 118). Applications of social constructivism are found in current research in the following section.

Current Application of Social Constructivism

Vygotsky (1978) argued that knowledge as a human product is socially and culturally constructed. This theory informed my research by providing a framework for learning in social groups, specifically collaborative learning practices in a PBL

environment. An analysis of current research using social constructivism as the lens was conducted.

Vygotsky and PBL

Vygotsky's social constructivism theory has been applied previously in ways like this current research. PBL's foundation is rooted in project studies that put the student in the center of the learning where students work together with peers to engage in real-life problems and collaborate to find solutions (Tascı, 2015). Using a case study approach, Tascı (2015) examined 41fourth grade social studies students through observation, student work, and interviews to explore if PBL learning increases students' abilities to gain and retain knowledge that can be used in the real world. The students engaged in two different group architecture projects. Using the lens of Vygotsky's theory of social constructivism, the researcher determined that PBL is an effective way to engage students and encourage the retention of information through both written and oral questions. Tascı used a qualitative approach, similar to my research, to examine elementary students engaging in PBL through the lens of Vygotsky.

Furthermore, Vygotsky influenced Duke et al. (2021) in a quantitative study using a randomized controlled trial to investigate the impacts of PBL on social studies, literacy achievement, and motivation of 684 second grade students from districts designated as high poverty. In the study, the principals of social constructivism support the notion that students learn through their interactions in social contexts. Forty-eight teachers were assigned at random to experimental and control groups. The experimental group taught four social studies PBL units, and the control group taught the social studies units as they

normally would. Academic achievement in social studies and informational reading was achieved, however, the results did not consistently indicate achievement in writing or motivation. The researchers attributed this to a lack of consistency in lesson delivery. Tascı (2015) and Duke et al. informed my current research in both methodology and theoretical framework by having examined similar participants' collaboration and instructor pedagogy within a PBL environment.

Vygotsky and Technology-Enhanced Collaboration

In another study that focused on technology-enhanced collaboration with mixed-ability pupils, similar results were indicated. Dukuzumuremyi and Siklander (2018) conducted a mixed-methods case study involving 21 primary pupils, the teacher, and the teaching assistant. The researchers collected data through classroom observations and a questionnaire administered to the teacher to determine how technology-enhanced collaboration increased interactions between students, and between students and their teacher. Results indicated that mixed-ability groupings were especially effective with primary age students working collaboratively on laptops. Also, collaboration can be further increased when applications such as Google Docs are utilized (Falloon, 2015). Falloon collected data from observations, surveys, and focus groups over three years from nearly 100 primary aged students and discovered that using technological devices with cloud-based applications such as Google Docs increased students' abilities to work collaboratively. These studies indicated the innovations in modern technology coupled with learning in social settings while in collaboration with peers increase achievement through asynchronous communication and is supported by Vygotsky's work. Through

applications such as discussion boards, Google Docs., wikis, blogs, and other applications such as Seesaw all students can participate and are encouraged to add thoughts and ideas in a cyclical process.

The previous study is like my study as I examined how technology may enhance the collaboration for students with learning disabilities. The data collected from focus groups is especially useful to my current study as the data collected informed my research questions that examined teacher perceptions of pedagogy that was linked to the technology used to enhance student collaboration. The research question framed in my current study relates to Vygotsky's theory of social constructivism and built upon Falloon (2015). The research question examined teacher perceptions of best practice when using technology-enhanced PBL to promote collaboration amongst students with and without disabilities and provided insights into unique social learning situations. Furthermore, subsequent follow-up research questions framed in my study examined the strengths of group members in scaffolding learning, promoting student self-efficacy, and insights in how to support students in online discussion forums and will further add to existing theory.

In another example, Lee et al. (2019) examined a collaborative online writing application to determine if student writing abilities would be enhanced. In the study, two special education teachers and two gifted education teachers along with 20 students, five from each of their classrooms from four different elementary schools from a Mid-Atlantic Appalachian state, engaged in an online writing application. All students completed a pre and posttest analyzing their narrative writing skills. The analysis focused on the

differences in the gains between the pre- and posttest for the students both in the experimental group that included students working in collaboration with peers and the control group where students worked individually. Results indicated that students who struggled with writing were able to add more details to enrich their writing, as well as students who were proficient writers, were able to enhance their writing mechanics when working in collaboration with peers.

Vygotsky, MKO, ZPD, and Students With Learning Disabilities

Vygotsky (1978) suggested using a child's ZPD and a peer or teacher who is more capable can influence learning to the highest degree creating opportunities for learning in group settings that would otherwise be thwarted. Students of all abilities can work together if given the proper support within the regular classroom setting and, according to Vygotsky, should be given this opportunity readily. Using Vygotsky's theory, teachers are utilizing online applications to aid in the collaboration of younger students. Cicconi (2014) examined research within two early elementary mathematics classrooms to investigate if vokis, voicethreads, and vodcasts promote higher-order thinking skills and peer collaboration. The classrooms consisted of one kindergarten and one first-grade classroom in a midwestern state. Through observations and interviews with teachers and teacher aides collected throughout the research studies, the researcher determined that students with learning disabilities and those without learning disabilities who were reluctant to participate in a regular classroom setting began to collaborate with their peers online. The researcher determined that with the addition of Web 2.0, an MKO can be an online application, a peer who collaborates online, or a student on the other side of the

world that can explain a mathematics problem. This research has expanded and broadened Vygotsky's definition of a traditional MKO into the 21st century and directly informed my research through the application of Vygotsky's theory and collaborative technology.

Furthermore, using Vygotskian tenets, Manrique et al. (2019) in a quantitative study examined 197 primary through secondary mathematics teachers who worked with students with and without disabilities in a regular classroom setting. The purpose of the study was to examine the pedagogical work of inclusive teachers and the use of support materials, such as software, devices, and assistive technology in the basic education of students in two South American countries. Data were collected from a questionnaire that included 48 questions and results from the study indicated that teachers need additional training in inclusive practices and continued development of support materials that will aid students with various disabilities in the regular classroom setting. The researchers purported using Vygotsky's social constructivism theory that educational institutions aiming at inclusive practices must move away from practices that promote social and cultural isolation of students with disabilities.

In addition, Burnett (2016) conducted an in-depth qualitative study examining children, ages 10-11, working together both on and offline. Findings suggested that understanding collaboration involves fully examining how children relate to one another. Such examinations would include investigating how students interact with people and things, and how groups of students inflect these interactions. Findings indicated that technology does enhance group collaboration by allowing students who are reluctant to

participate in a face to face setting the ability to collaborate with peers through the use of technology. Burnett indicated that more research needs to be conducted to fully understand the relationship between student interaction aided by technology. These group dynamics need careful consideration. Understanding collaboration involves understanding how children relate to one another, personally, through classroom communities, and in various groupings of students (Burnett, 2016). My current research built upon this idea when it examined group collaboration in an inclusive setting.

In conclusion, Vygotsky (1978) acknowledged the positive effect on learning that occurs when learners work together to solve problems during collaborative group work. While group work can be exercised in multiple settings and situations, one of the main components of PBL focuses on collaboration as a skill needed for students to be successful in the 21st century (Tascı, 2015). Using the social constructivism theory, which states that students need to work together in order to learn and make meaning, as a framework for exploring teacher perceptions of technology-enhanced PBL in collaborative settings provides a theoretical framework that is aligned with my research problem, purpose, methodology and questions. This provides a clear rationale for choosing this theory to support my research.

Literature Review Related to Key Variables and/or Concepts

In the following literature review, I will be examining the themes of PBL with students with and without learning disabilities. Within the framework of PBL, I will be looking specifically at collaboration and technology-enhanced collaboration. Themes that this section will address include, effectiveness of PBL, PBL and students with learning

disabilities, general collaboration in schools, collaboration and PBL, collaboration and students with learning disabilities, and technology and collaboration.

Effectiveness of PBL

In a review of the current literature, numerous studies have shown the positive effects of PBL in the classroom. Revelle (2019) examined 24 lower elementary school teacher perceptions of the success and challenges of implementing PBL with young students. In this qualitative research study that involved collecting data through interviews with elementary school teachers, a PBL literacy and social studies curriculum was implemented in 20 high-poverty schools. Eighteen of the 24 teachers identified increased student achievement and engagement with the curriculum as successful aspects of PBL. They indicated that the lessons were engaging and met standards as a success. Challenges included teachers finding adequate time to prepare PBL lessons, giving up control, and letting students take ownership of their learning, classroom management, using scaffolds effectively, and incorporating technology. Lack of time to prepare lessons for the teacher and lack of student prior knowledge was also a challenge with PBL. The teachers also discussed the delivery of the lessons as both a success and a challenge. This study provides an in-depth look into how teachers perceive the implementation of PBL including the factors that attribute to the success and challenges of the curriculum.

In another study, Farmer et al. (2019) examined mathematics and literacy skills of 19 second and third-grade students by using PBL to investigate animal environments in an afterschool setting. In the mixed-methods design using interviews and surveys, the researchers determined that PBL is effective in gaining both mathematics and literacy

skills as well as increasing positive attitudes towards mathematics and literacy instruction. Findings suggested that to engage students in math and literacy content, projects needed to be student-driven and have a meaningful connection to the community. The researchers also indicated that instructors of PBL should have significant professional development and found a disconnect between PBL methodologies and the afterschool instructors' expectations of student behavior. This study is significant as it shows the effectiveness of PBL with young elementary students in the areas of both math and literacy.

Further research was conducted in the field of science and PBL when Can et al. (2017) aimed to reveal the effects of a project-based science education program conducted using active learning on scientific process skills and conceptions of six-year-old children regarding the nature of science in the Middle Eastern region. The researchers used a quasi-experimental research design with a pre and posttest, including 26 participants, 17 in the experimental group, and nine children in the control group. Quantitative data were collected using the Preschool Scientific Process Skills Scale and qualitative data were gathered through interviews that defined the scientific process skills of children. The results of the study indicated that project-based science education in combination with active learning causes a significant increase in children's scientific process skills and conceptions about the nature of science. In addition to the findings from Farmer et al. (2019) and Can et al., yet another study by Erdogan et al. (2016) showed the positive effects of PBL in the science content area.

The purpose of the Erdogan et al. (2016) study was to understand how one instructional practice, science technology engineering and mathematics project-based learning (STEM PBL), consistently influences student achievement. Using a quantitative approach to research a longitudinal study the researchers determined that students who experienced STEM PBL in full implementation had the greatest effects on student academic achievement with no significant differences across gender or ethnicity. The sample for this study consisted of 565 students, 263 males, and 302 females, attending three different high schools in the southwest of the United States. Data collected included student achievement data for four years. The researchers examined gender and ethnicity, and by looking at the effects of PBL on these special groups, researchers can begin to understand how PBL affects different populations of students. While numerous studies in the content area of science show the positive effects of PBL on student learning and attitude, PBL is also shown to be effective in other content areas as well.

For example, Cervantes et al. (2015) showed the mathematics and reading benefits of PBL for urban middle schools in the southern United States. In a quantitative casual comparative study, seventh and eighth grade students who used PBL were compared to another group of seventh and eighth grade students who had not utilized this methodology. The outcome measures were The State of Texas Assessments of Academic Readiness mathematics and reading achievement scores. The study found statistical significance in that the PBL groups performed at a higher academic achievement level than did the non-PBL students on both mathematics and reading assessments. Likewise, in a systematic literature review, Merritt et al. (2017) examined the effectiveness of nine

PBL studies from kindergarten through eighth-grade students' mathematics and science achievement. The study examined the literature for evidence of PBL's effectiveness that included effectiveness in improving scientific academic achievement, knowledge retention, conceptual development, and attitudes towards science. The findings indicated that PBL is an effective method for improving K-8 skills in all these areas.

Additional research revealed the positive effects of PBL in elementary classrooms through skills that reach beyond academics in creativity and 21st-century skills. In a quasi-experimental quantitative study, Storer (2018) found a significant gain in creativity using the Torrance Test of Creative Thinking in two groups of fourth-grade students receiving PBL instruction. The two groups grew from the 21st percentile to the 31st percentile in creativity according to the pre and posttest administered to the students. An additional positive effect of PBL was found in yet another qualitative study in which Dole et al. (2017) interviewed 36 teachers to discover the influence of PBL on student motivation and student learning, discovering PBL increased positive student attitudes towards school and preparedness for the 21st century based on teacher perceptions after implementing PBL. These two studies are significant in fully understanding the effects of PBL and how it positively impacts the multi-facets of education.

Furthermore, PBL is also shown to be effective with diverse populations of students. The special populations of students include specific gender groupings, students with diverse learning needs, or perhaps the socio-economic status of students learning in a PBL environment. Hunter and Botchwey (2017) in a qualitative study examined the collaboration between 25 gifted and talented third and fourth grade students in

partnership with 20 undergraduate students who engaged in a collaborative urban planning project. The focus of the study was to determine if collaboration between higher education and elementary students is effective. The project was designed to meet the needs of both groups of students, from elementary school to higher education. The students worked together collaboratively throughout the project to achieve the goal of making their community a better place. The project focused on 21st-century skills of collaboration, communication, critical thinking, and civic engagement. Findings revealed that both groups of students benefited from the project because standards were met at both levels, the groups effectively collaborated, and considerations for future curriculums that engage in partnerships between K-12 education and higher education were formulated. This study is unique in that it provides insights into education for special populations of learners and the collaborative benefits from partnering higher education students with elementary students within a PBL environment.

Another example of how PBL impacts diverse populations positively is the research conducted by La Prad and Hyde (2017). They embarked on a qualitative case study that examined the impacts of PBL in a school specifically designed to support innovation. Individuals Dedicated to Excellence and Achievement public schools are designed to support 21st-century skills, such as innovation and creativity through design, engineering, arts, and sciences. Using an open-ended interview protocol, the researchers interviewed students, teachers, and parents. They observed 138 students attending the school who exhibited a wide range of demographics, including varying ethnic groups, gender, and learning abilities. Data from direct observation, curriculum documents,

interviews, and teaching and learning artifacts concluded that PBL supports innovation, creativity, communication, and collaboration across various groups making it an effective alternative to traditional educational approaches. This study supports that PBL is an effective method for instruction in diverse settings.

PBL and Students With Learning Disabilities

It is important within this literature review to establish that PBL has been founded in research before delving into the nuances found within the methodology, specifically collaboration. According to limited research, PBL is an effective strategy to use with students who have learning disabilities, as well as students without learning disabilities. Using a systematic literature review, Eldiva and Azizah (2019) and Junisbayeva (2020) concluded that the use of PBL is effective in improving the critical thinking skills of students with special needs. These critical thinking skills were measured in a student's ability to solve learning problems independently using their abilities to reason and persevere through the problem. In both reviews, the authors indicated that while adaptations were made for students with disabilities throughout a project, such as material adapted to the learners' abilities, overall PBL methodologies increased the critical thinking skills of children with and without special needs. The literature review included studies that examined elementary students who were mentally impaired, deaf, and visually impaired, as well as students without disabilities. In all cases, PBL increased students' critical thinking skills by allowing them to independently solve problems within a PBL environment.

In a quantitative study, Hotulainen et al. (2016) examined the reading, thinking, and mathematical skills of 149 low-achieving first-grade students using a quasi-experimental design with pre-, immediate post-, and delayed post-tests conducted with both the intervention and control groups. The students included low achieving participants in the intervention group and well-performing and low achieving participants in the two control groups. The intervention given included 12 lessons that included enriched discovery learning projects. The results showed that while there were differences in thinking skills, mathematical skills, listening comprehension skills, and reading fluency before the intervention was given, the low achieving students who received the intervention were able to reach the same level as their well-performing peers. These results indicate the effectiveness of project work with both young students and low achieving students.

An additional study that investigated the effectiveness of PBL on students with learning disabilities explored teacher perceptions of using this strategy with mixed-ability learners. Hovey and Ferguson (2014), in an exploratory study that examined survey results from both preservice and in-service teachers, found PBL as an effective method to use with these diverse learners to promote academic achievement. The researchers paid attention to those teachers serving diverse learners including gifted students and students with learning disabilities. However, they also noted that while PBL is effective, teachers indicated they need more training to fully understand what PBL entails to have a clear grasp of this methodology.

