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Mathematics Teachers' Attitudes and Intentions Towards Instructional Videos as Part of a Flipped Learning Model

Jessica Lee Lambert

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MATHEMATICS TEACHERS' ATTITUDES AND INTENTIONS TOWARDS
INSTRUCTIONAL VIDEOS AS PART OF A FLIPPED LEARNING MODEL

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DEDICATION

To my Dad. Whenever I think of what it means to be a lifelong learner, I think of you. You earned your first Master's degree when I was too young to remember. You worked hard to earn your second in business and that I do remember. More importantly though, you never stopped. Your actions prove that much of human knowledge is gained outside of university walls. Even now, in retirement, watching you learn how to build filters for Water Missions, learn how to keep bees, and learn Python to add to your repertoire of computer coding languages, you never stop. You are an inspiration and I want to stay motivated to keep learning, just like you. I hope to pass your legacy on to the next generation of learners in our family.

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ABSTRACT

Teachers' attitudes and intentions play an integral role in the integration of technology into their lesson designs for mathematics. All K-8 students at the research site are now one to one with a device, either a tablet or laptop, depending on their grade level. It is up to teachers to determine how and when to integrate technology into their instructional design for mathematics. The purpose of this action research was to evaluate and describe mathematics teachers' attitudes and intentions for integrating instructional videos as part of a flipped learning instructional model. The following questions served to guide this cycle of action research: (1) What are teachers' attitudes towards using instructional videos as part of flipped learning? (2) What are teachers' intentions towards using instructional videos as part of flipped learning? (3) What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics? (4) What challenges do teachers anticipate could hinder the use of instructional videos for flipped learning in mathematics?

This study used a descriptive mixed methods approach. 43 teachers from a K-8 school site in Fresno, CA participated. Quantitative data was collected through a survey administered to all teachers responsible for teaching mathematics for part or all of their duty day. The survey consisted of Likert-type items to evaluate and describe participants perceptions for using instructional videos as part of a flipped learning model of mathematics. Findings from the survey indicated that teachers see value in instructional videos and flipped learning.

Qualitative data was collected through one-on-one semi-structured interviews with 8 participants who also responded to survey. The themes that emerged from the data revealed that teachers associate instructional videos and flipped learning for mathematics instruction with benefits for both teaching and learning. Participants also identified specific challenges and supports they would need for success. Recommendations are provided regarding next steps to support flipped learning in mathematics instruction as well as for future research.

Keywords: teachers' attitudes, teachers' intentions, instructional videos, flipped learning, mathematics instruction

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LIST OF ABBREVIATIONS

CLT	Cognitive Learning Theory
NAEP	National Assessment of Educational Progress
NCTM.....	National Council of Teachers of Mathematics
SDT.....	Self-Determination Theory
TAM.....	Technology Acceptance Model
TBR.....	Theory of Planned Behavior

CHAPTER 1

INTRODUCTION

National Context

In 2019, the National Assessment of Educational Progress (NAEP) indicated that 59% of 4th graders and 66% of 8th graders across the nation are not meeting proficiency levels in mathematics. According to the NAEP, students who receive the score of proficient demonstrate problem-solving strategies and the ability to organize and present explanations of how they achieved their solutions in writing. The fact that only 41% of fourth graders can demonstrate this proficiency indicates that we have work to do at a national level. It becomes even more clear as proficiency levels drop by 8th grade to 34% indicating that as students advance in grade levels their ability to keep up with the demands of grade level mathematical proficiency decreases.

Every aspect of today's society is influenced by technology. Twenty-first century teaching and learning is no different. Tucker and colleagues (2017) remind educators that "We are at a moment in education where our schools can determine if they are Netflix or Blockbuster, Amazon or Borders, Samsung or Blackberry" (p. 9). One way to ensure that schools do not become obsolete like the latter in each of those comparisons is by adopting a blended learning culture which can put schools on a trajectory to use technology to meet the varied and diverse needs of today's learners (Tucker et al., 2017)

The Covid-19 school closures prompted many schools to divert funds to equip students with a device. Project Tomorrow (2020) reports that after Covid-19 school closures, 45% of teachers polled regularly created videos of lessons for students to watch outside of the classroom which is a 25% increase from pre-pandemic reporting. In addition, when educators were polled about the types of professional learning that would benefit them moving forward, 52% responded that learning how to implement a blended or flipped learning model was needed (Project Tomorrow, 2020). The National Council of Teachers of Mathematics' (NCTM), *Principles to Actions*, see technology as essential in providing students with opportunities to make sense of mathematical ideas. The NCTM cautions educators embarking on a flipped learning model that “the key issue is whether students in the flipped classroom are engaged in active learning” (p. 80). It is important that teachers consider how they incorporate this model because if the only thing that is happening is students watch the lecture for homework, then show up to class to work on worksheets, this does little to further mathematical reasoning or sense making (National Council of Teachers of Mathematics, 2014).

In mathematics classrooms across the nation and around the world, the teacher plays a critical role in enacting the curriculum in a way that integrates technology (Teo et al., 2016; Unal & Unal, 2021; Wong, 2015). Because of this, it is important to understand teachers' attitudes and intentions. The Theory of Planned Behavior (TBR) (Ajzen, 1991) proposes that a teachers' attitude towards technology impacts their intended behaviors. The technology acceptance model (TAM) (Davis, 1989) was developed based on TBR to determine how external variables influence attitude and attitude controls a person's behavioral intention. To best serve teachers, it is imperative to understand the factors

leading to integration of technology to provide the necessary supports.

Local Context

This research took place at a public school in Fresno, California. This school site serves students in kindergarten through eighth grade. It is part of a district that encompasses inner city students from southwest Fresno as well as rural students from the farmlands that surround the city's south side. Approximately 94% of the student population qualifies for free and reduced lunch and 95% of students represent a minority group. According to the 2020-2021 SBA results, 88% of the students tested do not meet state mathematical proficiency standards.

In response to the recent Covid-19 pandemic and school closure, the district purchased Google tablets for all students in Kindergarten through 2nd grade and Chromebooks for all students in 3rd through 12th grades. The 2020-21 school year is the first year that the district is 1:1 with a device for every student. Despite the momentum gained in the use of technology due to school closures and hybrid learning models that marked the 2020-21 school year, many teachers have stopped integrating technology into their lesson designs for mathematics in the 2021-22 school year.

One of the tools purchased for teachers last year to support distance and hybrid teaching and learning of mathematics was Eureka Math InSync. This platform provided additional digital tools to supplement the core Eureka Math curriculum. A major feature of this suite of tools is an instructional video designed to guide students in concept development for each lesson. Teachers using the platform can assign videos to students and track whether students viewed the video on their dashboards. Although some teachers utilized these features, others did not. Now that the district has returned to in

person learning, this product could be used as part of a flipped learning model and the district needs to make decisions regarding the renewal of its subscription to the Eureka Math InSync suite.

Statement of the Problem

All Kindergarten through 8th grade classrooms at Eagle Elementary and Middle School are 1:1 with a device. This provides an opportunity for students to utilize technology in Math classes as part of a flipped instructional format. Teachers' attitudes and intentions are determining factors for the integration of instructional videos as part of a flipped learning model. It is important to understand teachers' perspectives when deciding what supports they may need to incorporate technology in meaningful ways in their mathematics instruction.

Explanation of the Problem

To increase student achievement in mathematics, it is imperative that teachers deepen their content knowledge as well as develop a skill set to determine which technological tools enhance their pedagogies (Magana, 2019; Moschkovich, 2010). The need to improve learning outcomes is a persistent problem that shows up year after year in both state and national standardized testing results. Although the flipped learning model is a fairly new method for elementary education, there are indications that using this model increases student learning outcomes (Lai & Hwang, 2016; Webel et al., 2018b; Wei et al., 2020).

Research continues to indicate that mathematics teachers must undergo significant instructional shifts to help students reach the rigor of Common Core State Standards for Mathematics (CCSSM) that emphasize not only application of procedures, but deep understanding, critical thinking, and effective communication (Anderson, et al., 2018;

Kutaka, et al., 2017; Walters, et al., 2014). One way to do this is by incorporating the flipped learning instructional model (Bhagat et al., 2016; Unal & Unal, 2021; Wei et al., 2020). Formal inquiries regarding teachers' attitudes and intentions towards the use of instructional videos as part of a flipped learning instructional model in mathematics classes to improve student achievement and motivation were not conducted prior to this research. Understanding teachers' attitudes and intentions can help the district make decisions regarding the tools it purchases to support the integration of technology in mathematics instruction now that all students have access to a device.

Action Research Purpose Statement

The purpose of this action research was to evaluate and describe mathematics teachers' attitudes and intentions for integrating instructional videos as part of a flipped learning instructional model.

Research Questions

This action research cycle sought to answer the following questions:

1. What are teachers' attitudes towards using instructional videos as part of flipped learning?
2. What are teachers' intentions towards using instructional videos as part of flipped learning?
3. What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics?
4. What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?