Similarly, the few studies that were available regarding specific PBL methodology, and students with learning disabilities was research conducted by Filippatou and Kaldi (2010). The research focused on the effectiveness of project-based learning on primary school pupils with learning difficulties. The research examined students' academic performance and attitudes towards self-efficacy, task value, group work, and teaching methods applied. The study included six Greek fourth-grade mainstream classrooms with ninety-four pupils of mixed learning abilities. A PBL project with the topic of 'sea animals' was implemented over eight weeks. A combination of a pre experimental design and case study research design was used in the study. Data that were collected included a knowledge test that assessed student content knowledge before the project and at the project conclusion and an attitude scale that assessed five factors. These factors included student and teacher perceptions of cooperative learning, inquiry-based instruction, academic self-efficacy, student assessment of task value of environmental studies, and student motivation for learning.

Findings revealed that PBL does show benefits for pupils with learning disabilities regarding academic achievement, motivation, self-efficacy, and task value. The students also preferred experiential learning or learning such as PBL to traditional teaching. This study was supported by later works of Zainudin et al. (2019) who also found that self-efficacy increased in students with learning disabilities who experienced PBL in a regular education classroom with their peers. The quantitative study conducted by Zainudin et al. using a pre- and postquasi-experimental design which examined 30 learners with lower academic achievement in an Asian primary school found PBL to

benefit student self-efficacy. The researchers examined the self-efficacy of students in the intervention group and the control group. Findings revealed students who received the intervention of PBL had a higher self-efficacy than the control group. The research showed the benefits of PBL beyond academic achievement for students with learning deficits.

In another more recent study that supported the findings of Filippatou and Kaldi (2010), PBL was found to be effective amongst students with diverse learning needs with regards to their self-efficacy and motivation to learn (Council, 2018). Council (2018) used a mixed-methods approach to examine PBL effects on the motivation of students with learning disabilities. Data were analyzed using both student and teacher surveys, as well as teacher interviews. Results of this study indicated that when PBL methodologies were used in a classroom with students with learning disabilities in a general education setting both teachers and students expressed success and a motivation to learn.

Looking specifically at maker-centered PBL and students with learning disabilities, Sormunen et al. (2020) examined the engagement of students in reflective discussions. The study was conducted with primary school-aged children, using 44 students in an inclusive classroom, and examined one team of students, four girls and seven boys ages 12-13. Of this focus group of students, four students were identified with learning disabilities and seven participants as mainstream. The learning difficulties included difficulty in academic areas such as language and mathematics or areas such as attention and action control. The teacher organized reflective discussions to help support students through the PBL process. The discussions were video recorded, transcribed, and

analyzed. The results revealed that students with learning difficulties often need more intensive support from the teacher than students without learning difficulties. However, with these reflective discussions and interventions, students were able to actively participate and collaborate with group members through the maker-centered PBL project.

General Collaboration in Schools

Within the scope of PBL collaboration is a key component. Collaborative practices have been studied in numerous ways both within PBL classrooms and outside of student project work. Fung and Lui (2016) and Howe and Zachariou (2019) showed the positive effects of group collaboration across the age range, gender, and collaborative techniques. Fung and Lui examined 152 eighth grade students using pre and posttests to evaluate students' scientific conceptions, as well as written responses and audio-recorded discussions to examine the effects of group collaboration. The data were analyzed revealing group collaboration to be highly effective. The results indicate that students achieved greater cognitive growth when they engaged in cooperative learning activities using Vygotsky's ZPD framework than the students who did not participate in the cooperative groups (Fung & Lui, 2016). This level of the learner while in middle grades is relevant to elementary students as Vygotsky's (1978) ZPD theoretically is found to be effective at any age (Burnett, 2016; Cicconi, 2014; Tascı, 2015). Therefore, this study lent insights into elementary students working with a more able peer.

An additional study by Howe and Zachariou (2019) also showed the positive effects of group collaboration. This study examined the impact of small group collaboration on individuals from the ages of 10 to 22. The study used 90 participants, 20

from primary school, who engaged in a computer-based task working in small groups. Data from post-tests revealed that group dialogue where differing opinions occurred throughout discussions played a key role in understanding and joint analysis played an even more substantial role in the groups understanding of concepts. Using the Vygotskyan perspective that indicates student growth after group collaboration, the researchers found that when students differ on opinions the interaction stimulates metacognition and response to feedback. Of further interest, the age of the participants across the study showed little difference in results indicating that group collaboration can be effective from middle childhood to late childhood.

Finally, Altun (2017), after examining the effects of cooperative learning on students through a science and technology unit, determined that this type of strategy was successful by creating an environment for students to achieve academically by working together. The mixed-methods study examined the academic achievement of 20 sixth grade students who did not have learning disabilities. The data collected included pre- and posttests and focus group interviews and indicated cooperative learning improved students' social-emotional skills and improved academic learning. Findings demonstrate the effectiveness of small-group learning on student academic achievement.

These studies (Altun, 2017; Fung & Lui, 2016; Howe & Zachariou, 2019) all show the significance of collaboration in the learning process and how students achieve academically, increase cognition and metacognition, progress emotionally, and boost motivation for learning. These positive effects of collaboration in the learning process are important to establish before examination of collaboration within the constructs of PBL.

Collaboration and PBL

Looking specifically at collaboration within the framework of PBL only three studies were found. However, Lee et al. (2015) found in a case study of two high school classrooms that collaboration within PBL is a highly effective methodology. The researchers examined online questionnaires and follow-up interviews using a qualitative research analysis approach. They found a relationship between individuals' social skills and collaboration. Task and process conflicts were transformed into relationship conflicts when individual social skills were lacking. Meaning, that while groups may have disagreed on the process, they would use to complete a task, the conflict would be transformed into problems within each group member's relationships. However, the researchers found that group social skills, thinking of the students as a unit, had more influence in resolving conflict, than individual social skills in group work. This study provides insights into PBL and collaboration, and how groups of students working together can problem-solve to overcome conflict. Also, while this study focuses on high school students and not primary aged students, it did lend insight into the social interactions occurring during the learning process within a PBL environment. Additional research is needed to reveal if similar applications occur with elementary students.

In addition to this study, Easley et al. (2018) found similar results within elementary schools working collaboratively within PBL classrooms. The researchers examined through a case study two third grade classrooms working with a PBL unit. Through observations of students building and rebuilding a toy rocket project, researchers noted student engagement, scientific inquiry, and collaboration. They did indicate that at

times collaboration among the elementary students was difficult, but it did not affect student engagement in the project or learning outcomes. Findings revealed the collaborative practices within PBL for elementary students and show that even when there are difficulties in that collaborative process engagement and learning outcomes can still show positive results. These findings were also supported by the previously presented research of Sormunen et al. (2020) that closely examined maker-centered PBL and teacher-supported reflective discussions to support student collaboration in inclusive settings.

However, not all group collaborative efforts are successful. In a qualitative study, Aksela and Haatainen (2019) surveyed 99 Finish preschools through secondary teachers regarding teacher perceptions of the benefits and challenges of PBL using data-driven qualitative content analysis of three open-ended questions distributed in an e-survey. The researchers found that elementary and secondary teachers perceived PBL to be useful in creating a student-centered learning environment, a community of learners, and collaboration skills but also revealed that collaboration is a challenge of PBL across grade levels. This research provided insights into teacher perceptions as the study explored perceptions regarding collaboration within a PBL environment examining both benefits and challenges.

Collaboration and Students With Learning Disabilities

Not only has collaborative learning been found to be an effective strategy for students without learning disabilities within the PBL setting and outside of PBL (Easley et al., 2018; Fung & Lui, 2016; Howe & Zachariou, 2019; Lee et al., 2015; Schreiber &

Valle, 2013) but also with a more traditional approach to instruction. In an analysis of cooperative learning approaches within a traditional classroom setting, Sencibaugh and Sencibaugh (2016) examined six studies between 2000-2014 to determine the effectiveness of cooperative learning with students with learning disabilities academic achievement. The studies included students in third grade, sixth grade, and secondary students. The review determined that cooperative learning strategies, such as peer tutoring and peer-mediated learning are likely to improve the academic achievement of students with learning disabilities. However, they also revealed that the results of the review were limited due to the nature and brevity of the studies under review and stated that additional research needs to be done to confirm the efficacy of cooperative learning for struggling students.

However, in a more recent study, McGrath and Hughes (2018) were able to confirm the efficacy of cooperative learning for struggling students. The cross-case analysis examined six sixth, seventh, and eight grade students with learning disabilities who experienced an inquiry-based approach to instruction in science classrooms in Midwestern states. Data sources included both teacher and student interviews, student portfolios, and classroom observations. The study revealed that students who are learning disabled in the general education classroom struggled to gain the needed scientific content knowledge on their own. They instead relied on peer support to facilitate their learning. While the study focused primarily on the effectiveness of an inquiry-based approach to science education, it is important to note that it was only when the students with learning disabilities worked cooperatively with their peers that they found success

with this content area and instructional approach. This finding shows collaboration is a key component to inclusive classrooms for middle school students to succeed. This finding guided the development of interview questions that focus on the Vygotskian tenants of students working with a more able peer in their zone of proximal development.

Likewise, Jozwik and Douglas (2017) found similar results in a study that examined English learners with learning disabilities. The researchers provided interventions to four fourth grade students that provided the students with an opportunity to work in small groups with nonparticipants to increase reading comprehension. Using a multiple baseline design, students were assessed before, during, and after the interventions using comprehension rubrics. Results indicated that participants improved their comprehension abilities after being introduced to explicit strategies, web-based tools, and peer collaboration. Furthermore, participants perceived the technology tools and group collaboration as helpful. This research provided insights into inclusive elementary classrooms that use technology and collaboration amongst small groups to improve reading comprehension for students.

Another study that supports the collaboration of students with and without learning disabilities in the regular classroom setting was conducted by Forslund Frykedal and Hammar Chiriac (2018). The study focused on inclusive practices and how fourth grade students behave in small group work. The study examined collaborative practices and how the teacher either supported or impeded students in this setting. Video recordings of group work were analyzed and revealed when teachers refrain from the traditional authoritative role and provide more defined feedback, students with learning

disabilities were able to collaborate in small groups effectively. The role of the teacher helped to determine if the students with disabilities were to take an active role in those group discussions. This study provides insight into the structure of small group work in inclusive classrooms and what role a teacher needs to adhere to in order to support the collaboration of all students. This insight was extremely valuable when analyzing the effectiveness of group collaboration in situations that include students with learning disabilities. Findings indicated a teacher plays an active role in the decision making that accompanies choosing groups in inclusive settings at the elementary level.

Another research study by Miller et al. (2017) revealed insights into how to group students in inclusive settings. The researchers analyzed current research to present findings on cooperative grouping, as well as considerations for designing cooperative learning groups in inclusive settings. This research study was like that of Jenkins et al. (2003), who also indicated the success of the collaboration is establishing thoughtful and teacher-directed groupings of students. Findings gathered from the research indicate small group size around three to four students is critical, allowing an extended time for task completion, assigning specific roles to group members, carefully choosing the heterogeneous group members, and defining clear expectations all contribute to students' success while working in small groups. The relevance of both of these studies is revealed through the insights that are provided with structuring small group work in inclusive settings.

Technology and Collaboration

Classrooms today incorporate a variety of student abilities within the constructs of the regular education room. Teachers must meet the diverse needs of all students in an inclusive setting. Several research studies revealed that teachers use collaborative strategies to achieve this goal and often find these strategies to be enhanced with technology (Dukuzumuremyi & Siklander, 2018; Rhim & Lancet, 2018; Zheng & Warschauer, 2015). In a qualitative study, Dukuzumuremyi and Siklander (2018) surveyed 21 second-grade pupils in an inclusive classroom examining the interactions between pupils and their teacher in collaborative and technology-enhanced learning settings. The study revealed the use of the laptop increased collaboration amongst pupils. According to research, these online forums are successful for students of all ages, especially for elementary students. In a quantitative study, Zheng and Warschauer (2015) studied the online discussions of 48 fifth grade students and their teachers using archived discussion threads and statewide-standardized reading and writing test scores. Findings indicate that well-designed synchronous online discussions among diverse elementary-school students can result in increased participation and interaction. This provided insights as it explored online discussion forum benefits in elementary grades.

In the following research study by Rhim and Lancet (2018), it is also revealed that collaboration amongst students of all abilities continues to be effective and is enhanced with technology. The qualitative case study examined three different Thrive campuses serving students K-12, using interviews from school leaders, teachers, students, family members, and staff (paraprofessionals) and reviewing both publicly available resources

(such as school websites) as well as privately shared resources (such as special education-specific data). The results of this study revealed the Thrive schools had several key criteria that were attributed to their success; the use of technology, the practice of PBL, community-mindedness, and an entirely inclusive setting. The study supported the idea of using technology-enhanced PBL to support collaboration between students with and without disabilities in the regular classroom.

Another study that provided insights into the use of technology to enhance PBL with students with learning disabilities was revealed in a quantitative study by Terrazas-Arellanes et al. (2018). The study (Terrazas-Arellanes et al.,2018) using experimental and control groups examined three years of pre and post science data and surveys of both teacher and student satisfaction using chi-square statistic and *t* test to analyze the data from a total of 71 teachers (36 treatment plus 35 control) in 13 middle schools (seven treatment plus six control) across three school districts in Oregon and Georgia to test the effectiveness of a PBL online science unit. The study revealed the online science unit deepened scientific understanding and lessened the science literacy gap among middle school English learners and students with learning disabilities. This study provided insights into the design of my current interview questions as they focused on gaining insights into teacher perceptions of working with students with learning disabilities in an online setting.

Further examination of PBL and the use of technology was examined in a study by Gómez-Pablos et al. (2017). These researchers examined a PBL unit that had incorporated digital technologies and took an in-depth look at teacher perceptions in

Spain regarding this methodology. The researchers used questionnaires that were applied to 310 participants that included teachers from nursery school, primary school, and secondary school. Most participants indicated that using digital technologies and PBL increased student motivation, participation, and curricular skills. Some teachers did indicate that they had some difficulty implementing these projects and the researchers found that significant differences in participants' sex and years of experience affected their perceptions of the projects. Male teachers and teachers with more classroom experience looked to the methodology more favorable than female teachers and teachers who had less teaching experience. In a final examination of PBL, technology, and group collaboration, a qualitative action research study by Baser et al. (2017) using observation forms, interviews, forum archives, and website evaluation rubrics examined how 15 seventh grade students perceived a web-based science project. The results found virtual spaces such as online tutorials, forums, and collaborative and communicative tools to be beneficial for collaborative PBL. All these studies provided insight into the use of online forums to support collaboration in PBL settings with students of all abilities. The study's interview questions were used to inform interview questions for teacher perceptions in elementary grades. The focus of these questions relates to learning in an online setting while collaborating with peers and the perceptions of the instructional methodology.

It is important to also look at collaborative practices outside of PBL that have been enhanced by digital tools. Xie et al. (2018) used a synthesis approach to review the literature between 2007-2016 that incorporated mobile learning technologies in inclusive K-12 settings. The findings revealed that most studies focused on the effectiveness of

mobile learning and specifically found the potential for mobile learning to support students with learning disabilities. This study provided a unique perspective regarding digital technologies and special education students.

In another study surrounding mobile technologies, Reychav and Wu (2015) examined mobile collaborative learning using tablets. This study specifically researched student learning in group work. Content in the study was delivered through video and text. A set of field experiments was designed and conducted with 1,131 secondary students. Results indicate that student satisfaction, perceived understanding, and performance are influenced by peer learning and individual cognitive growth. The study also revealed that text delivery provides more students with greater satisfaction and higher performance in group work, while videos are more effective for individual learning. While this study is done with secondary students and not elementary students, it provided insights into the mode in which online learning could take place for group work to be more successful. The researchers recommended more research would need to be conducted to support these findings in elementary grades.

Similarly, in a quasi-experimental design, Saad (2017) examined elementary students in a middle-eastern girls' school. In the experimental treatment group, students used collaborative learning techniques such as wikis to engage in discussions, journals, and blogs, while the control group continued to be taught in a traditional lecture method. The research revealed that the students who participated in the technology-enhanced collaborative practices significantly increased their test scores in science on the posttest.

Furthermore, Davidsen and Vanderlinde (2016) in a qualitative case study that

included 41 second-grade students and three teachers in two classrooms examined children's collaboration around touchscreen devices and the teachers' role in designing collaborative opportunities and guiding students through the process of collaboration. Using Murphy's (2004) collaboration model and findings from the case study, the researchers suggest that for effective collaboration, students must reflect on peers' perspectives, co-construct a shared perspective, and create shared goals and purposes. The researchers suggest the teacher's role is to define what collaboration means to them and design lessons to guide students through collaborative processes. During the case study, the touchscreen device acted as a shared workspace for the students and a platform for the students to collaborate. However, according to the researchers it was how the teaches guided students through collaborative practices that allowed the students to work together successfully. This provided insights into how teachers need to present collaborative opportunities to students in elementary grades using digital devices.

Furthermore, in a meta-analysis and critical synthesis of mobile computer-supported collaborative learning, Sung et al. (2017) revealed that using mobile-supported-collaborative-learning (MCSCL) has produced improvements in the field of collaborative learning. The largest portion of the studies reviewed included college students, followed by elementary students, high school students, and mixed populations. Using moderator variables such as group size, subject, teaching method, and duration of the intervention, the researchers indicated that these variables would influence the effect of MCSCL on student outcomes. Their results were similar to the meta-analysis of Kyndt et al. (2013), who also found that the effects of cooperative learning were beneficial for

the categories of learning achievement and learning attitude even without mobile devices. When examining school subjects, the analysis revealed that MCSCL had more positive effects on mathematics and science than it did on social studies and language arts. Another finding of the study revealed that MCSCL positively affected learning achievement, learning attitude, and peer interaction. Some interesting findings indicated both homogeneous and heterogeneous groupings produced the same results when using MCSCL. Furthermore, the mobile enhancement group sizes can be larger, which differs from the finding of the previous study by Miller et al. (2017) who indicated smaller group sizes were ideal for collaborative work. Findings from the meta-analysis support the use of computer-supported-collaborative learning opportunities using mobile devices that are often found outside of the classroom.

In an additional qualitative study, Doyle-Jones (2019) examined 10 elementary teacher perceptions and how they implemented digital tools to enhance writing and collaboration amongst their students through interviews. Teachers reported during the implementation of digital tools to teach writing, students had the opportunity to collaborate with their peers more easily and were more apt to coauthor writing pieces. The teachers reported that students increased their time spent writing considerably when digital tools were introduced. Barriers to using digital technologies included limited or varied access to devices amongst students outside of school. This research provided insights on teacher perceptions of digital tools to aid in writing instruction and facilitate collaboration amongst elementary students.

Furthermore, digital technologies are being implemented to connect students across cultural divides between wealthy suburbs to impoverished urban centers. In a case study, Freedman et al. (2018) examined a project where students in elementary classrooms from predominately white wealthy communities are paired with elementary students from minoritized poor communities to work collaboratively to take a virtual tour and engage in discussions regarding similarities and differences using a Google Doc. The study reported an increase in cultural understanding and civic dialogue, mainly revealed through the participation of every group member and the contribution they made regardless of what community they inhabited. This is significant as it highlights the use of digital technologies to increase collaboration amongst students and help to break down barriers that may exist.

In the following studies, technology was also used to increase collaboration amongst elementary-aged students. Del-Moral-Pérez et al. (2019) investigated 201 primary-aged students from 6-12 years old who participated in a digital storytelling project to examine the collaboration amongst students using the technology. Data were analyzed using student work and an assessment rubric that included criteria for both narrative writing and collaboration skills. The teachers noted that the collaborative aspects of this project allowed students to express themselves creatively through their stories and were able to complete the entire project only because they were working with partners. This research provided insights into the benefits of collaboration and how technology can act as a platform for students to work together. Furthermore, Sahlin et al. (2017) also found similar results with the use of laptops, tablets, and smartboards. The

qualitative research case study observed and interviewed teachers and students in three different elementary schools in Sweden. Although the study explored skills such as critical thinking, problem-solving, and creativity and innovation of first through fourth-grade students, they also specifically looked at collaboration amongst students when utilizing the devices. The findings reveal an increase in collaborative practices with the use of devices in all three schools. Students were able to work together to complete given tasks and provide words of encouragement to their peers with the use of technology. This study showed the positive impact technology can provide to students who have access to devices.

Using technology to enhance collaboration in inclusive settings was also revealed in studies conducted by Asghar et al. (2017), Moore et al. (2020), and Adam and Tatnall (2017). In all three research studies, technology was used to enhance the collaboration between elementary students both with learning disabilities and students without learning disabilities. In an analysis of literature, Asghar et al. found students with learning disabilities can succeed when scaffolds are implemented when working on collaborative projects involving STEM activities. These scaffolds could include but are not limited to technologies designed to aid students in the collaborative aspects of a project or the use of visual aids to help reduce the cognitive load on the working memory. The review of the literature revealed that K-12 students with learning disabilities who were actively engaged in projects with sustained inquiry showed improvements in conceptual understanding and engagement.

Furthermore, Moore et al. (2020) using a mixed-methods approach examined one seventh grade social studies class in an urban school. The researchers' video-recorded group collaboration pre- and post-reflection to determine changes in student engagement. Students actively watched themselves collaborating with peers and gave and received feedback. The study revealed that by using this technology collaboration was improved by more time spent on tasks from all students and increased participation of students with and without disabilities. This study conducted with middle school students lends insights into the possibilities of elementary students' increased engagement with projects via technology following a similar protocol with group work. Finally, Adam and Tatnall (2017), in a qualitative study that researched two special elementary schools in Australia, investigated information communication technologies and how they could be used to support students with learning difficulties. The case study approach included classroom observations and interviews with school principals, teachers, and parents on student learning, attitudes towards learning, and academic progress. The research found that information communication technologies improve students' attitudes toward learning and academic knowledge. This study showed the importance of communication technologies to support students with learning disabilities and further supports the idea that technology improves student's attitudes towards learning and their academic skills.

Additionally, technology is used to aid in collaboration in project-based environments. Lau et al. (2017) in a mixed-method study examined 37 primary students ages 11-12 in four different classrooms participating in a group collaborative project using online wikis. The purpose of the study was to determine student's attitudes towards

learning with wikis, the effectiveness of interactions in online group work, and what students learned using wikis in a science inquiry-based project. A survey and focus group interview questions were used to assess student learning attitudes, online interactions, and learning benefits with wikis. The data from the student survey and focus group questions revealed that wiki-based learning within an inquiry project-based approach is effective in the learning and teaching of science inquiry-based projects in primary schools. This study showed the effectiveness of using online platforms, such as wikis to facilitate group work with young students.

While technology is one way in which students with and without disabilities are engaging in class discussions and group projects as indicated in the previous studies (Asghar et al., 2017; Dukuzumuremyi & Siklander, 2018; Moore et al., 2020; Reychav & Wu, 2015; Rhim & Lancet, 2018; Terrazas-Arellanes et al., 2018), current research also revealed teachers indicate the need for more strategies, interventions, and supports when including students with learning disabilities in the regular classroom. In a quantitative study, Cornoldi et al. (2018) used a questionnaire to survey 557 fifth grade teachers across three countries, the United States, Spain, and Italy, on teacher perceptions of students with learning disabilities and the practices that are appropriate for meeting the needs of students with learning disabilities. The study revealed that teachers, in general, have positive attitudes regarding students with learning disabilities in the general education classroom but feel support, training, and strategies for intervention are needed to best support these students. This study showed the importance of understanding teacher perception and how teachers need strategies to support the learning of students

with learning disabilities, which could include, but are not limited to, collaboration strategies.

An additional study that highlighted teacher perceptions of technology use was conducted by Constantine et al. (2017). Three elementary teachers who had participated in STEM professional development training co-constructed and implemented a STEM curriculum project. Qualitative analysis revealed that teachers' beliefs in technology directly impacted their practices. One educator viewed technology as a purposeful tool, while another indicated that technology can be a distraction or limited by technical difficulties. These findings provided a lens into the effectiveness of technology-based on teacher perceptions of technology.

In other research, a classroom layout may influence the use of technology to promote group interaction and learning. Mercier et al. (2016) explored two different classroom layout designs, each equipped with multitouch tables, and examined collaborative practices within each group of students in six elementary classrooms. Three of the classrooms sat in a traditional forward-facing approach and three of the classrooms had table groups facing each other towards the center of the room. While both classroom designs were equipped with the same technology in the form of the multitouch table, the centered room layout elicited a greater number of on-task discussions amongst the students. The findings highlighted the importance of the learning environment when implementing technology into the classroom.

Finally, while it is important to understand collaborative practices through many perspectives, often student perceptions are limited. However, Neokleous (2019) in a

qualitative study provided a baseline for young learners' attitudes towards the use of technology in primary schools, providing a unique perspective to the current research. During the semi-structured interviews with 14 students, attitudes towards the use of technology in the classrooms, and how well they thought the technology was integrated into the classroom was established from the students. The students unanimously expressed their appreciation for the use of technology in the classroom. One aspect of technology integration that students specifically appreciated was the opportunity technology provided for them to interact with their peers. Four of the students who identified themselves as shy, commented on how technology allowed them to actively participate, whereas without the use of technology they often sit back and observe. Furthermore, four of the students also cited those collaborative projects with students outside of their school offered increased engagement and a motivation to learn. The findings also revealed that overall, these students appreciate the shift from a teacher-centered classroom to a student-centered classroom with the introduction of technology. This research provided unique perspectives from elementary students that offered insights into the integration of technology to aid in collaborative practices.

Summary and Conclusion

Vygotsky (1978) acknowledged that when students work together in collaboration to solve problems it has a positive effect on learning. Group work exists in various educational settings and situations; however, it is deeply embedded within PBL environments as a key component of the curriculum. Using Vygotsky's social constructivism theory, which states that students need to work together to learn and make

meaning as a framework for understanding various collaborative environments, allowed me to gain insights into teacher perceptions of technology-enhanced PBL with students who have learning disabilities as they interact in collaboration with peers.

The major themes that emerged in my synthesis of the current literature included the overall effectiveness of PBL for both students with learning disabilities and without. The research was clear that PBL when implemented with integrity, can be effective in improving academic achievement, student motivation, and student engagement (Merritt et al., 2017; Revelle, 2019; Storer, 2018). The research also suggested that students with learning disabilities thrive in collaborative environments academically and socially (McGrath & Hughes, 2018; Sencibaugh & Sencibaugh, 2016).

PBL and its collaborative components increase student achievement and collaboration for students with learning disabilities and those without learning disabilities (McGrath & Hughes, 2018; Merritt et al., 2017; Revelle, 2019; Sencibaugh & Sencibaugh, 2016; Storer, 2018). Research indicates that when students work together in collaborative groups higher levels of learning are achieved and students have a sense of belonging with increased levels of participation. However, I did not know how these groups operate in an inclusive setting within a PBL classroom when enhanced with technology. It was also unclear how students with learning disabilities and students without learning disabilities felt about group collaboration enhanced with technology within PBL projects. Furthermore, I did not know teacher perceptions of these online interactions through PBL in discussion forums.

The present study helped to fill the gap in the literature by providing insights into teacher perceptions of technology-enhanced collaboration with elementary students of mixed ability within a PBL environment. Gathering teacher perceptions of these collaborative technologies for use in promoting collaboration between students with and without learning disabilities added to existing data on how to best serve the academic, social, and emotional needs of these students in the regular classroom. These new understandings extended current knowledge in the field. In the following chapter I discussed the methodology and process I adhered to throughout my research from the onset to my conclusions.

Chapter 3: Methodology

The purpose of this basic qualitative study was to explore elementary teacher perceptions of how students with mixed abilities collaborate using technology in a PBL environment. A qualitative approach was suitable for this study because it is exploratory, and a basic qualitative design was appropriate because I used an inductive strategy with a descriptive outcome (see Merriam, 2002).

In this chapter, I explain the research design, rationale, and my role as the researcher, including my relationship with participants and how participants were chosen for the study. The instrumentation of this study and data analysis plan are also discussed. Furthermore, I address the issues of trustworthiness and potential ethical concerns in the study.

Research Design and Rationale

The following research question and subquestions guided this study:

RQ: What are elementary teacher perceptions of using technology-based discussions to promote collaboration amongst students with mixed abilities in a PBL environment?

Subquestion 1: How do elementary teachers perceive interactions in online discussions have enhanced students' self-efficacy in mixed-ability classrooms?

Subquestion 2: How do elementary teachers view technology-based collaborative discussions in terms of how the strengths of group members have been utilized to scaffold other group members' learning during PBL?

Phenomenon of Study

The phenomenon of interest was elementary teacher perceptions of how students with mixed abilities collaborate using technology in a PBL environment. Inclusion indicates students with and without learning disabilities are educated within the same classroom simultaneously. In this study, I examined the collaborative component of PBL using technology platforms, such as Google Classroom, to explore how students collaborate and engage in class discussions in an online format. Collaboration within the framework of PBL is often a challenge a teacher can face, especially within classrooms of students with and without learning disabilities (Aksela & Haatainen, 2019; Alharbi et al., 2018). I focused on teacher perceptions to gain insight into best practices when using PBL and technology to support the collaboration of all students.

Research Tradition

A qualitative approach was necessary because of the exploratory nature of the study. The research topic under study could have been framed in a multitude of research traditions, and it was with much care and contemplation that I chose the generic inquiry approach. First, the topic can be regarded as a phenomenon experienced by teachers of students in a PBL collaborative environment; therefore, phenomenology might have been an appropriate methodology because it aims to uncover the phenomenon through the perceptions of participants (see Creswell, 2009; Patton, 2015). However, I did not choose this tradition because I did not want to limit the study to just the phenomenon but rather explore the experiences in a flexible and fluid study, applying the findings to real-life situations. I also considered grounded theory as the design because PBL and its

collaborative component enhanced with technology is a strategic process for learning. The grounded theory provides a conceptual approach to actions taken in real-life situations (Glaser, 1992). However, my aim with this study was not to create new theories. Another design I considered was a narrative inquiry approach. Talking with teachers who have experienced PBL with students of all abilities in collaborative settings required the use of storytelling to relay the experiences in the situation (see Creswell, 2009). Since all these research methodologies could have been used due to the multifaceted nature of the research topic, I ultimately selected a generic inquiry approached was ultimately chosen for its flexibility (see Liu, 2016).

A second determining factor for employing the generic qualitative design to examine teacher perspectives using an inductive strategy with a descriptive outcome is the real-world applications of the research (see Merriam, 2002). According to Patton (2015), a generic qualitative approach is appropriate when attempting to explore practical consequences and useful applications of what can be learned about the topic. Therefore, a generic qualitative inquiry approach was suitable for this study because I sought to answer a straightforward question and gain useful applications from the findings. By exploring teacher perceptions, insights into the influences of technology-enhanced collaboration between students of all learning abilities were revealed. Furthermore, the practicality of simply asking open-ended questions and observing matters of interest in real-world settings to improve pedagogy separates the current study from the epistemology from which it emerged into generic qualitative inquiry (see Patton, 2015).

Role of the Researcher

Qualitative research has a uniquely human component embedded deep within its construct. One of the most interesting things about qualitative studies is the researcher's role, influence, and stance within the research or the idea that "…the identity of the researchers is viewed as a central and vital part of the inquiry itself" (Ravitch & Carl, 2016, p. 10). Furthermore, because of this humanistic component to qualitative research, qualitative researchers subsist on the notion that there are multiple situated truths and perspectives (Ravitch & Carl, 2016). Through this qualitative research, I tried to capture these truths based on multiple perspectives and add to the existing body of knowledge in the field.