Researcher Subjectivities and Positionality

A researcher must reflect on their subjectivities and positionality throughout the research process. Acknowledging the impact that my subjectivity has had from beginning to end of this process allowed me to disclose areas that were affected (Peshkin, 1988). An awareness of my position as an insider within the system that I studied was imperative to fully rationalize and ensured that any effect this had on the research process was expressed in my writing (Herr & Anderson, 2005). Strategies were adopted to prevent unforeseen issues related to my subjectivity and positionality. To do this, I followed Mills (2001) suggestions to evaluate: the educational theories that have made an impact on me, my educational values, the work I do as an educator and my contributions, the historical context of my work within the school district, as well as the experiences that surround my beliefs of teaching and learning. Since I was pursuing a degree in learning design and technology, I also spent time reflecting on my views and subjectivities as they pertain to this field of study.

I am a White, middle-class, middle-aged female. I am hyper-aware of the privilege that this affords me within the constructs of a society that sadly still has a long way to go when it comes to issues of human rights, equality, and justice for all. This awareness began at an early age because of my love of reading. I was in fifth grade when I began reading books that opened my eyes to the negative impacts of oppression and racism. In high school and while earning my undergraduate degree, I filled my schedule with courses that centered on multiculturalism and social justice which was also the emphasis for my Master of Arts in Teaching. In my role as an educator in a district situated in Southwest Fresno, an area plagued by concentrated poverty but rich in

diversity, these experiences fueled my passion for serving a population of people groups that have been marginalized throughout history. It is my greatest hope that a culturally relevant, student-centered, tech-enhanced learning experience makes a difference in the life of every single student I impact.

I began my elementary teaching career in 2007 with four antiquated desktop computers in the back of my room and access to a computer lab for one hour a week. Seeing technology as a tool that would allow me to individualize instruction and allow for student voice and choice, we utilized this time for a variety of WebQuests and student-led research tasks. This access evolved throughout the years as the district slowly began purchasing laptops for student use in 2010. By 2014, my classroom was finally fully equipped and 1:1 with student Chromebooks. I was a 5th grade teacher, and we were the only grade level in the district to have a laptop for every student in the room. We knew with this privilege came the responsibility to prove that this was a worthwhile endeavor that would increase student engagement and achievement.

It was this opportunity and the desire to learn that led to my pursuit of a doctoral degree in learning design and technology. I believe that the use of instructional technology along with student-centered pedagogies that are culturally relevant enhances engagement and propels learning. I have had the privilege of supporting teachers within my former school district as a math coach for five years. In a recent transition to my current position, I now serve on the content team for Eureka Math, a subsidiary of the Great Minds, PBC. One of the products that I worked to create, called InSync, provides teachers and students with an instructional video for every lesson.

My positionality and prior service within the school, which was the context for my study makes me an insider. Dwyer & Buckle (2009) discuss the complexities to this, and I am likely occupying the space between. It is my deepest desire to have a positive impact so I checked-in with both teachers and curriculum fellows throughout my research process to ensure that my biases and values were not interfering with my research processes. It was important for me to stay focused on the authentic inquiry and I worked hard to remain neutral regarding other areas of classroom instruction throughout the study. I sought the perspectives of my participants throughout the entire research process to remain in alignment with my pragmatic paradigm. It was through this lens that I elevated the perceptions and experiences of all participants in this endeavor.

Defining My Paradigm

Before beginning this journey of scholarly action research, I defined the paradigm, or worldview, from which the study was conducted. Grant (2016) reiterates the necessity of this task because whether a researcher recognizes it or not, a person's beliefs, shaped by past experiences, both explicitly and implicitly impacts their research. This is inherent in the very notion of paradigm as it shapes how a person views the nature of reality (ontology), the nature of the relationship of knowledge and the knower (epistemology), the nature of how knowledge is obtained (methodology), and the nature of one's ethics and core values (axiology). Tracy (2020) defines paradigms as "preferred ways of understanding reality, building knowledge, and gathering information about the world" (p. 49). It is this impact on the very nature of research that required me as a researcher to determine my paradigm which helped me maintain cohesion and alignment throughout this study.

The task of defining my paradigm was a challenge because each paradigm consists of noteworthy attributes. Kinash (2006) defines paradigm as “a matrix of beliefs and perceptions” (p. 2). In action research, the matrix nature of paradigm lends itself to gray areas both within and between paradigms. This is especially true of the interpretivist, transformative, and pragmatic paradigms, with respect to action research because of the interactions and connections with the subject and participants being studied (Grant, 2016). Tracy (2020) reiterates this by stating “Many paradigms and qualitative territories overlap in topic or conceptual focus” (p. 71). Although I saw aspects of my worldview in all three paradigms, given the nature of this research, the pragmatic paradigm was the lens through which I endeavored to make sense of the educational reality presented throughout this study.

The pragmatic worldview bases itself on action, what works, and seeks to facilitate the discovery of solutions to problems (Creswell & Creswell, 2018). Because of this, the pragmatic paradigm affords flexibility and freedom to the researcher for choosing methods within the research design that were most likely to provide answers (Kankam, 2019). When it comes to pragmatism in educational research, Badley (2003) states “What a pragmatic approach to research actually leads to, through reflection, is a kind of useful if temporary equilibrium amongst the community of inquirers” (p. 296). This equilibrium allowed me as an educational researcher to utilize research outcomes as descriptions of reality rather than absolute truth or scientific fact as well as implore stakeholders to see connections between actions and consequences (Badley, 2003).

The pragmatic paradigm allowed the flexibility needed to examine a systematic approach of integrating technology that enhanced the digital capacities of mathematics

teachers. This study sought to determine teachers' attitudes and intentions that might have optimized the use of instructional videos as part of a student-centered flipped learning experience. The pragmatic approach allowed for freedom within the research design to explore and expand on the current reality with the methodologies that fit the research purpose and questions.

Sanders and George (2017) recommend that researchers look critically at the lessons that have emerged as the educational field has found itself in a cycle of ICT use, with ever increasing numbers of technological innovations being introduced that are not yielding the promised results. Keeping in mind that not all necessary skills can be acquired through a computer, necessitates that educational technology be incorporated with intentionality and purpose (Sanders & George, 2017). It also requires researchers to approach the field pragmatically (Sanders & George, 2017), with a careful focus on reality, which was the goal of my work with mathematics teachers to better understand their use of technology to transform current classroom experiences by gaining an understanding of teachers' attitudes and intentions for the use of instructional videos as part of a flipped learning model.

Definition of Terms

For the purpose of this research, **teachers' attitudes** were defined as one of many factors determining behavior (Ajzen & Fishbein, 1977; Glasman & Albarracin, 2006). "... a person's attitude represents his evaluation of the entity in question" (Ajzen & Fishbein, 1977, p. 889). This study sought to explore teachers' attitudes towards the use of instructional videos and flipped learning for mathematics instruction.

Teachers' intentions were defined as a conative response, or what people say they plan to do or would do, with respect to their attitude towards an object or idea (Ajzen, 1988). Fishbein & Ajzen (1975) define intentions as varying in dimension of specificity around four elements stating in their book "Intentions involve four different elements: the behavior, the target object at which the behavior is directed, the situation in which the behavior is to be performed, and the time at which the behavior is to be performed" (p. 292). This study sought to understand K-8 teachers' intentions towards using instructional videos and the flipped learning model for mathematics instruction.

Lesson design was generally defined as a collaborative process in which the researcher and teachers adapt existing curricular materials as a team to comply with the coherence of the curriculum and the reality of their context (Voogt et al., 2015). It is expected that teachers design their lessons with fidelity to the mathematics curriculum, however there is an intrinsic flexibility to adjust as needed to meet the needs of the student population. This study focused on the intentional incorporation of instructional videos as part of a flipped learning design for lessons that maximize the impact of delivery on student learning and achievement.

Technology Integration was defined as the appropriate incorporation of the digital tools and lesson videos into the teaching and learning process with the intent of improving student learning and ability to communicate their proficiency in mathematics (Ozel, Yetkiner, & Capraro, 2008). It is through intentional planning that technology is seamlessly integrated into the lesson design and utilized to build both mathematical content and language skills to maximize learning.

Instructional videos are multimedia embedded in lessons that use the Eureka Math curriculum to present content in the form of lesson videos, and to engage students in mathematical discourse using short clips to launch the lesson, detailed instruction of the learning objective for each lesson, as well as an opportunity to reflect on learning.

Flipped Learning Model aligned with Bergman and Verleger's (2013) view of flipped instruction consisting of a two-part technology supported model where video lessons are watched as individual direct instruction outside of the classroom, to prepare students for interactive group activities in the face-to-face classroom setting.

Mixed-Methods Action Research combined qualitative and quantitative methods to provide a thorough analysis to answer the research questions for problems of practice that were within the researchers' sphere of influence (Mertler, 2013).

Student-centered mathematics instruction provides students with the opportunity to construct mathematical reasoning to understand both the "why" and "how" of mathematical problem solving. It allows them to communicate their thinking and engage in discourse with others while making connections between concepts and persevering to solve real-world mathematical problems (Walters et al, 2014).

CHAPTER 2

LITERATURE REVIEW

The purpose of this action research was to evaluate and describe mathematics teachers' attitudes and intentions for integrating instructional videos as part of a flipped learning instructional model. It explored the impact of digital technologies and video lessons on teacher planning and enactment of the curriculum emphasizing the utilization of the flipped learning model for mathematics instruction. This action research sought to answer these questions: (1) What are teachers' attitudes towards using instructional videos as part of flipped learning? (2) What are teachers' intentions towards using instructional videos as part of flipped learning? (3) What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics? (4) What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?