My role as the researcher within this study was one as an interviewer. I conducted interviews using an interview guide and took field notes during the interviews. Furthermore, I kept a researcher's journal throughout the interview process. Carefully examining my personal bias throughout all phases of the study helped to ensure that the findings truly reflect the perceptions of the teachers from which the data were collected, synthesized, and analyzed. The qualitative researcher, as part of the research, needs to have a heightened awareness of the effect their role in the study can have on the research. Ravitch and Carl (2016) referred to this as researcher reflexivity, or an examination of the researcher's identity and an ongoing awareness of the bias and influence one can have while conducting and summarizing research. Using a journal to record my thoughts, feelings, fears, insights, and preconceptions helped to keep my research transparent (see Ortlipp, 2008). Using this form of bracketing to remove preconceptions before, during,

and after the research process helped eliminate any personal biases I may have unintentionally imposed on the study if I had not taken this reflexive stance (see Tufford & Newman, 2012).

I was not a participant or observer in this study; however, it should be noted that I had incorporated PBL into my classroom with students. I have used elements of Google Classroom to also promote collaboration amongst students with and without learning disabilities. However, I did not use my experiences or my students to conduct this research; instead, I ensured that my biases were removed by conducting interviews with participants with who I had no personal contact or relationship.

Methodology

Participant Selection Logic

Participant Population

I interviewed nine elementary teachers from multiple schools who had participated in PBL and used online discussions or collaborative documents during group project work with mixed-ability students. To participate in the study, the teachers needed to teach in an inclusive setting that included students of mixed abilities. The online learning platforms used during a collaborative project in some capacity could include Google Classroom, Canvas, or SeeSaw. All participants met the requirement of the inclusion criteria. These participants were sought out through networks for professionals who teach using PBL. I obtained these contacts through mutual relationships in professional organizations within the framework of PBL. I also obtained participants through soliciting participation from an administrator-generated email in my own district.

Sampling Strategy

I used purposeful sampling for this research because the teachers who were selected for the study contained information-rich knowledge about the topic (see Patton, 2015). This sampling strategy is aimed at gaining insight into the phenomenon, not generalizations from a sample to a population (Patton, 2015). In this study, I sought to specify and have an in-depth understanding of the social reality of teacher perceptions of this phenomenon (see Liu, 2016). Specifically, snowball or chain sampling was the purposeful strategy used. I started with one or a few relevant interviewees that fit the criteria being elementary teachers who teach in an inclusive setting and used technology to enhance the collaboration within a PBL environment (see Patton, 2015). These initial interviewees were asked for additional relevant contacts who could provide different or confirming perspectives (see Patton, 2015). As the researcher, I recruited participants based on contacts through a national project-based learning institution. This strategy created a chain of interviews based on people who know people who know people who would be good sources given the focus of inquiry (see Patton, 2015).

Participant Selection Criteria

Potential participants were made aware of this study through professional organizations, including contacts in the research department of a national PBL institution and their national faculty. I sent potential participants an invitation to participate and communicated with them through email correspondence.

I selected participants from schools embedded within the setting and population of this research problem, which inevitably helped to determine the sample size of this

research study (see Merriam & Tisdell, 2016). This means that for teachers to participate in this research study they had to serve Grade K-8 students both with and without learning disabilities within the regular elementary classroom setting. I specifically referred to this learning setting as an inclusive elementary classroom. The teachers also needed to be actively engaged in PBL and using technology-enhanced collaboration strategies within their classrooms. I noted how long the teacher has been using PBL and their experience using technology to promote collaboration amongst students because a teacher using PBL for the first time or a teacher versed in PBL methods within a technology-enhanced collaborative environment may have different experiences. For inclusion in this study, participants needed to have taught for at least 3 years in a PBL learning environment with students who have mixed abilities as well as have used collaborative enhanced technology. Teachers were known to meet the criteria through self-reporting on participation criteria found within the initial newsletter sent by a partner organization and reaffirmed at the beginning of the interview. Recommendations from peers drawn from the snowball sampling strategy and who met the inclusion criteria found within an email of initial contact were confirmed at the beginning of the interview.

Rationale for Sample Size

When determining the appropriate sample size in a basic qualitative study, a range of participants is recommended with reaching data saturation being the goal (Fusch & Ness, 2015; Marshall et al., 2019). Numerous qualitative researchers have agreed that any number of participants, ranging from 12-60 would be sufficient to reach data saturation depending on the purpose of the qualitative study (Baker et al., 2012). However, through

my extensive literature review, I found that when conducting interviews, a smaller sample size may be sufficient to reach data saturation. In similar qualitative studies, Neokleous (2019) conducted semistructured interviews with 14 students, and Doyle-Jones (2019) examined 10 elementary teachers' perceptions, indicating the feasibility of a smaller sample size. Furthermore, Constantine et al. (2017), McGrath and Hughes (2018), and Jozwik and Douglas (2017) all used fewer than six participants to conduct their qualitative research, some using as few as three participant interviews. Each study reached sufficient data saturation. Patton (2015) indicates that in qualitative sampling designs, a minimum sample based on expected coverage of the phenomenon should be determined; however, the design needs to be flexible and emergent throughout the study. Therefore, based on my review of the current literature, a minimum of nine to 12 elementary teachers was the approximate number of interviews I conducted. According to research based on the above criteria, this was an appropriate sample size and resulted in data and theoretical saturation.

Participant Identification, Contact, and Recruitment

I identified initial participants through contacts in a professional organization that works directly with teachers who teach using PBL. The initial contact was made through a monthly correspondence newsletter from the partner organization that included text as an invitation to participate. Information in the newsletter provided potential participants interested in participating with my contact information and the inclusion criteria to be considered for this study. When too few participants responded to the initial invitation, I included a follow-up in the monthly correspondence newsletter of the partner

organization. Once a participant was identified as meeting the criteria of an elementary teacher who teaches PBL in inclusive settings and uses technology to enhance collaboration amongst students, they contacted me. I identified additional potential participants through the recommendations of initial participants and an email sent from a district administrator to K-8 teachers in the district that I teach in.

Potential participants were contacted with respect for their privacy, and there was a lack of pressure and undue influence as I provided them with an accurate and clear description of the study and an unbiased presentation of the study (see Patton, 2015). Meaning, participants' identities were kept confidential, they were not coerced into participation, and they were also given a clear and accurate representation of the study. If potential participants did not meet the selection criteria for this study based on the inclusion criteria found within the newsletter from the partner organization, I informed them through email that they did not meet the requirements for inclusion in this study and thanked them for applying.

After receiving confirmation that a teacher met the selection criteria and may be part of the study, I sent them an informed consent email. After reading the requirements and reviewing their rights, the participant responded to the email with the phrase, "I consent." If participants did not respond within a week after receiving the email, I followed up with a reminder email and an additional reminder within the next week if needed. After sending two reminders and having received no response, I moved on to another potential participant. However, when each interviewee/participant responded with their consent, an interview was scheduled.

Saturation and Sample Size

The goal of my qualitative research was to reach data saturation. Morse (2000) described a concept of trade-offs in-depth versus breadth, indicating the greater amount of usable data obtained from an interview the fewer number of participants required. Therefore, as I conducted my research when a participant's interview did not add further perspectives or information, then saturation had been achieved. Using nine to 12 participants as the minimum number allowed for flexibility for either growth in participants if saturation has not been achieved or if saturation is achieved sooner than expected the number of participants can be reduced (Patton, 2015).

Instrumentation

Qualitative interviews were chosen as the instrument for this basic qualitative study. The purpose of qualitative interviewing was to capture how interviewees view the world in which they live or experience in an open format distinguishing it from closed questionnaires and tests used in quantitative studies (Patton, 2015). Data were collected from interviews with teachers and analyzed using inductive means exploring recurring patterns and emerging themes from the data (Merriam, 2002; Merriam & Tisdell, 2016; Ravitch & Carl, 2016). According to Ravitch and Carl (2016), the primary goal of individual interviews is to gain insights into the individual. Using these firsthand accounts helped me fully understand my research questions. As the researcher, I engaged with teachers through an interview process to record their experiences and ultimately analyzing the findings within this lived experience (Ravitch & Carl, 2016).

To gain insights into best practice and the lived experience of working with students with learning disabilities in the regular classroom conducting personal interviews with the teacher are important. The educational context of my research, which includes a PBL environment, collaborative activities enhanced with technology, and students with learning disabilities, required a unique set of experiences and expertise from my participants. According to Seidman (2012), an abundance of research is done on schooling, but truly little examines the perspectives of students and teachers. My research explored the perceptions of these elementary teachers and their stories of the experiences they have working with students who have learning disabilities in a PBL environment.

I used a researcher-produced interview guide and recorded the interviews virtually. Appendix A shows the complete interview protocol. I organized my interview with a couple of background questions, in the beginning, to make the interviewee feel comfortable (Patton, 2015), and then in the middle of the interview asked questions that got at the heart of the phenomenon and ended with a question that invited anything else they would like to tell me. Understanding the focus of my research questions and providing a balance in my questions provided data that were robust and captured the full experience of the interviewee (Patton, 2015).

I used a standardized open-ended interview. This allowed me to construct open-ended questions before the interview, focus those questions on my topic, and allowed me to compare the responses more easily (Patton, 2015). This also helped to ensure content validity. Each interviewee was asked the same questions and follow-up probing questions. I used structured interview techniques, not exploratory, with open-ended

interview questions and ask the same questions for each participant. Each participant was interviewed independently of one another. While each interview was unique in how the respondent answers the interview question, the questions were constructed to explore perceptions of elementary teachers. Vygotsky's (1978) social constructivism theory focuses on the collaboration of learners to construct knowledge and was the basis for the construction of the interview questions. Along with Vygotsky, the peer-reviewed studies of Neokleous (2019), Doyle-Jones (2019) Constantine et al. (2017), McGrath and Hughes (2018), and Jozwik and Douglas (2017) used a small number of participants and collected data through in-depth interview techniques that will be used to inform my interview questions. Neokleous, McGrath and Hughes, and Jozwik and Douglas focused on student perceptions, however, the line of questioning that links technology use and student attitudes, students with learning disabilities, and PBL all helped to refine the wording and content of my interview questions. Furthermore, Doyle-Jones and Constantine et al. constructed interview questions that focused on gaining the perceptions of teachers involved in project curriculums and how they specifically used technology to aid in the collaboration process. These interview questions provided further insights into the construction of my research questions.

My interview questions focused on group project work and the technological platforms used during collaboration. Furthermore, group work with mixed-ability learners also reveals the dynamics of the more knowledgeable other (Vygotsky, 1978). Therefore, my questions also focused on group make-up and how group members interacted with one another. Examining how group members scaffold learning for one

another and how group members learn to utilize individual strengths was also aligned with the theory of social constructivism which states that group members construct knowledge from working with others and learning both from and with them (Vygotsky, 1978).

When I designed these interview questions, I wanted to make sure I explored concepts within my research to fully answer my overall research question. The concepts that I explored include PBL, specifically collaboration, as well as online learning platforms that support students in the collaborative process in an inclusive setting, which were informed by my review of current literature (McGrath & Hughes, 2018; Merritt et al., 2017; Revelle, 2019; Sencibaugh & Sencibaugh, 2016; Storer, 2018). Speaking directly to inclusion, I specifically explored teacher perceptions of the collaboration between students in regular education and students with learning disabilities in the regular classroom setting.

I developed my interview guide with the assistance of my dissertation committee, input from two field experts, as well as guidance from the research department from a national PBL institution. The first field expert is a colleague who has been teaching special education for over 10 years and who is certified in PBL from the Buck Institute of Education. The second individual to review my interview guide is a colleague, who is considered an expert, as she has experience in inclusive settings as well as being trained and certified in PBL. These experts helped to ensure the structure of the interview questions aligned to the practices of both PBL and instructing students with learning disabilities with the use of technology. I revised my interview questions to reflect

inclusive practices and collaborative tools that aid students with learning disabilities. Furthermore, I received feedback from two experts in the research department of the national PBL institution. These experts provided feedback that helped me remove biases from my interview questions and clarify the overall intention of each question. The recommendations from the experts helped to ensure alignment between my research questions and my interview questions thus contributing to the validity of this study.

I used a semi structured interview (Rubin & Rubin, 2012) approach by determining my interview questions in advance and planning subsequent follow-up questions. The interview questions use "what", "how", and "describe" to prompt the participant to give a detailed description of the perceptions of technology-enhanced collaboration in PBL with students of mixed ability. The standardized open-ended interview uses exact wording and sequence of questions in an open-ended format (Patton, 2015). I interviewed participants from across the nation and the aspect of standardization for compatibility purposes using this type of instrumentation.

Table 1

Research Question and Interview Question Alignment

Teacher Interview Questions	SQ1	SQ2
1. What is your experience using collaboration with elementary students?	X	X
a. What are your best practices for supporting collaboration?	X	X
2. What is your experience teaching student in a project-based learning (PBL) environment?		X
a. Describe your experience with the collaborative components of PBL.		X
3. How do students with mixed abilities typically collaborate in your PBL classroom?	X	X
a. What part of PBL collaboration works well for your students without learning disabilities?		
i. Can you provide an example?		

Teacher Interview Questions	SQ1	SQ2
b. What part of PBL collaboration is difficult for your student without learning disabilities?	X	X
i. Can you provide an example?		
c. What part of collaboration works well for students with learning disabilities?	X	X
i. Can you provide an example?		
d. What part of collaboration is difficult for students with learning disabilities?	X	X
i. Can you provide an example?		
4. What would you identify as the most impactful teaching strategy to promote collaboration with your students? Why?	X	
5. What resources or tools have you used that would help your students collaborate?		X
6. What types of technology platforms have you used to support collaboration in an inclusive setting?		X
a. What has proven effective in the use of these technology platforms?		X
i. How do you know?		
b. What is ineffective with these technology platforms?		X
c. In your experience what if the most difficult aspect of technology supported collaboration?		X
d. In what ways have you seen technology increase the effectiveness of collaboration?		X
7. What support of training do you perceive you might need to better support online collaboration?		X
8. Have you noticed any changes in the participation of your students with mixed abilities as they engage online?	X	X
a. If yes, in what ways have students with learning disabilities changed?	X	X
b. If yes, in what ways have students without learning disabilities changed?	X	X
9. How have you leveraged groupings in online discussions?	X	X
a. Have you used group member's strengths to scaffold the learning of other group members?	X	X
i. If yes, in what ways?		
10. Describe how student self-efficacy has or has not been affected by online discussions.	X	X
a. From your perspective, describe how students with learning disabilities perceive their abilities after collaborating in online discussions.	X	X
b. From your perspective, describe how students without learning disabilities perceive their abilities after collaborating in online discussions.	X	X
c. How do you know?	X	X

Note. In Table 1, the alignment between the research subquestion one (SQ1) and subquestion two (SQ2) and the interview questions are shown.

Procedures for Recruitment, Participation, and Data Collection

The nature of my research inquiry was to explore teacher experiences, and therefore interviews were an appropriate inquiry method (Seidman, 2012). The interviews were done via telephone, Zoom, or Google Meets in a synchronous communication format with an asynchronous location. According to Novick (2008), a bias against telephone interviews as opposed to face-to-face interviews has developed in recent years. However, Novick also stated that research shows that participants often feel more relaxed in a telephone interview as they do not have the pressure that a face-to-face interview can produce. Using electronic qualitative interviews such as Google Meets also has its advantages and disadvantages. Opdenakker (2006) stated that having a face-to-face interview is optimal as it can account for social cues that may be important for the researcher, however, they do not have to be used. Opdenakker also indicated a telephone interview can achieve the same goals and be better suited for the budget and time of the researcher. My research did not necessarily depend on the social cues of my participants as the topic is not sensitive and strictly pedagogical, therefore, both a virtual face-to-face or telephone interview were appropriate. Based on the great geographical distance between my location and my participants I used asynchronous recorded telephone interviews as it is more feasible for my limited budget and considerations in travel time limitations, in addition to constraints of the pandemic.

I conducted one in-depth interview per participant. The duration of the interview and follow-up debriefing took approximately 60 minutes of the interviewee's time. Culminating the interview, a debrief with the participant ensued. The debriefing

procedures include thanking the participant for their time and providing a plan for the next steps in the process. This plan included a timeline for when they could expect to hear from me. Each interview was recorded and transcribed. Each interviewee had a chance to view the transcription and summary through email correspondence and review the accuracy and meaning before data analysis. Interviewees had the opportunity to make any changes or additions at that time. Although this did not occur in the interviews I conducted, participants were informed that a follow-up interview may be required if original data was weak, or a more in-depth examination of a response needed to be explored or clarified. The line of questioning for follow-up interviews included clarification on responses from the participant, such as "you stated _____, could you please tell me a little bit more", "I didn't quite understand what you meant by the statement _____, can you please explain" or "you mentioned this _____, and it was really interesting, can you please elaborate."

Data Analysis Plan

In basic qualitative studies, the researcher is considered the primary instrument of data collection and analysis. The researcher uses descriptions from the findings in conjunction with the literature and theoretical framework that influence the study to analyze the data (Merriam & Tisdell, 2016). This study used procedures described by Saldaña (2016) and Patton (2015). In Table 1 a description of the connection between the interview questions to the research questions was documented, and in the following plan the procedure for coding, software used for analysis, and treatment of discrepant cases will be specified.

Interviews from PBL teachers were collected and analyzed using emergent, data-driven, or inductive means to explore recurring patterns and emerging themes from the data (Merriam & Tisdell, 2016; Saldaña, 2016). I used in vivo coding, or literal coding, according to Saldaña (2016), to capture the unique perspectives of the teachers in my study. The stories my participants shared with me needed to be told in their own words. Using this coding method helped ensure that I stayed authentic to their individual experiences. According to Saldaña (2016), in vivo coding applies to practitioner research as it captures the words of the participants and is more likely to capture people's experiences. When transcribing a participant's phrases such as “Technology is helpful in some ways but can be problematic in others” or “Students with LD at times have difficulties collaborating with peers”, or “I just don’t feel I have enough time to design PBL lessons online” or “Collaboration online needs to be well thought out and planned before executing with students” represent anticipated responses. Based on the literature (Doyle-Jones, 2019; McGrath & Hughes, 2018; Schneider, 2017) similar responses from participants were found. An example of codes I could pull from these phrases could include “technology good and bad”, “connectivity issues”, “time constraints”, or “online collaboration planning.”

For the first round of coding, I used the qualitative data analysis software, Dedoose (2021). This web-based tool allowed me to quickly organize my in vivo codes and allowed me to view my data in multiple ways. Dedoose was affordable and offered a wide range of features including graphs and tables to view my data, as well as collaborative options. Furthermore, Dedoose also allowed me to import and export data

to and from Word and Excel programs. This capability was especially important to me as I used this software in conjunction with Excel to pull quotes and categorize my data. According to Meyer and Avery (2009), using Excel to organize information in meaningful ways and using its logical function can be beneficial in qualitative research. Using Excel allowed me to utilize the codes created in Dedoose and analyze the data to find patterns and emerging themes from the data. Then reflecting on the data through memo writing and second cycle coding, I condensed the number of in vivo codes to reanalyze my initial work (Saldaña, 2016).

Furthermore, during the analysis process, I not only looked for patterns, but I also looked for cases that did not fit within the initial findings. When a case emerged that did not fit within the constructs developed through initial coding and analysis, special attention and thought was given to the discrepant case. These discrepant or negative cases can lend insight into the boundaries of the pattern, change the conceptualization of the pattern, or cast doubt on the pattern altogether (Patton, 2015). As I analyzed the data, I committed ample time to find patterns and themes, as well as find data that did not fit within these initial constructs. Spending time looking for these divergent patterns can lend credibility to the research by trying to make the most sense out of all possible conclusions found within the data, not just one conclusion (Patton, 2015).

Issues of Trustworthiness

Credibility

The credibility of my research began with the adoption of well-established methods of a basic qualitative study (Shenton, 2004). Using multiple interviews from

various schools allowed me access to multiple perceptions of similar learning contexts adding to a real time-time account of teaching within a PBL classroom with students of multiple abilities (Ravitch & Carl, 2016). Furthermore, the results of a qualitative study must be understood within the context of the organization's attributes and the geographical area in which the study was carried out (Shenton, 2004). Using multiple data sources, which included multiple participants from different geographical locations, iterative questioning, my reflective commentary in terms of field notes and journaling, member checking, and thick descriptions helped to add credibility to my research. These sources of information compensated for the individual limitations of one data source and helped to portray a better more stable view of reality (Shenton, 2004). Being able to examine my observations comparing them with the interview data and checking for consistency across interviewees, provided credibility of qualitative sources (Patton, 2015). Interviewing participants until data saturation was reached also helped ensure the credibility of the research.

Addressing the issues of credibility within the research was conducted both inductively and logically. According to Patton (2015), an interview should be analyzed systematically and conscientiously. The researcher needs to remove personal bias and search for alternate themes. This can be done inductively by organizing data in alternate ways or logically by seeing logical possibilities that the data supports (Patton, 2015). As I analyzed my interview data, I looked for data that specifically supports an alternate explanation.

Transferability

The nature of qualitative research makes transferability implausible, however, to assess the extent to which findings may be true of people in other settings, similar projects employing the same methods but conducted in different environments could well be of great value (Shenton, 2004). Even though I only had nine participants their perceptions came from very different instructional environments in different geographical locations. These participants provided a variation in participant selection geographically and with their experiences. These participants' experiences created a baseline for understanding (Shenton, 2004) teacher perceptions of technology enhanced collaboration in a PBL environment with students of mixed abilities. The rich data that was analyzed from the participants helped to provide external validity to the research. According to Ravitch and Carl (2016), describing the setting and participants with thick descriptions as well as interpreting and making sense of my data in authentic ways also helps ensure the trustworthiness of my research.

Dependability

To address the dependability issue more directly, the procedures and practices within the study should be reported in detail, allowing future researchers to repeat the work (Shenton, 2004). Time was taken to construct alignment between research questions and methodology (Ravitch & Carl, 2016). This includes getting expert feedback on interview protocol and interview questions. Furthermore, this research was documented through various methods. Data analysis included verbatim transcribed interviews, field

notes, the researcher's reflection journal, and great care in the coding of the data created data that helped to ensure the dependability of the research.

Confirmability

The concept of confirmability is the qualitative investigator's mission to achieve impartiality (Shenton, 2004). Using appropriate strategies to establish confirmability, such as reflexivity, were used throughout the research process. The process of examining and reflecting on oneself as the researcher and the research were done continually throughout the research through reflective journaling. To increase transparency throughout the research process I made my opinions, thoughts, feelings, and experiences visible as I recorded them in a reflective journal and revisited the entries throughout the research process (Ortlipp, 2008). Taking the stance of continual reflection prompted me to constantly review my approach to research, potential bias, or misunderstandings specifically throughout the entire interview process. Exploratory and reflective journal writing allows the researcher to grow and change with the research. These journals allow the researcher to understand their role as researcher, interviewer, and interpreter of the data generated via interviews, and to record decisions made and theoretical justification for the decisions (Ortlipp, 2008). This form of bracketing helped to eliminate my preconceptions and bring light to biases from the conception of the research question and throughout the research process (Tufford & Newman, 2012).

Furthermore, part of my responsibility and the power I have as a researcher is to remain as authentic as possible to the participants' experiences (Ravitch & Carl, 2016). I have many roles that play a part in this research effort. Primarily, I am an educator. This profession is so deeply

ingrained in how I view the world that it undoubtedly influences how I interpret data. According to Saldaña (2016), coding requires that the person wears a researcher's lens that is influenced by personal perspective and the individual's interpretation. I examined my reflective journal, notes and observations, transcript data, and coding using the lens of an educator. Again, by critically confronting my interpretations as a researcher and my potential biases I took a reflexive approach to research (Ravitch & Carl, 2016).

Another way in which I remained objective throughout my research was to remain open-minded. Taking the stance that everyone is an expert in his or her own experiences (Ravitch & Carl, 2016) allows me to fully grasp the perspective of another individual. While I may have similar experiences or can relate to topics discussed during the interviews, understanding that the person's experience is his or her own was critical in this process. I took the view that there are differences, and those differences are valuable (Ravitch & Carl, 2016). Furthermore, I used member checking during and after the culmination of each interview. Each interview was recorded and transcribed. Each interviewee had a chance to view the transcription and review the accuracy and meaning before the data was analyzed. Interviewees had the opportunity to make any changes or additions at that time.

Ethical Procedures

Ethical issues invariably arise during the research process. Being transparent is not only necessary for conducting an ethical study, but it is also an important aspect of achieving validity (Ravitch & Carl, 2016). Being open and honest throughout the research process is a critical aspect of the research. A researcher needs to inform the participants of their involvement in the research and gain their consent before conducting the research. This consent form was sent to each

participant through email and discussed the research process. According to Ravitch and Carl (2016), consent forms should include the following information: an establishment that participation is voluntary, and they have the right to withdraw at any time during the process, as well as clear description of the research process. The consent form also included an honest evaluation of any risk to the participant and the time commitment the participant can expect throughout the process. Other factors that were included are how the data will be used after the interview is completed and how their information will be kept confidential. I used pseudonyms for participants' names, attributes, and job titles. Furthermore, carefully considering aspects of the relationships with participants and setting boundaries for the researcher and participants can help eliminate issues. A researcher never wants to use a prior relationship with a participant to coerce them into participating in the research (Ravitch & Carl, 2016). I also applied to and received approval from Walden University's Institutional Review Board, approval number 08-02-21-0672458, before commencing with the data collection phase of this study.

Ethical considerations during an interview also need careful consideration once informed consent had been achieved and the interview commenced. Using scripts before the onset of an interview is one way to fully disclose what will be happening during the interview, how the research will be used, and the participant's involvement in the research, creating the basis for informed consent of the participant, as well as, promoting ethical research practices (Ravitch & Carl, 2016). The statement from Ravitch and Carl was short and succinct and communicates that the information obtained from the interview is important, why it is important, and shows respect for the interviewee (Patton, 2015). After the study commenced, I fully disclosed how the data can be used and who has access to the data.

Summary

The exploratory nature of this study made it suitable for a basic qualitative design, using an inductive strategy with a descriptive outcome. This study intended to explore the perceptions of elementary teachers in using collaborative tools, such as online discussion forums, to facilitate group work with students who have mixed abilities within a PBL environment.

In this chapter I explored my research design, rationale, and explained my role as the researcher including my relationship with participants and how participants were chosen for the study. Discussions of instrumentation and plan for data analysis were additionally defined. Finally, issues of trustworthiness and potential ethical concerns were addressed in this research methodological plan. In the following chapter I include the results from the interviews and qualitative analysis of the data.

Chapter 4: Results

The purpose of this basic qualitative study was to explore elementary teacher perceptions of how students with mixed abilities collaborate using technology in a PBL environment. A qualitative approach was suitable for this study because it is exploratory, and a basic qualitative design was appropriate because of the use of an inductive strategy with a descriptive outcome (see Merriam, 2002).

The following research question and subquestions guided this study:

RQ: What are elementary teacher perceptions of using technology-based discussions to promote collaboration amongst students with mixed abilities in a PBL environment?

Subquestion 1: How do elementary teachers perceive interactions in online discussions have enhanced students' self-efficacy in mixed-ability classrooms?

Subquestion 2: How do elementary teachers view technology-based collaborative discussions in terms of how the strengths of group members have been utilized to scaffold other group members' learning during PBL?

In this chapter, I discuss the research setting, demographics, and data collection process as well as provide an analysis of the data. The issues of trustworthiness and research results are also presented.

Research Setting

Participants were made aware of this study through a professional organization and school-districtwide email. These communications included contacts in the research

department of a national institution that focuses on PBL and their national faculty that sent an invitation to participate in the study through their monthly newsletter and one districtwide email from the rural study site school district in a western state. Participants received an invitation to participate and applied to take part in the study through email correspondence sent from a district administrator. From the initial invitation in the national institution's monthly newsletter, only one participant responded. Therefore, I sent a second invitation in the following month's newsletter but received no further participants from this source. However, through snowball sampling from the initial participant, three additional participants agreed to be a part of the study. The districtwide email procured another four participants and then snowball sampling led to one more participant.

I interviewed participants over the phone. To participate the teachers had to serve Grade K-8 students both with and without learning disabilities within the regular elementary classroom setting. I specifically referred to this learning setting as an inclusive elementary classroom. The teachers also needed to be actively engaged in PBL and using technology-enhanced collaboration strategies within their classrooms. Many of the teachers interviewed were recently returning to the classroom for face-to-face instruction after nationwide school closures due to the COVID-19 pandemic. These conditions may have influenced the participants' perceptions and experiences at the time of the study and should be considered when interpreting the results of this study.

Demographics

Nine participants from across the country took part in this study. Despite repeated attempts, only nine participants responded to the initial invitation, follow-up invitation, snowball strategy or district email. Some of the participants tried to connect me with additional participants; however, they never responded to my emails or follow-up emails.

From the nine participants, six participants came from three different western states and three participants came from the midwest. Of these participants, seven were female teachers and two were male teachers. The participants taught in Grades K-8 with class sizes ranging anywhere from 20 to 40 students. The communities that these teachers taught in were both rural and suburban. The students in these classrooms came from various cultural backgrounds and socioeconomic statuses and had varying learning abilities. Some of the teachers interviewed taught in cotaught classrooms with multiage students spanning two grade levels. Three of the participants had coteaching partners where the partnership consisted of a regular education teacher and a special education teacher in a full inclusion approach. Two of the participants taught in a coteaching situation where two regular education teachers shared a classroom of 40 students. Other participants were the sole teachers in the room. All participants had experience using technology-supported collaboration in a PBL environment. Their years of experience with PBL varied; some of the teachers had 3 or more years of experience, while others had up to 10 or more years of teaching experience in a PBL classroom. One of the teachers interviewed was also a mentor in PBL teaching strategies.

Table 2

Descriptive Data for Teacher Participants

Pseudonym	Gender	Grade Level	Setting	Class Size	Region
P1	Female	PreK-2	Urban	20	West
P2	Female	PreK-2	Urban	40	Midwest
P3	Female	PreK-2	Urban	40	Midwest
P4	Female	3-5	Rural	21	West
P5	Female	6-8	Rural	20	West
P6	Male	3-5	Urban	22	Midwest
P7	Female	3-5	Rural	20	West
P8	Male	3-5	Rural	20	West
P9	Female	PreK-5	Rural	20	West

Data Collection

Nine participants were individually interviewed using a basic qualitative approach. I conducted the first interview on September 20, 2021 and finished the last interview on November 23, 2021. One in-depth interview with each participant was conducted via telephone and recorded using Google Voice. Using Google Voice increased the quality of the audio recording because it was embedded within the device and not an outside recording. The interviews were conducted in a private setting (e.g., a private room with the door closed) to minimize interruptions and protect the privacy of the participants. The duration of the interviews and follow-up debriefing took between 40 and 60 minutes of the interviewee's time. Culminating each interview, I held a brief

debrief session with the participant. The debriefing procedures included thanking the participant for their time and providing them with a plan for the next steps in the process, including a timeline for when they could expect to hear from me.

Each interview was recorded and transcribed using a transcribing software called Sonix (2021). Each interviewee had a chance to view the transcription and summary through email correspondence and review their accuracy and meaning before I commenced data analysis. Interviewees also had the opportunity to make any changes or additions at that time, although only minor changes were identified. No follow-up interviews were needed to clarify or gather more in-depth information. Teachers provided descriptive explanations to my interview questions. An unusual circumstance occurred during one interview when the phone call was dropped due to a storm, but the glitch did not seem to affect the content being discussed.