Literature Review Methods

The method used for conducting this literature review included isolating the variables pertaining to the research questions of educational technology, instructional technology, teacher attitudes and beliefs, technology integration, instructional design, flipped classroom model, Eureka Math, multimedia educative curriculum materials, and mathematics. These were then utilized as keywords in my search of university databases. I also sought to support these with learning theories which led to the keywords: situated learning theory, cognitive learning theory, constructivist theory, cognitive theory of

multimedia learning, theory of planned behavior, technology acceptance model, and theories to ground research. Action research was also used as a search term to locate prior examples of action research related to this study. In addition to searches under these keywords, data mining was conducted using sources cited that directly related to the topic. Through the University of South Carolina library search, the following databases were accessed: *EBSCOhost, EL SEVIER, Encore, ERIC, JSTOR, ProQuest, Routledge, Springer, and the Taylor & Francis Group*. Searches were also conducted using *Google Scholar* which was supported by the *ResearchGate* open database. Recommendations from the committee overseeing this research were also reviewed and cited.

This literature review was organized into two main sections. The first section focuses on the way technology is integrated into K-12 mathematics classrooms. It explores teachers' attitudes and perspectives towards educational technology as well as the pedagogies for instructional design which allows for the delivery of mathematical content that is maximized and in line with the Common Core State Standards for Mathematics (CCSSM). This section also discusses theories related to teachers' acceptance of technology as well as planned behavior. The second section focuses on the flipped learning model as a practice that integrates technology and allows for student-centered classroom activities. It looks at the various ways researchers have designed this approach and the effect that flipped learning has on performance and motivation in mathematics.

Technology Integration in Mathematics Education

In this section the reviewed studies reveal research findings related to the integration of technology into K-12 classrooms. This research specifically analyzed

educational technology integrations for mathematics teachers, their attitudes and intentions, as well as the support they need to maintain successes and overcome challenges. The Eureka Math curriculum was built upon the mathematical frameworks and the CCSSM, so this section also explores how technology has been utilized to support instructional content that deals specifically with these standards and the State Standards for Mathematical Practice (SMP's).

Technology integration in education has been taking place throughout history incorporating technologies like the radio and motion picture to today's easily accessible computing devices. Researchers have explored various models for integration like SAMR, which stands for substitution, augmentation, modification, and redefinition, as well as TPACK, which refers to technological, pedagogical, and content knowledge (Hilton, 2015; Joo et al., 2018; Koh, 2019; Yeh et al., 2017). Magana (2017) explores integrating technology into teaching and learning as taking place within a framework with three marked stages. As teachers acquire the knowledge and skills they need to fully leverage the power of technology for student learning, they start in a translational stage, progress to a transformational stage, and finally reach the transcendent stage, which is where the student learning experience is optimized because the teachers' ability to seamlessly incorporate and utilize technology (Magana, 2017). Research shows that successful integration of technology is impeded when the focus is technology-centered, so an integral component of successful technology integration is a learner-centered approach (Drijvers et al., 2010; Magana, 2017; Mayer, 2009). For the purpose of this study, technology integration is the intentional use of technology to enhance the learning experience for both teachers and students.

Teacher Beliefs, Perceptions and Attitudes Towards Technology

Teachers' attitudes, perspectives, and beliefs towards educational technology are important variables to explore as they tend to be an indicator to the extent in which technology is infused into the learning environment. Teachers' beliefs about teaching and learning are typically referred to as their pedagogical beliefs and there is evidence that these beliefs impact teachers' decision-making processes when it comes to technology integration (Agyei & Voogt, 2011; Drent & Meelissen, 2008; Ertmer & Ottenbreit-Leftwich, 2010; Mertala, 2019; O'Neal et al., 2017; Tondeur et al., 2017). Belief systems are thought to be somewhat static in nature but that doesn't mean they are not subject to change especially when it comes to educational technology integration. There are also signs that vicarious experience and social-cultural influences can change the way teachers view technology integration (Ertmer, 2005). These ideas are important to keep in mind as technology integration becomes increasingly necessary to promote 21st Century learning.

When integrating technology into instructional design, there are shifts in traditional teaching pedagogies that must occur which requires teachers to embrace learning as they explore strategies that move the focus from the teacher to the student. Ertmer and Ottenbreit-Leftwich (2010), reiterate this idea when they state "To use technology to support meaningful student learning, teachers need additional knowledge of the content they are required to teach, the pedagogical methods that facilitate student learning, and the specific ways in which technology can support those methods" (p. 260). The way teachers perceive instructional technology then impacts their professional reasoning process for integration decisions (Heitink et al., 2017). In their review of past

research, Sanders and George (2017), state that “Educational technologies must therefore be seen as learning tools to serve pedagogy and not the other way around” (p. 2923).

In addition, teachers’ positive attitude towards technology has the same significance as experience and knowledge when it comes to crafting a technology-supported pedagogy (Agyei & Voogt, 2011; Hughes, 2005). The tricky part about acquiring technological knowledge is that technology is constantly and rapidly changing. Drent and Meelissen (2008) found what they refer to as, personal entrepreneurship, or the connections teachers make with others to grow professionally, to be a characteristic in teacher attitudes for teachers’ innovative use of technology for teaching and learning. This supports Ertmer’s (2005) findings mentioned previously, that vicarious experience, or the opportunity to see student-centered technology integration modeled, as well as the social culture within a school’s environment are elements that impact teachers’ experience and knowledge acquisition.

Tondeur and fellow researchers (2017), in their review of studies on the subject, found that there are factors that impact teachers’ beliefs and some benefit technology integration while others act as barriers. Ertmer (2005) points out the importance of teacher beliefs and how they are drawn on the way teachers perceive technology as either being just one more thing to do or just another tool to incorporate into their instructional design. Not surprisingly, time or the lack of it, was one of the most common barriers for teachers who participated in these studies (Tondeur et al., 2017).

Teachers, especially elementary school teachers, are responsible for multiple content areas and a wide variety of curricular goals as well as school site and district initiatives. This makes it even more challenging to integrate technology in meaningful

ways. Cennamo and colleagues (2013), in their seminal work on the subject, list four areas in which teachers must have knowledge in order to integrate technology in a meaningful way: “(1) they must identify which technologies are needed to support specific curricular goals, (2) specify how the tools will be used to help students meet and demonstrate those goals, (3) enable students to use appropriate technologies in all phases of the learning process including exploration, analysis, and production, (4) select and use appropriate technologies to address needs, solve problems, and resolve issues related to their own professional practice and growth” (p. 10). These four areas require teachers to make decisions.

Kopcha and fellow teachers turned scholars (2020) have continued to explore factors that influence teachers’ decision-making processes when it comes to technology integration. Their teaching experience led them to explore these processes and note that there is a disconnect between current research on technology integration and the reality teachers face in their classrooms. Expanding on Ertmer’s (2005) work that discusses barriers that impact teachers’ decisions to integrate technology, their review of literature focused on the process that teachers engage in. Their findings indicate that “Specifically, technology integration is (1) value driven, (2) embedded in a dynamic system, and (3) a product of teacher’s perception of what is possible” (Kopcha et al., 2020, p. 731).

Theory of Planned Behavior

The theory of planned behavior (Ajzen, 1991) posits that behavioral intentions are predictable and predicated on a person’s attitude toward the behavior as well as subjective norms, and perceived behavioral control. “At the most basic level of explanation, the theory postulates that behavior is a function of salient information, or

beliefs, relevant to behavior” (Ajzen, 1991, p. 189). The consideration of a person’s attitude toward the behavior is the degree to which the behavior has a favorable evaluation or not. Subjective norms look at social context and the influence of others to engage in a behavior or not. Perceived behavioral control incorporates the ideas of perceived ease of use discussed in the previous section. Depending on the situation attitudes, subjective norms, and perceived behavioral control may all factor in or just one, or a combination of two, rather than all three simultaneously. Because of this, it is important to analyze these as three separate constructs that allow for the prediction of behavior (Ajzen, 1991).

In education, there are many initiatives relating to the integration of technology. However, whether a technological tool is used is determined by each individual teacher who is typically influenced by a variety of factors (Teo et al., 2016). In order to impact and increase teachers’ technology integration, it is important to understand intentions and attitudes. Desimone, Smith, and Phillips (2013) define characteristics of effective professional development as being “content-focused, designed with active learning experiences throughout, consistent with teacher beliefs’, delivered over time, and embedded with opportunities for collaboration” (p. 11).

Quantitative methods were used throughout the extant research to determine teachers’ perceptions of technology integration and the support they receive to do so (Agyei & Voogt, 2011; Akiba & Liang, 2016; Havard et al., 2018; Liu et al., 2017). Quantitative methods consisted of surveys (Akiba & Liang, 2016; Drent & Meelissen, 2008; Sheffield et al., 2018), pre- and post-surveys (Sheffield et al., 2018), and questionnaires (Gurevich et al., 2017; Venkatesh et al., 2003; Wong, 2015).

Technology Acceptance Model

Knowledge of factors that contribute to the acceptance of technology for teaching and learning is important to generate in any effort to promote successful integration. The technology acceptance model (TAM) is a well-known framework used to understand the factors behind users' intentions related to the use of technology (Ibili et al., 2019; Joo et al., 2018; Pittalis, 2020; Teo et al., 2016). Applying this framework allows researchers to explore factors that may contribute to technology acceptance and use in 21st century learning environments (Wong, 2015).