Data Analysis

I conducted interviews with PBL teachers and analyzed their responses using emergent, data-driven, or inductive means to explore recurring patterns and emerging themes from the data (see Merriam & Tisdell, 2016; Saldaña, 2016). I used in vivo coding, or literal coding, following the suggestion of Saldaña (2016), to capture the unique perspectives of the participants. The stories my participants shared with me needed to be told in their own words in order to ensure that I am understanding their actual perceptions. Using this coding method helped ensure that I stayed authentic to their individual experiences. According to Saldaña (2016), in vivo coding applies to practitioner research as it captures the words of the participants and people’s actual

experiences. I used a total of 110 codes to code the data. When transcribing P1's interview, phrases such as "I do think of our classroom as a collaborative classroom in the sense that it's a democratic community. We make decisions together. We problem solve together." or "it starts with building a really safe environment…an environment where there's emotional safety, intellectual safety, where children know that they can make mistakes" became the codes of democratic community and safe environment, respectively. Another example of coding would be when P9 stated, "I would say that I generally try to use flexible grouping so that those mixed ability groups are there" became coded as flexible grouping methods.

For the first round of coding, I used the qualitative data analysis software, Dedoose (2021), which is a web-based tool that allowed me to quickly organize my codes and view my data in multiple ways. Dedoose was affordable and offered a wide range of features, including graphs and tables to view my data as well as collaborative options. Dedoose also allowed me to import and export data to and from Microsoft Word. This capability was especially important to me because I used this software in conjunction with Microsoft Excel to pull quotes and categorize the data. I pulled codes and corresponding definitions directly from Dedoose into Excel to analyze the data. According to Meyer and Avery (2009), using Excel to organize information in meaningful ways and using its logical function can be beneficial in qualitative research. Using Excel allowed me to utilize the codes created in Dedoose and analyze the data to find patterns and emerging themes.

Reflecting on the data through memo writing and second-cycle coding, I condensed the number of in vivo codes to reanalyze my initial work (see Saldaña, 2016). These in vivo codes were condensed into 13 categories or patterns and became subthemes of the four primary themes identified in the data. The patterns that initially emerged are included in Table 3. A full description of the codes, definitions, patterns, and themes can be found in Appendix B.

Table 3

Descriptive Patterns and Emerging Themes

Pattern	Theme
• Teachers build communities prior to collaboration • Teachers provide expectations to students throughout the collaborative process • Teachers provide opportunities to engage in collaboration • Teachers discuss a variety of grouping methods when students engage in collaboration	Theme 1: Student preparation for collaboration
• Teachers provide feedback and support throughout the collaborative process • Collaboration benefits all learners • Difficulties and collaboration	Theme 2: Benefits and difficulties with collaboration
• Strategies when using technology to collaborate • Student self-efficacy • Collaboration in a virtual environment has positive impacts • Teachers use a variety of applications and programs to collaborate virtually	Theme 3: Technology can increase student collaboration
• Problems exist when using technology to collaborate • Teacher's voiced strong opinions regarding collaboration during the pandemic	Theme 4: Virtual collaboration has consequences and problems

Discrepant Cases

During the analysis process, I looked for patterns and cases that did not fit within the initial findings. When a case emerged that did not fit within the constructs developed through initial coding and analysis, I gave special attention and thought to it. These discrepant or negative cases can lend insight into the boundaries of the pattern, change the conceptualization of the pattern, or cast doubt on the pattern altogether (see Patton, 2015). As I analyzed the data, I committed ample time to find patterns and themes as well as data that did not fit within these initial constructs. Spending time looking for these divergent patterns can lend credibility to the research by trying to make the most sense out of all possible conclusions found within the data, not just one conclusion (see Patton, 2015). A very negative response to technology emerged from some of the interviews involving teachers who had spent considerable time teaching solely virtually due to the COVID-19 pandemic.

Evidence of Trustworthiness

Evidence of trustworthiness is found throughout this study within the areas of credibility, transferability, dependability, and confirmability.

Credibility

The credibility of my research began with the adoption of the well-established method of a basic qualitative study (see Shenton, 2004). Conducting interviews with teachers from various schools allowed me access to multiple perceptions of similar learning contexts, adding to a real-time account of teaching within a PBL classroom with students of multiple abilities (see Ravitch & Carl, 2016). The results of a qualitative study

must be understood within the framework of the particular organization and the geographical area in which the study was carried out (Shenton, 2004). Using multiple data sources, including multiple participants from different geographical locations, iterative questioning, my reflective commentary in terms of field notes and journaling, member checking, and thick descriptions, helped to add credibility to this study. These sources of information compensated for the individual limitations of one data source and helped to portray a better more stable view of reality (see Shenton, 2004). Being able to examine my observations by comparing them with the interview data and checking for consistency across interviewees provided credibility of qualitative sources (see Patton, 2015). I also helped to establish credibility when I recognized interviewees responses were similar, demonstrating data saturation. During analysis, the information that the participants were presenting were no longer creating new codes after P6's interview. The codes had already previously been identified and were just noted and used in the following interview transcripts.

I addressed the issues of credibility within the study both inductively and logically. According to Patton (2015), an interview should be analyzed systematically and conscientiously. The researcher needs to remove personal biases and search for alternate themes, which can be done inductively by organizing data in alternate ways or logically by seeing logical possibilities that the data supports (Patton, 2015). As I analyzed my interview data, I looked for data that specifically supported an alternate explanation to my current data analysis. For example, I initially organized the collaboration data into two categories: face-to-face instructional categories and virtual

experiences. Then I organized the data in relation to experiences during the COVID-19 pandemic, and a much more negative response to technology in the elementary classroom was depicted. After reexamining the data and organizing it in a way that separated teacher perceptions of technology during face-to-face instruction and teacher experiences during school closures, something different emerged. Teachers were generally more positive about technology used to help students collaborate and viewed it as just another tool to help students work with their peers.

Transferability

The nature of qualitative research makes transferability implausible, however, according to Shenton (2004) similar research could be of great value if conducted with different participants in other locations. I used participants from four different states and grade levels spanning kindergarten to eighth grade to gather perceptions. These participants provided a variation in participant selection geographically and with their experiences and the participants' replies helped to establish external validity, thereby demonstrating transferability for some themes and experiences. These participants' experiences created a baseline for understanding (Shenton, 2004) teacher perceptions of technology enhanced collaboration in a PBL environment with students of mixed abilities.

I took the time to keep detailed notes regarding the demographics of each participant and the environment in which they teach. I noted details such as class size, student population, teacher's experience with PBL, geographical location, teacher gender, and community demographics. I then used member checking to ensure the accuracy of

my notes, as well as bracketing to ensure I was removing personal bias from the findings. According to Ravitch and Carl (2016), describing the setting and participants with thick descriptions as well as interpreting and making sense of my data in authentic ways also helps ensure the transferability of my research.

Dependability

To address the dependability issue within research, the process of the research must be reported completely, allowing a future researcher to repeat the study (Shenton, 2004). Time was taken to construct alignment between research questions and methodology (Ravitch & Carl, 2016). This includes getting expert feedback on interview protocol and interview questions. Furthermore, this research was documented through various methods. Data analysis included verbatim transcribed interviews, field notes, the researcher's reflection journal, and great care in the coding of the data. I also used member checking by providing the transcript of the interview and a summary of responses to each participant for review. The value of creating an audit trail as described above, can create a transparent description of the study contributing to the trustworthiness of the research (Amankwaa, 2016).

Confirmability

The concept of confirmability ensures the researcher remains neutral or impartial throughout the research process (Shenton, 2004). Appropriate strategies to establish confirmability, such as reflexivity, were used throughout the research process. The process of examining and reflecting on oneself as the researcher and the research were done continually throughout the research through reflective journaling. To increase

transparency throughout the research process I made my opinions, thoughts, feelings, and experiences visible as I recorded them in a reflective journal and revisited the entries throughout the research process (Ortlipp, 2008). Taking the stance of continual reflection prompted me to constantly review my approach to research, potential bias, or misunderstandings specifically throughout the entire interview process. This form of bracketing helped to eliminate my preconceptions and bring light to biases from the conception of the research question and throughout the research process (Tufford & Newman, 2012).

Furthermore, part of my responsibility and the power I have as a researcher is to remain as authentic as possible to the participants' experiences (Ravitch & Carl, 2016). I have many roles that play a part in this research effort. Primarily, I am an educator. This profession is so deeply ingrained in how I view the world that it influences how I interpret data. According to Saldaña (2016), coding requires that the person wears a researcher's lens that is influenced by personal perspective and the individual's interpretation. I examined my reflective journal, notes and observations, transcript data, and coding using the lens of an educator. Again, by critically confronting my interpretations as a researcher and my potential biases I took a reflexive approach to research (Ravitch & Carl, 2016).

Another way in which I remained objective throughout my research was to remain open-minded. Taking the stance that everyone is an expert in his or her own experiences (Ravitch & Carl, 2016) allowed me to fully grasp the perspective of another individual. While I may have had similar experiences or can relate to topics discussed during the interviews, understanding that the person's experience is their own was critical in this process. I took the view that there are

differences, and those differences are valuable (Ravitch & Carl, 2016). Furthermore, I used member checking during and after the culmination of each interview. Each interview was recorded and transcribed. Each interviewee had a chance to view the transcription and summary of the interview to review the accuracy and meaning before the data were analyzed. Interviewees had the opportunity to make any changes or additions at that time.

Results Overview

When examining my patterns and themes from the coded interviews my research question regarding teacher perceptions of using technology-based discussions to promote collaboration amongst students with mixed abilities in a PBL environment can be viewed with insights and examples from the interviewee's personal experiences.

The four themes that emerged from the interviews revealed that teachers are using technology as a tool to help their students of mixed abilities engage in collaborative discussions and group work. These themes are included in the following bulleted list and in detail found in Appendix B.

- Theme 1: Student preparation for collaboration
- Theme 2: Collaboration with benefits and difficulties
- Theme 3: Technology can increase student collaboration
- Theme 4: Virtual collaboration has consequences and problems

The following section discusses how each research question and subsequent questions were supported through the data and theme analysis.

Theme Analysis and Results

Theme 1

The first theme that I identified, student preparation for collaboration, explained how teachers perceive collaboration to be most successful if students are prepared to collaborate. This theme encompassed the ways in which teachers use strategies prior to collaboration to help their students find success within the process. The first pattern that emerged from the codes to generate this theme titled teachers build communities prior to collaboration identified strategies teachers used in both virtual and face-to-face environments. These included but were not limited to building classroom communities, creating group norms to collaborate, and establishing an understanding that learning happens within a community. Every participant discussed strategies that they used prior to even beginning collaboration with students. P1, P2, P3, P7, and P9 discussed building a classroom community with their students where students felt safe to share, use their voices, and work together to solve problems. P6 discussed establishing a democratic community, where students have ownership and agency over their learning. She stated, "It's a democratic community. We make decisions together; we solve problems together." Furthermore, P8 along with P1, P2, P3, P4, P6, and P7 discussed the teacher's role as a facilitator where students were in the driver's seat. Examples included students designing their learning, choosing the projects in which they collaborate, or deciding how to show their competency of a skill through various methods that the student chooses. "I am more of your coach, than I am your teacher," stated P3 when describing this facilitator role.

The second pattern that emerged from the data, teachers provide expectations to students throughout the collaborative process, included codes such as teachers creating

rubrics to collaborate, explicitly modeling collaboration, holding students individually accountable and assigning group roles or jobs. All participants either modeled collaboration skills or explicitly taught the skills to their students. For example, “I really think that it starts with me just modeling language, modeling how I treat other students, modeling, how I react to certain situations,” stated P9 as she discussed her modeling strategies in the classroom. Furthermore, P1, P2, P3, P6, and P8 used collaboration rubrics to establish clear expectations prior to beginning collaborative projects within their classrooms. P8 expressed, “I guess probably a good way to generate that is like a rubric, even if it's a student generated rubric on what good collaboration looks like, something to help guide their…behaviors and their thinking while they're collaborating.” Each of these strategies, such as rubrics, explicitly modeling collaboration, holding students individually accountable, and assigning group roles or jobs, provided students with clear guidelines and the needed skills to embark on collaboration with peers.

The third pattern that emerged contributing to Theme 1, teachers provide opportunities to engage in collaboration, emphasized the time and space teachers are providing for students to engage in collaboration. The codes included engaging in project-based learning, establishing a space for students to collaborate, and allowing students the opportunity to collaborate. All the interviewees discussed how experiential learning, authentic problem solving, and project-based learning allow real-world opportunities in their classrooms for their students to engage in collaborative activities and projects with peers. P1, P3, and P6 specifically discussed the importance of giving students multiple opportunities to collaborate. P1 explained how she provided students

with sometimes messy chances to collaborate, “Giving them some low-stakes opportunities to collaborate…[like] playing a game, it's going to be messy, let them fail…then having open, honest conversation to learn from each other.” P1, P2, P3, and P5 discussed how opportunities to collaborate were given both virtually and face-to-face with the use of technology.

The final pattern that emerged, teachers discuss a variety of grouping methods when students engage in collaboration, identified how teachers use various ways to group their students to help them successfully engage with peers to solve problems or work on projects. Every interviewee used more than one method throughout the year to group their students. These methods included flexible grouping, groupings based on interests, homogenous groups, or students with similar abilities, and heterogenous groups that included students of mixed abilities. When P5 talked about student grouping she stressed, “I think that there's tremendous power in the mixed abilities [of students] and having heterogeneous groups. I deliberately will put kids that are kind of all over the place in terms of ability [in one group].” P2, P4, P6, P7, and P8 identified using strategic or purposefully grouping with their students. P1, P6, P7, and P9, specifically discussed the size of the groups and emphasized the importance of small groups of students working together as ideal.

This theme answered RQ, teacher perceptions of technology-enhanced collaboration in a PBL environment with students of mixed abilities, as being effective if the teacher prepared students to collaborate. Participants revealed that this preparation included utilizing strategies such as creating a classroom community, providing students

with expectations, giving opportunities for collaboration, and utilizing various grouping methods.

Theme 2

The second theme that emerged from the data, collaboration with benefits and difficulties, showed how teachers perceive collaboration as a process with benefits and difficulties. This theme revealed insights into the positive and negative aspects of collaboration in a K-8 setting. Teachers provide feedback and support throughout the collaborative process, was the first pattern to emerge that contributed to the identification of this theme. P1, P2, P4, P5, P6, P7, and P8 identified how they utilize scaffolding during the collaborative process to help students of mixed abilities. For example, P4 shared, “The collaborative components of PBL as it relates to special education students when they are collaborating with their classmates in heterogeneous groups, provides that equity in education where all students have access to high levels of learning.” P2, P4, P5, and P8 discussed providing clear feedback from peers and teachers during the collaborative process. P3 stated, “I think the critique and revision…is huge because here you're putting two groups together to collaborate and helping them as a group to have that honest reflection.” Furthermore, P1 specifically discussed using proximity to students during collaboration and responsive teaching strategies to facilitate collaboration in real time when problems emerge. For example, P1 mentioned positioning proximity close to the group that may have been disagreeing on how to complete a task or who was going to do a certain aspect of the project to remind students to use their skills of collaboration. P1

explained that sometimes just being close reminded the students of their collaboration skills, including compromising, that they should be using when working together.

Another pattern that was generated from the data was that teachers perceive collaboration benefits all learners. Teachers discussed the benefits they recognized in a classroom of mixed-ability students engaging in collaboration. P1 and P2 discussed how collaboration creates empathy amongst students, allows students to use their strengths, and allows the teacher to differentiate. In addition to these benefits, P6 discussed how collaboration with students of mixed abilities allows students to find their voice, increases participation from all students, and helps students take on more leadership roles. P7, P8, and P9 discussed how students in mixed-ability groups rely on their peers for support. P7 said, "[A]mazing things happen watching students not only grow independently but being able to grow as a whole class and as a team and how they come together through their differences and all of their abilities." Also, P7, P8, and P9 felt that this type of grouping allowed different students to take on leadership roles, and let students use their strengths as they contribute to the group's work.