The TAM has grown over time but has foundations in Bandura's (1986) social cognitive theory as well as later work on an agentic theory of human development, adaptation, and change, and research findings on self-efficacy (Bandura, 2006; Davis, 1989). When it comes to human agency, and people's readiness for adopting and adapting to change, Bandura (2006) sites four core properties: (1) intentionality, (2) forethought, (3) self-reactiveness, and (4) self-reflectiveness. Davis (1989) refers to Bandura's (1986) work in support of two constructs of the TAM: (1) perceived usefulness and (1) perceived ease of use. Perceived usefulness seeks to determine the degree to which a person believes a technological tool or system provides advantages and improves performance. While perceived ease of use is the degree of effort required to incorporate a technological tool or system (Davis, 1989). Research on these two constructs confirms their significance on teachers' intentions to integrate technology (Joo et al., 2018; Teo et al., 2016).

Although the TAM model is well recognized in technological research circles, there are other models with relevant constructs to explain the acceptance and use of

technology. Like the TAM model, the unified theory of acceptance and use of technology (UTAUT) builds on the theories of reasoned action (Ajzen & Fishbein, 1977) and planned behavior (Ajzen, 1991). However, UTAUT includes constructs of subjective norms (SN), behavioral intention to use (BI), and attitude towards technology (ATT) (Venkatesh et al., 2003). It extends the original version of TAM according to Joo and colleagues (2018) “by including external variables that affect perceived usefulness and perceived ease to use, and ultimately, intention to use technology” (p. 4).

These models and frameworks are specific to the field of technology, but not necessarily directly tested in the field of educational technology. Research continues to further explore and explain how these constructs can inform the field of educational technology by determining teachers’ acceptance and intentions about integrating technology in their classrooms (Ibili et al., 2019; Joo et al., 2018; Ndlovu et al., 2020; Pittalis, 2020; Teo et al., 2016). Table 2.1 illustrates the purpose, methods, and findings when the constructs of TAM are explored in educational contexts.

Table 2.1 Research on TAM for Educational Contexts

Researcher(s)	Purpose	Methods	Findings
Ibili et al., (2018)	Explore math teachers’ acceptance and intention to use an augmented reality tutorial system in geometry.	<ul style="list-style-type: none"> Survey 	Perceived ease of use effected perceived usefulness with effected teacher attitudes which had a strong influence on teachers’ intentions.
Joo et al., (2016)	Investigate the relationship between TPACK, self-efficacy, PEU, PU, and intention to use technology for preservice teachers.	<ul style="list-style-type: none"> Survey 	TPACK positively affects self-efficacy, PEU, and PU which has a positive influence

Researcher(s)	Purpose	Methods	Findings
Ndlovu et al., (2020)	Investigate preservice teachers' beliefs about their intentions to integrate technology in their mathematics classrooms.	<ul style="list-style-type: none"> • Survey • Focus Group Interviews • Individual Interviews 	on intentions to use technology. PU has the largest impact for determining teachers' intentions to integrate technology. PEU beliefs' influence teachers' desire for training.
Pittalis (2019)	Extend the TAM to assess secondary mathematics teachers' intentions as well as to include a new construct of perceived pedagogical-learning fit.	<ul style="list-style-type: none"> • Survey 	Perceived pedagogical-learning fit and attitude are the strongest predictive factors for teachers' intentions to use technology.
Teo et al., (2016)	Test the validity of extending TAM to include elements of TPB to explain teachers' intention to use technology for teaching and learning.	<ul style="list-style-type: none"> • Survey 	Attitude and perceived behavioral control had the largest positive impact on intention to use technology while subjective norm had a negative impact.

The Flipped Learning Model

The flipped learning model has been a focus of recent research on integrating technology into teaching and learning (Bergmann & Sams, 2015; Bishop & Verleger, 2013; DeLozier & Rhodes, 2017). Flipped learning, which is a form of blended learning, occurs when the traditional model of instruction is reordered so that what is direct instruction that would normally take place in class is delivered in video format for

homework or as part of an in class station rotation model, which frees up class time for learner-centered activities (Abeysekera & Dawson, 2015; Bergmann & Sams, 2015; DeLozier & Rhodes, 2017; Tucker et al., 2017). In flipped classes, students receive content instruction from technology and apply knowledge in class with help from the teacher (Gundlach et al., 2015). Abeysekera and Dawson (2015) add to this definition that the flipped classroom approach can be seen as a set of pedagogical approaches that: “(1) move most information-transmission teaching out of class, (2) use class time for learning activities that are active and social, and (3) require students to complete pre-and/or post-class activities to fully benefit from in-class work” (p. 3). Similarly other researchers describe flipped learning as an instructional method that utilizes video lectures accompanied by practice problems for homework and incorporates group problem-solving activities in class (Bishop & Verleger, 2013; Lo & Foon Hew, 2015). Class time is also freed up for individual and differentiated instruction (Carhill-Poza, 2019; D’addato & Miller, 2016). Flipped learning was defined in two parts for the purpose of this study: (1) an approach in which students view content and direct instruction through interactive videos provided as web-based curriculum materials for homework, and (2) students then participate in teacher-supported learner-centered activities as well as differentiated instruction in class.

There is a wide variety of research and many ways that the flipped learning model has been utilized depending on instructional needs. Several studies focused on the types of instructional design that teachers can use that is specifically related to the videos and multimedia learning techniques used to flip instruction (Almasseri & AlHojailan, 2019; de Araujo et al., 2017; Song & Kapur, 2017). A growing body of research analyzes the

effects of flipped learning on student engagement, achievement, and motivation (Bond, 2020; Karabatak & Polat, 2020; Lai & Hwang, 2016). Bond (2020) conducted a review of 107 articles related to student engagement and flipped learning and concluded that most of the studies found a positive relationship between the two variables. Karabatak and Polat (2020), incorporated Keller's ARCS model (2010) and found that when combined with the flipped learning approach student motivation increased significantly. Similarly, Lai and Hwang (2016) incorporated self-regulation strategies and the flipped learning approach as part of their quasi-experimental research and found that the group that received this intervention showed higher gains in both achievement and motivation.

A focus on mathematics instruction that incorporates flipped learning, reveals benefits and challenges to using the flipped learning model. One of the biggest benefits reported for the use of this model is that content instruction can be delivered outside of class, which frees up class time for collaborative problem-solving activities and additional support from the teacher if remediation is needed (D'addato & Miller, 2016; deAraujo et al., 2017; Kanjug et al., 2018). The challenges then become the time it takes to design, create, and organize the videos (Bergmann & Sams, 2015; Lo & Hew, 2015), as well as students' accountability for watching the videos to prepare for class (Abeysekera & Dawson, 2015; deAraujo et al., 2017; DeLozier & Rhodes, 2017; Lo & Hew, 2015).

Instructional Design and the Flipped Learning Model

Creating videos of instruction is one of the most time-consuming challenges for facilitators of flipped learning (D'addato & Miller, 2016; Lo & Foon Hew, 2015; Webel et al., 2018b). Bergmann and Sams (2012), who write extensively about their own

successes with the model share anecdotal evidence that teachers should create their own videos. In their experience, students are more likely to watch the videos at home, or outside of class for homework, when it is their actual teacher as opposed to a random instructor. They speculate that this is because of the relationships that they cultivate with their students. In contrast to their findings, other researchers have found that the use of videos created by others, found online on platforms like Kahn Academy, still had positive effects on students (Zengin, 2017). The videos do become part of both the designed and enacted curriculum when teachers create their own (de Araujo et al., 2017; de Araujo et al., 2017; Prestridge, 2012; Zengin, 2017).

Classroom activities in flipped learning environments vary depending on the instructional design (DeLozier & Rhodes, 2017; Granberg, 2016; Song, Y., Kapur, 2017; Webel et al., 2018a). Instructors can use the time in class to correct misconceptions if the videos they create are embedded with questions that serve as checkpoints in student learning (Webel et al., 2018b). DeLozier and Rhodes (2017) found that in most of the research they reviewed, it was not the video lecture that increased student performance, but the time in class focused on learner-centered strategies like pair-share activities and student presentations that allowed students to activate learning and increase their depth of knowledge.

Flipped Learning in Mathematics

Flipped learning is an instructional model that increases student motivation, engagement, and performance in mathematics (Almasseri & AlHojailan, 2019; S. C. Chen et al., 2016; Wei et al., 2020). Some research has specifically focused on analyzing student performance gains to compare low, medium, and high students across groups to

see if this variable was a factor. In several studies, the data analysis showed greater gains for lower-performing students (Almasseri & AlHojailan, 2019; Bhagat et al., 2016).

While other research has shown that medium-performing students experienced the highest overall gains because of the flipped classroom approach (Wei et al., 2020). All the studies found that the flipped classroom model did not show significant impact on high-performing students. This could be because high-performing students tend to be highly motivated students who thrive independent of the instructional approach.

The flipped learning model is an instructional strategy that has been incorporated into mathematics classes to increase student engagement. Research findings indicate that although desired achievement gains are not always reported (Clark, 2015; Kirvan et al., 2015), when engagement is a variable that is analyzed, it typically increases because of flipped learning (Bishop & Verleger, 2013; Clark, 2015; D'addato & Miller, 2016; Yorganci, 2020). For example, Clark's (2015) research on flipped learning revealed that although no significant changes were shown regarding academic performance, students who participated in the study reported an increase in engagement and communication in their mathematics classroom.

A growing body of research looking to increase these gains even more by incorporating self-regulation strategies and motivation design frameworks into the flipped learning model (Abeysekera & Dawson, 2014; Karabatak & Polat, 2020; Lai & Hwang, 2016). Lai and Hwang (2016) explored incorporating goal setting and self-evaluation to help students self-regulate and found that this led to increased performance, higher self-efficacy, and self-regulation skills. Karabatak and Polat (2020) specifically looked at embedding Keller's ARCS model (2010) for instructional design. The findings

indicate a positive increase in motivation when these models are combined. This demonstrates that although the flipped learning model is a well-rounded approach for mathematics instruction, intentional incorporation of instructional design methods can lead to greater overall outcomes.

Theory and the Flipped Learning Model

The flipped learning model is a versatile approach to teaching that encompasses many theories. When it comes to motivation and cognitive load, research has been analyzed through the lens of self-determination theory (SDT) and cognitive load theory (CLT) (Abeysekera & Dawson, 2014). The flipped learning model requires students to engage in videos outside of class time. Viewing the videos is an essential part of what makes the in-class activities successful. Since students must view these videos to engage with this model, it lends itself to SDT which emphasizes motivation levels in the promotion of learning outcomes (Deci & Ryan, 2008). Sweller's (1988) CLT is a broader theory that builds on Piaget's work and cognitive learning theory. De Jong (2010) states "the basic idea of cognitive load theory is that cognitive capacity in working memory is limited, so that if a learning task requires too much capacity, learning will be hampered" (p. 105). Abeysekera and Dawson (2014), use SDT and CLT as a theoretical framework to analyze extant research and their review led them to make five propositions about learning environments created by the flipped learning approach. The first four propositions relate to SDT, while the fifth proposition connects to CLT: (1) when students' needs for competence, autonomy, and relatedness, are met, intrinsic motivation increases, (2) when the need for autonomy is met, extrinsic motivation is likely to increase, (3) when the need for competence is met, extrinsic motivation is likely to

increase, (4) when the need for relatedness is met, extrinsic motivation is likely to increase, and (5) cognitive load is likely to be reduced by the fact that students have access to recorded videos of the information so they can learn at their own pace.

Almasseri and AlHojailan (2019), also argue that the flipped learning approach incorporates elements of cognitive science and information processing theory like CLT because the direct instruction is contained in the videos. This provides students with the ability to pause, re-watch parts if they don't understand, or even speed up parts they already know. They also recognize that the flipped learning approach takes on the ideas of the constructivism relating to in-class activities that can be learner-centered activities that provide opportunities for reflection and application. Considering these theories, flipped learning has the potential to enhance the overall learning experience as it combines elements of both cognitive and constructive macro-theories.

Another relevant theory, the cognitive theory of multimedia learning (CTML), also plays a role in the impact of the flipped classroom model, especially for the instructional design within components of the videos used to engage learners (Almasseri & AlHojailan, 2019; Bhagat et al., 2016; C. Chen & Yen, 2021; Mayer, 2009). Mayer (2009) defines CTML as “A research-based theory of learning aimed specifically at explaining how people learn from words and pictures” (p. 31). Although not all studies utilized CTML to inform the instructional design of the video content created for flipped learning, some researchers have specifically created videos according to some or all the design principles that make up the framework of this theory (Almasseri & AlHojailan, 2019; Bhagat et al., 2016; Chen & Yen, 2021).

Previous Research Methodologies

Qualitative methods were incorporated into the research design to determine the impact of the flipped learning model on teaching and learning (Carhill-Poza, 2019; de Araujo et al., 2017; Webel et al., 2018a) but most studies incorporated a mixed-methods design (Clark, 2015; D’addato & Miller, 2016; Kanjug et al., 2018; Lai & Hwang, 2016; Wei et al., 2020; Zengin, 2017). Quantitative Methods were used alone in several studies to determine the effectiveness of the cognitive theory of multimedia learning (Bhagat et al., 2016; C. Chen & Yen, 2021) as well as explore teachers’ pedagogical models for incorporating a flipped learning approach (Hossein-Mohand et al., 2021). The mixed-methods approach was widely used among researchers seeking to paint a full analysis of the impact of the flipped learning approach (S. C. Chen et al., 2016; Clark, 2015; Hung, 2015; Prodromou et al., 2015; Wei et al., 2020; Zengin, 2017). Quasi-experimental studies were the most common and typically involved a control group of traditional instruction compared to the flipped learning approach (Bhagat et al., 2016; Clark, 2015; Gundlach et al., 2015; Hossein-Mohand et al., 2021; Kirvan et al., 2015). In these studies, baseline data was collected from both the control and experimental groups then compared to data collected after the experimental group received the intervention. Other studies collected data relating to the flipped learning experience through interviews, surveys, and questionnaires (Chen et al., 2016; D’addato & Miller, 2016; de Araujo et al., 2017; Webel et al., 2018; Wei et al., 2020). Chen and Yen (2021), utilized an instrument to rate cognitive load that was adapted to determine the impact of CTML on extraneous and germane loads. A review of extant literature informed the development this study.

Chapter Summary

The use of technological tools and digital media to support the teaching and learning of mathematics is a growing field. We can look to the research to determine effective practices for integration that benefits not only student learning but allows teachers to plan, design, and differentiate instruction with an additional set of tools designed to make their jobs easier (Bates, 2017; Pepin, Gueudet, et al., 2017). Schools must do more than just make these tools available. Teachers need training and support. In order to provide appropriate training and support, it is imperative to understand teachers' attitudes and intentions for incorporating instructional videos as part of a flipped learning model.

Utilizing instructional videos as part of a flipped learning model to maximize mathematics instruction shows promise to improve student achievement in mathematics. One way that educators can provide learning experiences that are student-centered is by using technology to implement the flipped classroom approach as part of their instructional design (Bergmann & Sams, 2015; Clark, 2015; Zengin, 2017). The flipped classroom approach incorporates multiple theories of learning. Almasseri and AlHojailan (2019) point out that the use of technology to create videos allows for direct instruction, which aligns with the information processing theory, but it also incorporates learner-centered constructivist theories because it allows for class activities to meet student needs, whether that is differentiation with the teacher or time for more collaborative activities that strengthen conceptual understanding through social learning experiences.

CHAPTER 3

METHOD

This section describes the methods that were used to answer the research questions regarding teachers' attitudes and intentions when it comes to using instructional videos in mathematics as part of a flipped model for teaching and learning. Included in this section is a description of the research design and rationale, the setting and participants, how the methodologies used aligned with the data sources, the plan I followed for data analysis, a timeline, methods for ensuring rigor and trustworthiness, and the plan I used for sharing and communicating findings.

The following questions guided this action research cycle:

1. What are teachers' attitudes towards using instructional videos as part of flipped learning?
2. What are teachers' intentions towards using instructional videos as part of flipped learning?
3. What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics?
4. What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?

Research Design

This study followed a mixed methods action research design. This type of research design lends itself to the context of teaching and learning and can be the impetus for improving problems of practice that arise in educational settings (Mertler, 2019; Mills, 2018). Action research is inquiry conducted by practitioners within an organization as both a systematic and reflective cycle which results in recommended actions that lead to the improvement of a specific problematic issue (Herr & Anderson, 2014; Mills, 2018). Mertler (2019) advocates that “in order for teachers to be effective, they must become active participants in their classrooms as well as active observers of the learning process” (p. 15). Arslan-Ari and colleagues (2018), see action research as offering the flexibility necessary to answer research questions with evaluative and descriptive goals because of its alignment with the pragmatic paradigm.

In a study conducted to delineate the characteristics of action research, Rowell and colleagues (2015) found that action research can be characterized by its pursuit of transformative change. In action research, the practitioner is the researcher, there is freedom to choose research methods that align with the problem being studied and the question asked, and the results are shared with participants as well as others within the organization so that the findings inform future practices (Herr & Anderson, 2014; Mertler, 2019; Rowell et al., 2015). Unlike traditional research, action research is conducted for the purpose of exploring a specific problem of practice within a specific context rather than a broad topic for the purpose of generalizing results.

The design of this action research took on a convergent mixed methods approach. The decision to incorporate both quantitative and qualitative research minimized the

individual limitations while relying on the strengths that each type of data provided (Creswell & Creswell, 2018; Mertler, 2019; Mills, 2018). A convergent mixed methods action research design allowed for the generation of both qualitative and quantitative data to determine teachers' beliefs in a single research phase. The convergence of quantitative survey data and qualitative interview data provided an opportunity for triangulation of the different types of data. It also strengthened the findings that one phase of data collection produced since an analysis of each data set individually along with a comparison of the findings to see if they are similar or different provided more complete answers to the research questions (Creswell & Creswell, 2018). In this design, the data was collected concurrently. The quantitative data served as the statistical results and the qualitative data allowed for the generation of themes (Creswell & Creswell, 2018; Tracy, 2020).

The compilation of data collected and analyzed provided a well-rounded description of teacher beliefs within the context of this school and allowed for triangulation of the findings through the merging of the multiple sources. Through this process of triangulation, the separate data sets helped to verify the findings of the other which helped to increase credibility (Mertler, 2019).