Along with the perceived benefits, teachers also identified difficulties during the collaborative process in the pattern of difficulties and collaboration. Most interviewees, specifically P1, P2, P3, P4, and P6, discussed the disagreements during collaboration with students. P3 explained, "I find that learning how to compromise when you're working with other kids is difficult and sometimes disagreeing, but in a respectful way." P6, P7, and P8 discussed instances where students working in mixed-ability groups often have difficulty acknowledging peers' abilities. Furthermore, P2, P3, and P6 noticed that

when working in mixed-ability groups students often see their differences or inabilities. P6 stated that working in a collaborative group perpetuates students to "figure out they may have a learning disability in reading, however, even if they're not good at the more academic side of the project or task…they're able to still find a way to contribute to the group." When this issue arises, P6 continues to focus on the individual strengths of each student and how those strengths contribute to the group. Other problems were identified such as P2, P4, P5, and P7 noticed how some students struggle with maintaining independence during group work. P8 and P9 noticed how some group members take a passive role in the group and are often reluctant to lead within their group. P6, when discussing students with learning disabilities in group work, stated as a generalization, "[Students with learning disabilities have a] tendency to take a more passive role in the group, waiting to be told what to do, whether it be by an adult or by another peer in the group." The tendency to continually take a passive role would prompt the teachers to at times assign group roles or rotate roles within a group so that all students had the chance to lead.

This theme also further explained RQ as it breaks down teacher perceptions of how collaboration is experienced in the elementary classroom with students of mixed abilities. The analysis fully described the role of the instructor as the facilitator and how group project work has both benefits and problems. Teachers perceive through feedback and support students of all abilities found success when engaging in the collaborative process.

Theme 3

This theme was identified as technology can increase student collaboration and examined technology specifically in conjunction with collaboration. Teachers felt that when used successfully, technology can increase student collaboration. The first pattern that emerged to contribute to this theme was the strategies used to collaborate virtually. Just as in a face-to-face environment, teachers discussed using strategies such as small groups. P2 and P3 discussed using breakout rooms, peer feedback, and private chats to help facilitate group work when virtual. P3, P4, and P9 discussed the social connections that students can make when collaborating within a virtual space. P9 commented on the way in which students now connect with each other is all through social media, "I would say more often than not…it is just how kids are wired these days."

Another pattern that was revealed lent insights on student self-efficacy. P1 and P2 did not feel that students' self-efficacy had been changed when they were collaborating online. However, all other participants felt that student self-efficacy had improved when collaborating online. The teachers indicated that students believed in their abilities more after engaging in collaboration online than face-to-face. P6 said, "being back face to face, I think online communication within face-to-face instruction makes them feel a little more empowered to share their thoughts and what they think." In addition, P8 also indicated that self-efficacy perhaps had weakened online, even though she had previously indicated that in some cases, it had improved.

In another pattern, collaborating in a virtual environment has positive impacts, teachers indicated that in this virtual environment students had positive impacts in addition to their self-efficacy improving. All interviewees, except for P1, indicated they

saw an increase in student participation in students with and without learning disabilities. P3, P5, P6, P7, P8, and P9 saw students of mixed abilities confidence increase as they were collaborating online. P6 stated, “Online communication within face-to-face instruction makes them feel a little more empowered to share their thoughts and what they think.” Other factors that were identified as being positive from virtual collaboration included codes such as, leveling the playing field, increasing empathy, building relationships, making students feel safe, increasing communication, student engagement increased, and many saw an increase in individual accountability. P4, P6, and P8 commented on students’ ability to show their knowledge in multiple ways when collaborating online. P6 expressed that “participation overall increases when they feel like they have something to contribute. And I think collaboration, both online and in person is a means to that.” P8 said,

> Well, you know, you have a kid who's maybe a real, hands-on, artsy kid and you instruct on with all these tools to kind of celebrate their learning. And then you got, you know, you've got the kids who are maybe more auditory and they're creating a skit with their group to demonstrate they're learning. It's just all the different methods that maybe a student would prefer to show they're learning rather than paper pencil. Technology really opens that avenue for all kinds of different ways to display what they're what they're learning, what they're picking up. So, without that technology, that all goes away.

Only P1 did not indicate a positive impact from collaborating online. This discrepancy is further discussed in the Discrepant Cases section.

Some of the applications and platforms teachers used to help students collaborate were discussed in the final pattern, teachers use a variety of applications and programs to collaborate virtually. These applications included Flipgrid, Keynote, online discussions, Padlet, Podcasts, Schoology, SeeSaw, video, and Zoom. However, Google was the most predominately used tool with P1, P4, P5, P6, P7, P8, and P9 who discussed its uses and benefits in their classrooms. P5, P6, P7, and P8 discussed the real-time benefits of working with in Google documents, slides, or sheets.

When examining Theme 3 in relation to the research questions posed for this study, all participants found that if students are given the proper instruction in collaboration skills, expectations, or modeling, students of mixed abilities could use technology to aid in collaboration within a PBL environment. Theme 3 goes on to answer SQ1 and SQ2 as technology is revealed through teacher perceptions to increase the self-efficacy of students with mixed abilities and described how teachers utilize the strengths of group members to scaffold the learning of other members of the group.

Theme 4

In the theme, virtual collaboration has consequences and problems, students collaborated virtually and experienced negative consequences and problems. I separate teacher perceptions during the pandemic, from typical collaboration using technology in a face-to-face environment. In the face-to-face environment all nine interviewees indicated that when using technology to collaborate they have had some sort of issue or problem. P1, P2, P3, P4 and P7 discussed that either the technology was inappropriate for the age of their students or simply the students lacked the technology skills to use the tool.

Furthermore, P1, P3, P4, P5, P7, P8 and P9, commented on the lack of skills and training that they possessed when trying to interact with the digital tools that would help their students collaborate. P7 said “If I am being completely honest, sometimes the kids know more than I do about the online aspect.” P3, P4, and P8 commented on connectivity issues when trying to engage online, and P6 and P8 discussed the time constraints it takes to teach students how to use the technology to collaborate. P5 and P9 shared when working in Google shared documents, slides, or sheets students often inadvertently delete groups members’ work or projects without permission.

When looking at the patterns of codes when referring to the time students spent collaborating during the pandemic, the pattern of teacher's voiced strong opinions regarding collaboration during the pandemic emerged. P1, P2, P3, P4, and P6 voiced that they perceive negative impacts to students during schoolwide shutdowns. P1, P2, P3, and P6 had all experienced school closures that were longer than a year. In addition, P1, P2, P3, and P4 indicated that not only did it negatively affect students’ academics, but it also had negative consequences socially and emotionally. P6 stated, “[S]o, when we were 100 percent teaching online, I think that was very challenging and I saw a dip in student motivation and how they felt about themselves as learners.” However, P2 indicated that she felt that in some regards, learning completely virtually had similarities to face-to-face instruction, including the strategies she used to help her students collaborate.

To fully understand the results of this study, both the positive and negative aspects of technology-supported collaboration needed examination. Teachers believed that students of mixed abilities could grow and learn from and with each other. This idea

was apparent when teachers discussed both virtual and face-to-face collaborative experiences. However, teachers expressed a clear perception that collaboration is a skill that students must practice daily. Teachers believed that students needed feedback and multiple opportunities to practice this skill. Teachers also acknowledged that collaboration is difficult. To answer RQ completely acknowledgment of both the positive and negative aspects of collaboration in person and online was established. Furthermore, SQ1 and SQ2 were answered as teachers believe that using students' strengths in group work to help peers' learning can be accomplished online. They also expressed the notion that different strengths of students with mixed abilities often are revealed when working online. These strengths lay dormant unless students have the opportunity to collaborate in an online setting.

Discrepant Cases

Special attention was given to the discrepant cases. P1-P3 worked with students in grades kindergarten through second grade and had been forced to teach virtually for an entire year due to school closures from COVID-19. They all discussed the time spent trying to help their students collaborate solely online, without the ability to intervene face-to-face when the students were struggling and expressed clear aversion to using technology in this capacity with their young students. Participants described the experience with feelings and statements. P1 said that "No child should have to learn that way." P3 reiterated "No, I would never want to go back to virtual learning." P4 made the comments that "My students were left traumatized" that were coded as negative effect on

learning during the pandemic and negative effect on social emotional learning during the pandemic.

I chose to consider teachers' responses with a separate lens if they were discussing learning and collaboration during the pandemic versus using technology in a face-to-face environment to help students collaborate. If teachers were referring to experiences during the pandemic, I would code their responses under the parent code of virtual collaboration during the pandemic. Otherwise, I would code responses under the various codes discussing the benefits and difficulties of virtual collaboration. Due to the timing of my research and the global pandemic, the two could not be entirely separated as teachers were fresh from the experience, however, I tried to differentiate comments that were directly related to time spent collaborating completely virtually and time spent collaborating when the technology was used to help facilitate face-to-face collaboration.

Another exception to the patterns that emerged was P6 indicated that he felt he was not lacking the technology skills or training needed to fully utilize technology in his classroom during collaborative experiences. When I asked P6 if there was any support or training that he might need to better serve students online, he stated, "Nothing is immediately coming to mind." This was a very different response than most of the teachers who felt that perhaps more training in how to utilize technology with younger students would help improve the collaborative experiences.

Summary

Based on the above analysis of Themes 1-4, teacher perceptions of both face-to-face and online indicated that they believe if students are instructed throughout the

collaborative process on how to collaborate with modeling and explicit teaching of expectations, collaboration is more successful. In relation to the overall research question, RQ, examined teacher perceptions of technology enhanced collaboration on students of mixed ability in a PBL environment, the findings of this research supported the idea that students of multiple abilities can find success collaborating in online discussions if given the instruction on how to collaborate.

In addition to the main research question, insights were also revealed for the two sub questions; How do elementary teachers perceive interactions in online discussions have enhanced students' self-efficacy in mixed-ability classrooms? (SQ1) and How do elementary teachers view technology-based collaborative discussions in terms of how the strengths of group members have been utilized to scaffold other group members' learning during PBL? (SQ2). Teachers acknowledged that online discussions could occur in many formats. These formats included online discussions synchronously and asynchronously, feedback via chat messages, collaboration in Google Docs or Slides, video discussions via Zoom, and voice threads to capture a few. Teachers overall believed that students' self-efficacy can be improved through online collaboration, however, it is also important to note that not all teachers agree that technology helps students believe in their abilities more positively. Regarding SQ2, teachers' overall belief that students working in collaborative groups in online discussions mirror their beliefs about collaboration in general.

Finally, every teacher interviewed expressed the importance of understanding that technology is a tool. P5 summed it up,

> Technology is a tool, and I think good brain-based teaching and learning can never be and will never be replaced by technology…having the kids know this is a tool that can help me show what I know. But my most effective vehicle for showing what I know is me and my voice and my presence and keeping that human aspect in there.

Overall, technology is a tool that can be used successfully with students of multiple abilities to aide in collaboration within a PBL environment.

In summary, this research revealed educators across the country perceive technology belonging in the elementary classroom when used to help students of mixed abilities collaborate in a PBL environment. In addition, many teachers interviewed also believe that students' self-efficacy can be influenced positively when using technology to help them collaborate. Finally, teachers believed that students of mixed abilities can grow and learn from each other both online and in person. In the following chapter I will interpret the findings of this research, discuss the limitations to trustworthiness, give recommendations for further study, and discuss implications of this research for positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

The overall purpose of this basic qualitative study was to explore elementary teacher perceptions of how students with mixed abilities collaborate using technology in a PBL environment. By exploring teacher perceptions, insights into the influences of technology-enhanced collaborative discussions among students of all learning abilities were revealed.

Teachers in the current study believed that students of mixed abilities can grow and learn from and with each other both virtually and face-to-face. When given proper instruction on the skill of collaboration, teachers felt that students of mixed abilities found success using technology as a tool to aide in the collaborative process. Teachers also acknowledged the difficulties students face when working in collaborative groups with their peers. Disagreements with group members, domineering group members, or students taking a passive role within the group were a few of the difficulties discussed by the participants. This finding includes teachers' acknowledgement of both the positive and negative aspects of using technology with elementary students. Difficulties that students face collaborating in a face-to-face environment were also present in a virtual environment. To combat the negative aspects of collaboration both online and face-to-face, teachers believe students need numerous opportunities to participate in collaborative experiences followed by receiving direct feedback from both their peers and their teacher.

Teachers found students who often struggled in the face-to-face environment, sharing their ideas, or taking a more active role in the group found their voice within the virtual environment. Most teachers found students' self-efficacy was greatly improved

with the use of technology when collaborating online. This was also true for collaboration in general face-to-face environments as well. However, some teachers interviewed believe that using technology with some of the youngest learners can be detrimental to students of mixed abilities collaborating with peers.

Teachers noted that when students collaborate both face-to-face and in virtual environments, they utilize the strengths of group members to scaffold the learning of peers. During the interviews, teachers revealed the strength of collaboration is found when each group member brings their individual assets to the group, and together, they accomplish greatness beyond what each student could do alone.

Interpretation of Findings

The major themes that emerged from my review of the current literature included the overall effectiveness of PBL for both students with learning disabilities and without. When implemented with integrity, PBL can be effective in improving academic achievement, student motivation, and student engagement (Merritt et al., 2017; Revelle, 2019; Storer, 2018). Students with learning disabilities thrive in collaborative environments, both academically and socially (McGrath & Hughes, 2018; Sencibaugh & Sencibaugh, 2016). This idea was also confirmed in my research findings. In the current study, teachers described the effectiveness of learning within a PBL environment for students of mixed abilities. All participating teachers explicitly described scenarios where students of mixed abilities, ranging in grade level from kindergarten to eighth grade, found success both educationally and socially within collaborative groups. Participants described professional strategies, including explicitly teaching collaborative skills,

providing students with clear expectations prior to collaboration, and continually giving feedback throughout the collaborative process, as ways to help students find success working with peers in mixed-ability groups. Participants perceived the positive effects of learning collaboratively were found in both face-to-face and virtual environments.

PBL and its collaborative components increased student achievement and collaboration for both students with learning disabilities and those without learning disabilities (McGrath & Hughes, 2018; Merritt et al., 2017; Revelle, 2019; Sencibaugh & Sencibaugh, 2016; Storer, 2018). When students work together in collaborative groups, higher levels of learning are achieved, and students have a sense of belonging with increased levels of participation (Merritt et al., 2017; Revelle, 2019; Sencibaugh & Sencibaugh, 2016). However, previous studies did not indicate how these groups operate in an inclusive setting within a PBL classroom when enhanced with technology. In the current study, teacher participants perceived students of mixed abilities collaborated using technology in much the same way as they do in face-to-face environments. Teacher participants used similar strategies when providing opportunities and instruction in collaboration that aids students in functioning successfully in both types of learning environments. Additionally, participating teachers reported students of mixed abilities engaging in technology-enhanced collaboration found new ways to participate within the group than they would have in just a face-to-face environment. This finding is supported by previous research evidence that indicated that students participate more fully when collaborating with the use of technology (see McGrath & Hughes, 2018; Merritt et al., 2017; Revelle, 2019; Sencibaugh & Sencibaugh, 2016; Storer, 2018).

Prior to this current research study, it was unclear how students with learning disabilities and students without learning disabilities felt about group collaboration enhanced with technology within PBL projects. Research has shown technology use in collaboration is beneficial (Dukuzumuremyi & Siklander, 2018; Zheng & Warschauer, 2015), and PBL increases both academic and social skills of all types of learners (Baser et al., 2017; Rhim, & Lancet, 2018; Terrazas-Arellanes et al., 2018); however, the understanding of teacher perceptions of technology use to support collaboration within PBL for students of mixed abilities was still unknown. Recent research (i.e., Aliyyah et al., 2020; Hebebci et al., 2020) supported the need to study online practices for all learners provided further evidence that this gap exists. The results of the current study show that teachers perceive students' self-efficacy increased with the use of technology supported collaboration. The teachers interviewed reported that students often found their voice within the virtual setting and discovered new opportunities to take on leadership roles.