Setting and Participants

This descriptive action research study took place at one school site within a small school district in central California. Eagle Elementary and Middle School is a Title 1 school located in Southwest Fresno with an enrollment of about 945 students. Enrollment numbers fluctuate continuously due to the transient tendencies of the families, of which 20% are registered migrant farm workers. In 2019, the school was rated 44 points below standard in mathematics according to the state of California's equity report (California

Department of Education, 2019). All mathematics classrooms have been equipped with a Chromebook cart that is managed by the teacher for student use while in the classroom. The district has also provided each teacher with a desktop computer, a projector, and a document camera.

This study investigated teacher beliefs and intentions for integrating instructional videos to build conceptual understanding of grade level, standards-based mathematics content. The district has been using the Eureka Math curriculum for core mathematics instruction since 2014 and began purchasing the Eureka Math InSync platform in 2020. The Eureka Math InSync platform provides teachers and students with access to instructional videos designed by the Eureka Math team to guide students through concept development for every lesson. The platform was created to provide a supplemental suite of tools to support learning in the classroom or at home. In the 2020-21 school year teachers used the videos to support students with distance learning. Now that the school has returned to in person learning there is an opportunity to continue using the platform as part of a flipped learning model for mathematics instruction.

All kindergarten through eighth grade teachers responsible for teaching mathematics for some or all of their contract were informed of the study and asked to respond to an initial survey. A review of teacher placement and position showed that a total of 48 teachers were eligible to participate in this study. There were 8 kindergarten teachers, 7 first grade teachers, 6 second grade teachers, 7 third grade teachers, 6 fourth grade teachers, 6 fifth grade teachers, 5 sixth grade teachers, 1 seventh grade teachers, and 2 eighth grade teachers. Table 3.1 provides additional demographic data for the teachers eligible to participate in the study.

Table 3.1 Eligible Teacher Demographics by Grade Level, Gender, and Race

Grade Level	Gender		Race			
	Male	Female	White	Asian	Hispanic	Black
Kindergarten (<i>n</i> = 8)	0	8	5	0	3	0
First Grade (<i>n</i> = 7)	0	7	4	0	3	0
Second Grade (<i>n</i> = 6)	0	6	3	1	2	0
Third Grade (<i>n</i> = 7)	0	7	3	1	2	1
Fourth Grade (<i>n</i> = 6)	1	5	5	1	0	0
Fifth Grade (<i>n</i> = 6)	1	5	3	0	2	1
Sixth Grade (<i>n</i> = 5)	2	3	2	1	2	0
Seventh Grade (<i>n</i> = 1)	1	0	0	0	1	0
Eighth Grade (<i>n</i> = 2)	2	0	2	0	0	0

Purposeful sampling (Tracy, 2020) was used to include participants in this study, and to invite them for semi-structured one-on-one interviews. For the interviews, I intentionally selected teachers with experience and without experience utilizing instructional videos to ensure that diverse viewpoints were represented in the interview data. I also intentionally selected teachers with varying degrees of experience in the classroom in general.

Data Collection

The data collection techniques employed an enquiring lens (Mills, 2018). This type of action research occurs when the researcher asks and seeks to describe a phenomenon of interest. This study utilized two main sources: (1) a teacher survey, and (2) teacher interviews. The alignment between the research questions and data collection methods is illustrated in Table 3.2 below.

Table 3.2 Research Questions and Data Sources Alignment

Research Question	Data Collection Methods
(RQ1) What are teachers' attitudes towards using instructional videos as part of flipped learning?	<ul style="list-style-type: none"> • Teacher Survey • Semi-Structured one-on-one interviews

Research Question	Data Collection Methods
(RQ2) What are teachers' intentions towards using instructional videos as part of flipped learning?	<ul style="list-style-type: none"> • Teacher Survey • Semi-Structured one-on-one interviews
(RQ3) What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics?	<ul style="list-style-type: none"> • Teacher Survey • Semi-Structured one-on-one interviews
(RQ4) What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?	<ul style="list-style-type: none"> • Teacher Survey • Semi-Structured one-on-one interviews

Teacher Survey

The primary purpose of this research is to describe teachers' beliefs regarding the use of instructional videos in a flipped model for mathematics teaching and learning. Survey research gives participants the opportunity to provide a self-report on their own attitudes, intentions, and behaviors (Adams & Lawrence, 2019; Mertler, 2019) which aligns with the purpose of this study. Another reason a survey method was employed was due to the efficiency it allowed for in the data collection process (Creswell & Creswell, 2018; Mertler, 2019) given the time constraints for this cycle of research. A survey also allowed for a wider range of teachers to participate when they had the time to respond.

Adams and Lawrence (2019) warn that there are disadvantages to this type of research method due to inaccuracy that can arise in self-reporting which is typically attributed to social desirability bias. This bias occurs because of "the tendency of individuals to present themselves favorably" (Zerbe & Paulhus, 1987). For this reason, survey sub-scales were used to test for validity (Adams & Lawrence, 2019).

The survey is cross-sectional requiring participants to respond to it in its entirety in one sitting (Creswell & Creswell, 2018). Participants were asked to respond to closed ended items that utilized a Likert rating scale. Items with rating scales lend themselves to this type of research because they allow the researcher to quantify beliefs and behaviors

(Mertler, 2019). Each Likert scale item began with a statement which participants agreed or disagreed with on a 5-point or 7-point continuum depending on the original survey from which the item was adopted. Although there are valid arguments for and against neutral options in Likert-type scales according to Mertler (2019), for the purpose of this research there were items for which teachers truly were neutral and this position helped to ensure relevance in the results the survey generated.

Thirteen of the survey items came from Wong's (2015) research on educational technology which was adapted from Venkatesh et al.'s (2003) research on user acceptance of technology. Three of these constructs influenced survey items: (1) attitude toward technology, (2) subjective norms, and (3) behavioral intention to use technology. Attitude toward technology (ATT) is defined as an individual's positive or negative feelings. Subjective norms (SN) describe people's perceptions of what others think of the behavior being analyzed. While behavioral intention (BI) is defined as an individual's plan to use the technology in the future (Venkatesh et al., 2003). Another variable that Wong (2015) examined was facilitating conditions (FC). The FC subscale seeks to explain teachers' beliefs of their ability to access required resources, expertise, and technological support that is needed when integrating into their instructional designs (Wong, 2015).

These items utilized a 5-point Likert scale and were analyzed as sub-scales based on the constructs discussed above. Some of the language was adapted to match the slight difference between the original survey items and the research questions this study sought to answer. For example, when Wong's (2015) survey items used educational technology, these were adapted to instructional videos as part of a flipped learning model for this

study's survey. An example of an adaptation from each sub-scale is illustrated in Table 3.3.

Table 3.3 Instrument Adaptations

Wong's (2015) Sub-scales	Wong's (2015) Survey Item	Adaptation for this Study
Attitude (ATT)	Using educational technology is a good idea.	Using instructional videos is a good idea.
Subjective Norms (SN)	I believe that people who influence my behavior will think that I should use educational technology.	I believe that people who influence my teaching behaviors will think that I should use instructional videos as part of a flipped classroom model.
Behavioral Intention (BI)	I intend to use educational technology in my future teaching.	I intend to use instructional videos as part of a flipped learning model in my future teaching.
Facilitating Conditions (FC)	I believe that I will have the resources necessary to use educational technology.	I believe that I have the resources necessary to use instructional videos as part of a flipped learning model.

Wong conducted a confirmatory factor analysis to identify and eliminate survey items with small factor loadings. Cronbach's alpha, composite reliability, average variance extracted (AVE), and discriminant validity were reported as well (Wong, 2015). Table 3.4 shows the Cronbach's alpha and the composite scores for each subscale.

Table 3.4 Sub-scale Validity Results

Wong's (2015) Sub-scales	Cronbach's Alpha	Composite Reliability
Attitude (ATT)	0.79	0.79
Subjective Norms (SN)	0.75	0.76
Behavioral Intention (BI)	0.76	0.76
Facilitating Conditions (FC)	0.69	0.69

Cronbach's alpha measures the internal consistency of a scale. Cronbach's alpha values of 0.70 or higher can be interpreted as acceptable (Adams & Lawrence, 2019). Careful

attention was applied to the interpretation of the FC construct as it is just below acceptability.

Four survey items were adapted from Lee and Chen (2016) who developed a questionnaire to explore the impact of an Activate Mind Attention (AMA) training on technology-integrated mathematics instruction. Like Wong (2015), they adapted items from Lederer et al.'s (2000) technology acceptance model (TAM). The items incorporated a 7-point Likert scale which was maintained in this research. These items were also written specifically for mathematics instruction, but items were adapted to align with the research questions for this study by changing AMA to instructional videos.

Lee and Chen (2016) used five subscales in their questionnaire and items were taken from one of these subscales for use in this study's survey: (1) perceived usefulness to teaching. Perceived usefulness explores teachers attitudes towards how something adds to their repertoire in a way that makes their job easier. The items related to this concept as well as the adaptations for use in this study are illustrated in Table 3.5.

Table 3.5 Instrument Adaptations

Lee and Chen's (2016) Sub-scale	Lee and Chen's (2016) Survey Item	Adaptation for this Study
Perceived usefulness to Teaching (PT)	Using AMA makes teaching math easier.	Using instructional videos makes teaching math easier.
Perceived usefulness to Teaching (PT)	Using AMA makes teaching math easier.	Using the flipped learning model makes teaching math easier.

The researchers also conducted a factor analysis of the questionnaire items and reported a Cronbach's alpha of 0.96 for the PT sub-scale, which demonstrates excellent internal consistency for the items on the original survey (Lee & Chen, 2016).

Nine survey items were adapted from a teacher survey designed by Gough et al. (2017). Their research examined teachers' perceptions of the flipped learning model using a 5-point Likert scale. The researchers conducted a thorough review of related literature to ensure that validity for the survey items was established. The survey instrument was critiqued by four teachers and two administrators with expertise in implementing the flipped classroom model. Some items were adapted to better fit the language used in this research study. For example, the term recorded lectures was changed to instructional videos. Some examples of the adaptations are illustrated in Table 3.6. However, other items were used without any alteration.

Table 3.6 Instrument Adaptations

Gough et al. (2017) Survey Item	Adaptation for this Study
Recorded lectures aid struggling students because they can re-watch portions of lessons they do not understand.	Instructional videos aid struggling students because they can re-watch portions of lessons they do not understand.
Preparing flipped learning materials was time consuming.	Preparing to use instructional videos as well as other flipped learning materials was time consuming.

Ten survey items were written to inform the third and fourth research questions about successes and challenges related to the incorporation of instructional videos as part of flipped learning models. These questions were created to generate a more robust set of data for these questions as instruments that specifically addressed these areas were difficult to find. The items were written with support from my advising professor and adjusted based on feedback received from committee members. These items utilized a 5-point Likert scale. They were analyzed for internal consistency using the Kuder-Richardson 20 (KR-20) method to determine Cronbach's alpha (Cronbach, 1951). The items and the research questions they aligned with are included in Table 3.7.

Table 3.7 Research Question and New Survey Item Alignment

Research Question	Survey Item
RQ3: What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics?	I would benefit from professional learning on the use of instructional videos.
	I would benefit from professional learning on the use of flipped learning.
	I would need additional time to prepare lessons that incorporate instructional videos.
	I would need additional time to prepare lessons that incorporate a flipped learning design.
	I would need additional technology resources to incorporate instructional videos.
	I would need additional technology resources to incorporate a flipped learning design.
RQ4: What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?	I would need assistance in provided student self-regulation strategies to encourage completion of video-related tasks at home.
	There is a lack of professional development related to the use of instructional videos.
	There is a lack of professional development related to flipped learning designs.
	Students lack self-regulation skills to complete video-related tasks at home.

Teacher Interviews

This action research utilized convenience sampling to select teachers for one-on-one interviews (Tracy, 2020). Eight teachers were selected based on their availability and willingness to participate ($n = 8$). The researcher used an interview protocol (Appendix C) to guide the semi-structured interview sessions. The interview responses allowed for triangulation of the data from the surveys and an opportunity to develop additional insights into teachers' attitudes and intentions on the utilization of instructional videos in a flipped learning model for mathematics instruction as well as their views on successes and challenges (RQ1, RQ2, RQ3, and RQ4). According to Tracy (2020) "Interviews

provide opportunities for mutual discovery, understanding, reflection, and explanation via a path that is organic, adaptive, and oftentimes energizing” (p. 156). Interviews were conducted in person in each teachers’ classroom when students and other adults were not present. Each interview took approximately thirty minutes. In person interviews were audio recorded using the voice memo feature on a Macbook as well as on an iPhone.

Data Analysis

The following section describes the data analysis methods conducted with two data sources: (1) the teacher survey, and (2) one-on-one semi-structured interviews. Table 3.8 illustrates the alignment between the research questions, data sources, and data analysis methods.

Table 3.8 Data Analysis Sources and Methods

Research Question	Data Sources	Data Analysis Methods
RQ1: What are teachers’ attitudes towards using instructional videos as part of flipped learning?	<ul style="list-style-type: none"> • Teacher Survey • Semi-Structured one-on-one interviews 	<ul style="list-style-type: none"> • Descriptive Statistics • Inductive analysis
RQ2: What are teachers’ intentions towards using instructional videos as part of flipped learning?	<ul style="list-style-type: none"> • Teacher Survey • Semi-Structured one-on-one interviews 	<ul style="list-style-type: none"> • Descriptive Statistics • Inductive analysis
RQ3: What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics?	<ul style="list-style-type: none"> • Teacher Survey • Semi-Structured one-on-one interviews 	<ul style="list-style-type: none"> • Descriptive Statistics • Inductive analysis
RQ4: What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?	<ul style="list-style-type: none"> • Teacher Survey • Semi-Structured one-on-one interviews 	<ul style="list-style-type: none"> • Descriptive Statistics • Inductive analysis

Descriptive Statistics

Quantitative data collected from the survey was analyzed using *JASP*, an open-source statistics software. Descriptive statistics were used to analyze the data sets collected. Nominal data such as gender, school site, and grade level were recorded using frequencies. The frequency of the responses are discussed in the narrative as well as displayed in tables by individual subscale (Adams & Lawrence, 2019). Measures of central tendency, like mean and median were used to analyze data and gather a general sense of the beliefs and perspectives of the participants surveyed (Field, 2013; Mertler, 2019). The mean as well as standard deviation from the mean were used to analyze participants' responses to the survey and the degree to which data varies within each data set (Adams & Lawrence, 2019). The analysis of these measures of dispersion and central tendency helped to describe teachers' beliefs (RQ1), as well as intentions (RQ2), supports identified for success (RQ3), and challenges (RQ4) when it comes to using instructional videos as part of a flipped model for teaching mathematics.

Inductive Analysis

An inductive analysis of the data collected from the semi-structured one-on-one interviews was conducted. This type of analysis goes well with action research as it allows for the derivation of practical knowledge from the context in which the research is conducted (Srivastava & Hopwood, 2009; Tracy, 2020). The inductive analysis that was conducted was framed by three basic questions that Srivastava and Hopwood (2009) suggest "(1) What are the data telling me? (2) What is it I want to know? (3) What is the dialectical relationship between what the data are telling me and what I want to know?" (p. 78).

Simultaneous procedures were conducted as part of this qualitative study as I began my analysis and write-up of findings while conducting interviews (Creswell & Creswell, 2018). Table 3.9 refers to steps outlined by Creswell and Creswell (2018) which I used to engage in the process of qualitative analysis.

Table 3.9 Creswell and Creswell (2018) Steps of Qualitative Analysis

Creswell and Creswell's (2018) Steps	Details
Step 1. Organize and prepare the data for analysis.	<ul style="list-style-type: none"> • Transcription of interviews • Organization of data
Step 2. Read or look at all the data	<ul style="list-style-type: none"> • Read to get a general sense of the data
Step 3. Start coding all the data	<ul style="list-style-type: none"> • Data was be uploaded to Delve • Coding of data • Codes grouped and categorized
Step 4. Generate a description and themes	<ul style="list-style-type: none"> • Analysis of codes and categories • Document emergent themes
Step 5. Represent the description and themes	<ul style="list-style-type: none"> • Determine and convey meaning

In the first step of analysis, the recordings and notes from the interviews were organized and transcribed. An online speech to text transcription software called Temi was used to transcribe the interview audio files. Once transcribed, I proofread the transcription and edited the errors that occurred related to spelling, punctuation, and grammar.

In the second step, I read the data and recorded any trends and impressions that arose from the initial review as I familiarized myself with the data (Braun & Clarke, 2006). This entailed reading the transcripts and documenting initial observations. In the third step, Delve, an online qualitative data analysis tool was utilized to begin the coding process. Codes were assigned inductively as meanings emerged (Creswell & Creswell,

2018). This initial coding process continued until data saturation was reached and no new codes emerged (Tracy, 2020).

In the fourth step, codes were grouped into categories based on similar patterns and trends. As categories emerged, they were labeled, and the data re-evaluated to determine whether it belonged to the code or category. These categories were analyzed to generate themes which became part of the narrative that expressed the qualitative findings that were written in step five (Creswell & Creswell, 2018; Tracy, 2020).

Procedures and Timeline

The procedures and timeline for the action research is outlined in this section. The six-week research cycle took place in three two-week stages: two weeks for participant recruitment, two weeks of data collection to administer the initial survey, and two weeks of data collection to conduct interviews. In Table 3.10 each stage is detailed along with the anticipated duration.

Table 3.10 Timeline of Research Stages and Procedures

Stage	Procedure	Duration
Participant Recruitment	<ol style="list-style-type: none"> 1. Email electronic consent form 2. Monitor responses 3. Send email reminders 4. Send acknowledgement emails of study participation 	2 Weeks
Data Collection: Survey	<ol style="list-style-type: none"> 1. Email survey to study participants 2. Monitor responses 3. Send email reminder 	2 Weeks
Data Collection: Interviews	<ol style="list-style-type: none"> 1. Invite participants for interviews 2. Monitor responses 3. Send reminders 4. Coordinate date and time for interviews 	2 Weeks

Stage One: Participant Recruitment

Teachers were emailed an electronic consent form to participate in the study. An email went out using a district listserv to inform future participants that a survey would be emailed to them as part of a research study motivated by the desire to serve teachers and create educational technology resources and instructional videos to provide teachers with the tools they need to support student learning in mathematics. The responses were monitored, and reminders were emailed. All respondents received an email acknowledgement of their consent to participate in the study.