Furthermore, it was not known how teacher perceive these online interactions in PBL discussion forums. The current study findings show that teacher participants perceived students' ability to help one another in various capacities throughout group work increased with the use of technology, which is also supported in the current literature (see Adam & Tatnall, 2017; Asghar et al., 2017; Del-Moral-Pérez et al., 2019; Doyle-Jones, 2019; Freedman et al., 2018; Moore et al., 2020; Sahlin et al., 2017).

According to most interviewees, the online discussion forums provided students with enough anonymity or confidence that they felt comfortable sharing and

collaborating with their peers regardless of ability. These results can be used to confirm those of current research and also extend the present knowledge in the field by providing evidence regarding teacher perceptions of how students of mixed abilities feel about group collaboration enhanced with technology within a PBL environment.

During the interviews, teachers provided specific strategies when engaging with collaboration online, such as preteaching collaboration skills, communicating expectations with rubrics and class contracts, and how to structure the students in each group. It should be noted that one teacher, teaching the very youngest learners, reported that technology had no place in the elementary classroom. This finding was in direct contradiction to the literature reviewed that indicated that even the youngest learners can use technology to aid in collaboration with peers (see Del-Moral-Pérez et al., 2019; Freedman et al., 2018; Sahlin et al., 2017). However, it should also be noted that P1 who made this statement was just returning to face-to-face instruction after a year of schoolwide shutdown and was still dealing with the effects of the school closures with her young students.

The findings confirm the tenets of Vygotsky's (1978) social constructivism theory, which posits that students need to work together to learn and make meaning as a framework for understanding various collaborative environments, with teacher perceptions of technology-enhanced PBL with students of mixed abilities as they interact in collaboration with peers. Vygotsky acknowledged that when students work together in collaboration to solve problems, it has a positive effect on their learning. This idea was confirmed because teachers reported the success students of various abilities achieved

when working in collaborative groups face-to-face and online. Group work exists in various educational settings and situations; however, it is deeply embedded within PBL environments as a key component of the curriculum increasing students' academic and social skills (Baser et al., 2017; Rhim & Lancet, 2018; Terrazas-Arellanes et al., 2018). The findings of the current study extend Vygotsky's theory by confirming teachers perceive collaboration enhanced with technology can be an effective part of learning from and with peers.

Limitations of the Study

One limitation of this study was researcher bias. I have personally used online discussion platforms, such as Google Classroom, in my PBL classroom and have seen the benefits of this collaborative technology. However, with the use of bracketing (see Tufford & Newman, 2012), the negative effects of my biases or preconceptions were mitigated. Using a reflective journal to record my thoughts throughout the research process also helped to ensure the transparency of my research (see Ortlipp, 2008). I found this journal also helped me to reflect throughout the interview process as I considered how my biases may have entered the discussions within the interviews themselves. These biases were found in instances when I followed up with leading questions instead of sticking verbatim to the protocol. As I progressed through the interviews, I became more adept in the skill of interviewing because I took the time to examine my role within the process. I was also able to receive feedback throughout the process from my committee as they analyzed my transcripts and interview summaries to help me hone my skills and remove bias.

A small sample size of nine participants also created limitations for this study. Participants only came from four different states and comprised two male interviewees and seven female interviewees. To suggest that these interviews could be equated to a nationwide perspective would not be accurate; instead, I used these perspectives to only confirm what has been discovered previously in current research and begin to add to the existing body of knowledge.

The timing of this study could also be considered a limitation. I conducted my interviews within months of schools reopening after being closed due to the COVID-19 pandemic. This nationwide pandemic inevitably influenced the responses from the educators, some of whom had spent the last year teaching remotely, when discussing the use of technology to aid collaboration.

Recommendations

The following recommendations for further research are grounded in the strengths and limitations of the current study as well as the gap that still exists in current literature. My review of the literature indicated that research has shown technology use in collaboration is beneficial (Dukuzumuremyi & Siklander, 2018; Zheng & Warschauer, 2015) and PBL increases both academic and social skills of all types of learners (Baser et al., 2017; Rhim, & Lancet, 2018; Terrazas-Arellanes et al., 2018); however, a gap exists regarding the understanding of teacher perceptions of technology use to support collaboration within PBL for students of mixed abilities. Recent research (i.e., Aliyyah et al., 2020; Hebebci et al., 2020) supported the need to study online practices for all learners, providing further evidence that this gap exists.

Teacher participants in this study reported positive outcomes from technology-enhanced collaboration conducted with students of mixed abilities in a PBL environment, thus I would recommend that teachers structure collaborative activities within a PBL classroom to include technology. It is also recommended that this study be replicated with more participants from across the nation to get a more robust representation of teachers' perceptions of students of mixed abilities working within a PBL environment collaborating with the use of technology. Additional teachers from kindergarten through eighth grade are needed to fully understand the research questions. Furthermore, when considering the timing of this research study, in the aftermath of school shutdowns and a nationwide pandemic, further research needs to be conducted after teachers have had the time to recover from the trauma. Finally, further research is needed to fully understand student self-efficacy within virtual environments by getting actual student perspectives, not just teachers' perceptions.

Implications

The findings of this study could lead to positive social change by providing information regarding teacher perceptions of how PBL and technology can be used to enhance collaboration in an inclusive setting. This information could potentially help teachers meet the collaborative learning needs of all students in their inclusive classrooms, ultimately increasing all students' abilities to work collaboratively, which would directly impact their academic achievement. Learning and collaborating with peers regardless of ability is the right of every student (Kozleski, 2020). This is a social justice issue, and well-planned collaborative practices could address this concern. Therefore,

schools should require educators to design learning with the diversity of all students in mind (Kozleski, 2020). This is critical for all children but especially for students whose learning needs have been marginalized throughout history (Waitoller, 2020).

Due to the global COVID-19 pandemic, schools across the country were completely shut down in various capacities. According to Hebebci et al. (2020), the COVID-19 pandemic that forced instruction online around the world revealed challenges in collaborative practices online, such as difficulties due to restricted interaction, communication difficulties, and infrastructure problems. The teachers that I interviewed expressed similar experiences teaching during school closures. The results of the current study provide an understanding of what teachers using these technological tools, such as online discussion forums, videos, Google Docs, Google Slides, and Wikis, find challenging and beneficial to help students of multiple abilities collaborate.

In a PBL classroom, students work collaboratively with peers to complete a real-world project that requires them to think critically, persevere through challenges, and communicate with their group members and a public audience (Junisbayeva, 2020; La Prad & Hyde, 2017). Previous research findings have shown PBL as a unique opportunity to engage both struggling and high-achieving students in the regular classroom simultaneously (Council, 2018), specifically in elementary schools (Smith & Pastor, 2016). Advances in technology have created opportunities for students to collaborate in new capacities, so additional research was needed to explore technology-enhanced collaboration within PBL by examining teacher perceptions of how these collaborative practices, such as discussion forums and group projects, influence students with learning

disabilities. The results of this study have the potential to effect positive social change by lending insights to technology-supported collaborative strategies that teachers can use to better instruct both students both with learning disabilities and those without learning disabilities.

Conclusion

The traditional approach to education can create students who are not prepared to enter the world outside of a schoolroom, specifically elementary-aged students in mixed-ability classrooms in the area of collaboration (Schleicher, 2018). In an inclusive setting, students with learning disabilities often do not feel included amongst peers (Stiefel et al., 2018). Inhibited in participating actively, low-status students are often underestimated, and high-status peers ignore their efforts (Le et al., 2018). Learning and collaborating with peers regardless of ability is the right of every student (Kozleski, 2020) and fundamental for students as future participants of a global society (Plucker et al., 2016). This is a social justice issue that needs to be addressed for all learners, especially those learners who have been marginalized throughout history (Waitoller, 2020).

To combat the failure of a traditional approach to instruction, some teachers have begun to change how they teach by incorporating skills such as collaboration in real-world, hands-on approaches to instruction (Rabacal et al., 2018). This instructional approach is promoted in PBL classrooms servicing students of varying abilities (Halverson, 2018). In a PBL classroom, students work collaboratively with peers to complete a real-world project that requires them to think critically, persevere through challenges, and communicate with their group members and a public audience

(Junisbayeva, 2020; La Prad & Hyde, 2017). Furthermore, advances in technology have created opportunities for students to collaborate in new capacities.

In this study, I explored technology-enhanced collaboration within PBL by examining teacher perceptions of how these collaborative practices, such as discussion forums and group projects, influenced students of mixed abilities. The results indicated that the teacher participants believe if students are instructed throughout the collaborative process on how to collaborate with modeling and explicit teaching of expectations, collaboration is more successful both face-to-face and online.

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Appendix A: Interview Protocol Guide

Introduction and Protocol: Make introductions and discuss the process of the interview and follow-up, go over any necessary paperwork, and timeline, ask for any beginning questions/concerns.	
Warm-up: Thank you for allowing me to come to do this interview. Please tell me about your classroom and students.	
Research Q1. What are elementary teacher perceptions of using technology-based discussions to promote collaboration amongst students with mixed abilities in a project-based learning environment? ● *SQ1*. How do elementary teachers perceive interactions in online discussions have enhanced students' self-efficacy in mixed-ability classrooms? ● *SQ2*. How do elementary teachers view technology-based collaborative discussions in terms of how the strengths of group members have been utilized to scaffold other group members' learning during PBL?	
1. What is your experience using collaboration with elementary students?	SQ1 SQ2
a. What are your best practices for supporting collaboration?	SQ1 SQ2
2. What is your experience teaching students in a project-based learning (PBL) environment?	SQ2
a. Describe your experience with the collaborative components of PBL.	SQ2
3. How do students with mixed abilities typically collaborate in your PBL classroom?	SQ1 SQ2
a. What part of PBL collaboration works well for your students without learning disabilities?	SQ1 SQ2
i. Can you provide an example?	
b. What part of PBL collaboration is difficult for your students without learning disabilities?	SQ1 SQ2
i. Can you provide an example?	
c. What part of collaboration works well for students with learning disabilities?	SQ1 SQ2
i. Can you provide an example?	
d. What part of collaboration is difficult for students with learning disabilities?	SQ1
i. Can you provide an example?	SQ2

4. What would you identify as the most impactful teaching strategy to promote collaboration with your students? Why?	SQ1
5. What resources or tools have you used that would help your students collaborate?	SQ2
6. What types of technology platforms have you used to support collaboration in an inclusive setting?	SQ2
a. What has proven effective in the use of these technology platforms?	SQ2
i. How do you know?	
b. What is ineffective with these technology platforms?	SQ2
c. In your experience, what is the most difficult aspect of technology-supported collaboration?	SQ2
d. In what ways have you seen technology increase the effectiveness of collaboration?	SQ2
7. What support or training do you perceive you might need to better support online collaboration?	SQ2
8. Have you noticed any changes in the participation of your students with mixed abilities as they engage online?	SQ1 SQ2
a. If yes, in what ways have students with learning disabilities changed?	SQ1 SQ2
b. If yes, in what ways have students without learning disabilities changed?	SQ1 SQ2
9. How have you leveraged groupings in online discussions?	SQ1 SQ2
a. Have you used group members' strengths to scaffold the learning of other group members?	SQ1 SQ2
i. If yes, in what ways?	
10. Describe how student self-efficacy has or has not been affected by online discussions.	SQ1 SQ2
a. From your perspective, describe how students with learning disabilities perceive their abilities after collaborating in online discussions.	SQ1 SQ2
b. From your perspective, describe how students without learning disabilities perceive their abilities after collaborating in online discussions.	SQ1 SQ2
c. How do you know?	
11. Is there anything else you would like to tell me?	
Debrief Thank you so much for taking the time today to discuss project-based learning and collaboration.	

Follow up timeline and contact information
I will be in touch with you soon to share our conversation transcript and to receive your feedback.
Here is my contact information.
Again, thank you.

Appendix B: Codes, Patterns, Themes

Initial In Vivo Code	Pattern	Theme
Building Community	Teachers Build Communities Prior to Collaboration	Teachers Believe that Collaboration is Most Successful if Students are Prepared to Collaborate
Classroom Agreements		
Classroom Culture of Collaboration		
Acceptance and Equity		
Building Relationships		
Safe Environment		
Democratic Community		
Student Ownership and Agency		
Student Voice and Choice		
Co-creating Norms and Routines		
Collaboration Norms		
Setting Collaboration Expectations		
Learning Happens within a Community		
Learning From and With Peers		
Teacher as Facilitator		
Learner Centered Classroom		
Varying Abilities/Disabilities		
Collaboration Rubrics	Teachers Provide Expectations to Students throughout the Collaborative Process.	
Individual Accountability		
Group Role or Jobs		
Modeling Collaboration		
Explicit Teaching of Collaboration Skills		
Create Spaces to Collaborate	Teachers Provide Opportunities to Engage in Collaboration	
Opportunities to Collaborate		
Increased Student Engagement through PBL		
Experiential Learning		
Authentic Problem Solving		
General Collaboration		
Face to Face vs. Virtual Collaboration		
Flexible Grouping	Teachers Discuss a Variety of Grouping Methods when Students Engage in Collaboration	
Groupings Based on Interests		
Heterogenous Grouping		
Homogeneous Grouping		
Small Groups		
Strategic Grouping		

Peer Feedback	Teachers Provide Feedback and Support Throughout the Collaborative Process	Teacher's Perceive Collaboration is a Process with Benefits and Difficulties
Critique and Revision		
Proximity		
Responsive Classroom Strategies		
Scaffolding during Collaboration		
Mixed-Ability Grouping		
Works Well in Collaborative Groups	Collaboration Benefits All Learners	
Creating Empathy through Collaboration		
Finding Voice		
Increase in Participation in Person		
Leadership Roles		
Rely on Peer for Support		
Students use Strengths		
Differentiation		
Acknowledging others' Abilities	Difficulties and Collaboration	
Communication Problems		
Disagreements while Collaborating		
Managing Time and Resources		
Passive Group Role		
Reluctant Leader		
Struggle with Independence		
Students See Differences		
Breakout Rooms	Strategies when using Technology to Collaborate	Teachers Feel that When Used Successfully Technology Can Increase Student Collaboration
Peer Feedback		
Private Chats		
Setting Clear Expectations		
Small Group Virtually		
Social Connections		
Breakout Rooms		
Peer Feedback		
Private Chats		
Setting Clear Expectations		
Small Group Virtually		
Social Connections		
Breakout Rooms		
Peer Feedback		
Private Chats		

Setting Clear Expectations		
Small Group Virtually		
Social Connections		
Collaborating online Improved Self-Efficacy	Student Self-Efficacy	
Collaborating online weakened self-efficacy		
No Change in Student Self-Efficacy		
Positive Effects of Virtual Collaboration	Collaborating in a Virtual Environment has Positive Impacts	
Builds Confidence		
Increase in Participation Virtually		
Levels Playing Field		
Multiple Ways to Show What you Know		
Relationship Building		
Students Feel Safe to Share Virtually		
Students Find Voice Virtually		
Tech increases Communication		
Tech Increases Empathy		
Using Tech increases Engagement		
Virtual Collaboration Increase Individual Accountability		
Technology used to Collaborate	Teachers use a Variety of Applications and Programs to Collaborate Virtually	
Flipgrid		
Google		
Google Collaborate in Real-Time		
Keynote		
Online Discussions		
Padlet		
Podcasts		
Schoology		
SeeSaw		
Video		
Zoom		
Technology Problems	Problems Exist when Using Technology to Collaborate	Students Collaborating Virtually Can Experience Negative Consequences and Problems.
Connectivity Issues		
Deletions in Shared Documents		
Student Lacking Technology Skills		
Teacher Lacking Technology Skills		
Technology Inappropriate for Age of Student		

Time Constraints		
Virtual Collaboration During Pandemic	Teacher's Voiced Strong Opinions Regarding Collaboration During the Pandemic	
Negative Effect on Learning		
Negative Effect on Social Emotional Learning		
Virtual is Similar to Face-to-Face Collaboration		