Stage Two: Data Collection (Surveys)

The survey was sent out on March 1, 2022. Responses were monitored, and reminders were emailed to teachers that had not yet responded on March 8, 2022. An initial analysis with the application of specific criterion was conducted on the teacher responses received. This data was utilized to select teachers for the semi-structured interviews.

Stage Three: Data Collection (Interviews)

The teacher survey included an item at the end so that teachers could indicate if they were willing to meet for a one-on-one interview. Seventeen teachers indicated that they would be willing participants for an interview. I selected 8 teachers from across grade levels and with varying degrees of tenure and experience teaching mathematics. These teachers were individually emailed an invitation to participate in a one-on-one semi-structured interview. When teachers indicated that they were willing, I worked to find times when we could meet in a private setting with no other children or adults

present. The interviews ranged from 25 minutes to 35 minutes long and they were all conducted in the participating teacher's classroom.

Rigor and Trustworthiness

A combination of methods was incorporated in the data collection and analysis for this study to improve rigor and trustworthiness. The convergence of quantitative and qualitative methods allowed for maximization of the strengths of each approach (Creswell & Creswell, 2018). In this study, quantitative methods helped to ensure validity and reliability while qualitative methods provided triangulation, rich description, member checking and peer debriefing to ensure rigor and trustworthiness was attained.

Validity and Reliability

In quantitative research, validity refers to the assessment of the data collected and its ability to provide interpretable results or findings that answer the research questions (Mertler, 2019; Mills, 2018). Mertler (2019) suggests that practitioner-researchers engaged in action research pay careful attention to ensure that evidence of validity based on instrument content is utilized to ensure that the tool and the construct it measures is aligned. I ensured validity by thoroughly examining each item which ensured that it addressed the specific behavior domain it was designed to measure. In addition, an expert on research methods was consulted to review the instruments which ensured the content was valid.

Reliability is a construct that measures consistency in the results that an instrument obtains over time (Mertler, 2019). In action research, the time needed to develop an instrument and apply a test-retest method to ensure reliability is not available. Since this method is unavailable for this research, the methods of equivalent forms and

internal consistency were applied. The survey items were taken from instruments used in prior research studies and shown to be reliable. A statistical analysis using the Kuder-Richardson formula 21 (KR-21) was applied to the data collected from this survey. In addition, the Cronbach's alpha statistical test was used to determine internal consistency for the items in the survey (Adams & Lawrence, 2019).

Triangulation

The use of multiple sources allowed for triangulation of the data collected (Tracy, 2020). Triangulating data sources adds to the rigor and trustworthiness of research findings by converging multiple methods to minimize bias and limitations that could occur when data is used in isolation (Creswell & Creswell, 2018). Findings from the qualitative iterative analysis of transcribed notes from interviews was compared to the quantitative results from the survey. The triangulation of the two types of data helped to increase the credibility of each (Creswell & Creswell, 2018). My analysis indicated a relationship. My interpretation of the qualitative data was that the relationship was positive, which allowed me to couple these findings with results from the quantitative results to corroborate the findings.

Rich, Thick Description

The data collected from the interview transcripts was thoroughly explained to provide thick description of teachers' beliefs which increased credibility (Shenton, 2004). A thorough description of the context and setting, as well as clearly written details of the phenomenon and the process for investigating it, added to my overall findings as it helped to make implied meanings discernable (Tracy, 2020). Verbatim quotes from the interviews adds to this description while elevating the voices of the study's participants.

The quotes could also help the reader to determine if the findings of this study are transferable to their context (Shenton, 2004).

Member Checking

Member checking was conducted as part of the data analysis process. Tracy (2020) refers to this process as member reflections because it is a way to share preliminary findings with participants through dialogue that gives them an opportunity to ask questions, provide feedback, and collaborate with the researcher regarding the findings. A draft of the findings was shared with participants and volunteers were asked to meet with me to engage in dialogue regarding their thoughts and feedback of the preliminary findings. According to Thomas (2017), this type of follow-up ensures accurate representation of the participants' perspectives.

Peer Debriefing

Peer debriefing occurred throughout the data collection and analysis method as this study was reviewed by my dissertation chairperson. In addition, colleagues from my cohort as well as colleagues within the Eureka Math organization and the School District assisted in providing accountability and credibility to my findings through regular debriefs. This type of external validation helps to ensure that the results are credible (Shenton, 2004).

Plan for Sharing and Communicating Findings

This action research study and the findings it generated was shared with all stakeholders. I made copies of the report available as well as emailed it to all teacher participants. I also created a presentation that covers the seven main aspects of sharing recommended by Mertler (2020) which included: background information, the purpose of

the study, methodologies used, results, conclusions, action plan, and an opportunity for questions and answers. To ensure anonymity, all participants were referred to using pseudonyms in the presentation.

Tracy (2020) reminds researchers that “reporting back to the field means adapting to the audience” (p.348). Acknowledging that different audiences require different iterations of the presentation, as well as the logistics of getting all stakeholders together in one spot, my plan included multiple opportunities to present throughout the district as well as to inform the Eureka Math organization a subsidiary of Great Minds, PBC to inform its digital footprint and the products being created. The mission of the Eureka Math organization is to create knowledge building materials so that every teacher and every student is empowered to achieve greatness. If the opportunity arises, I plan to share at regional or state conferences relating to mathematics and technology.

CHAPTER 4

ANALYSIS AND FINDINGS

The purpose of this action research was to evaluate and describe mathematics teachers' attitudes and intentions for integrating instructional videos as part of a flipped learning instructional model. This chapter describes the quantitative and qualitative data analysis and findings that describe teachers' attitudes and intentions towards using instructional videos as part of flipped learning. Of the 48 teachers at the K-8 level eligible to participate in this study, 43 responded to the survey. Eight teachers were selected to participate in the qualitative one-on-one interview based on convenience sampling.

The data collection focused on the following research questions:

1. What are teachers' attitudes towards using instructional videos as part of flipped learning?
2. What are teachers' intentions towards using instructional videos as part of flipped learning?
3. What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics?
4. What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?

This chapter consists of three sections. In the first section, the quantitative analysis of the teacher survey is presented. In the second section is the qualitative data analysis and findings from the teacher interviews. In the third section, findings from the quantitative and qualitative analyses are converged and consolidated.

Quantitative Findings

The quantitative findings presented in this section come from an analysis of the teacher survey. The survey was administered prior to conducting the one-on-one interviews. Names were removed from the survey to protect anonymity. The survey data collected was analyzed in JASP using descriptive statistics (Adams & Lawrence, 2019).

Teacher Survey

The teacher survey consisted of seven subscales: (1) perceived usefulness to teaching, (2) attitude, (3) subjective norm, (4) perception of instructional videos and flipped learning, (5) perception of flipped learning, (6) behavioral intention, and (7) facilitating conditions. These scales were adapted from the work of other researchers using self-reported 5-point Likert scale items. Each item consisted of a statement and participants' responses indicated their level of agreement with the statement. Participants could respond: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, or (5) strongly agree.

The open-source data analysis software JASP was used to test each of the subscales for reliability utilizing Cronbach's Alpha (Cronbach, 1951). Cronbach's Alpha assesses the internal consistency of a scale by computing the intercorrelations between responses and values of .70 or higher are considered acceptable (Adams & Lawrence, 2019). The reliability coefficients for each of the subscales fell within the acceptable

range except for the facilitating conditions subscale with a coefficient of .68. The Cronbach's Alpha coefficients for each subscale are presented in Table 4.1.

Table 4.1. Cronbach's Alpha Test of Subscale Reliability

Subscales	Cronbach's α
Perceived Usefulness	.92
Attitude	.91
Subjective Norm	.87
Perception of Instructional Videos	.84
Perception of Flipped Learning	.75
Behavioral Intention	.89
Facilitating Conditions	.68

Descriptive Statistics

The survey data was analyzed by subscale using JASP. Table 4.2 shows the results for each item in the perceived usefulness to teaching subscale which asked participants to rank the degree to which they agree or disagree with five statements. Each survey statement was designed to determine how useful teachers find instructional videos and flipped learning for teaching mathematics. Overall, most teachers agree that instructional videos have a positive impact on learning mathematics with flipped learning. The highest score was on the statement that videos help explain math concepts more clearly ($M = 4.09$, $SD = 0.89$). The lowest score ($M = 3.86$, $SD = 0.94$) was in response to the statement that teaching math is more effective using instructional videos.

Table 4.2. Perceived Usefulness to Teaching

Subscale Item	M	SD
Using instructional videos and flipped learning makes teaching math easier.	3.88	0.95
Teaching math is more effective using instructional videos.	3.86	0.94

Subscale Item	<i>M</i>	<i>SD</i>
I find using instructional videos as part of flipped learning useful in math.	3.97	0.86
I think using instructional videos helps me explain math concepts more clearly.	4.09	0.89
I think using instructional videos as part of flipped learning is convenient and time efficient.	3.91	0.81

The results for each item within the attitude towards using instructional videos and flipped learning are presented in Table 4.3. This subscale was designed to determine teachers' attitudes which is often a predictor of what teachers will incorporate into their instructional plans. Teachers responded with favorable attitudes towards instructional videos and flipped learning with the lowest ranking for the item that instructional videos in mathematics are fun ($M = 3.91$, $SD = 0.84$) and the highest that instructional videos as part of flipped learning in mathematics is a good idea ($M = 4.09$, $SD = 0.84$).

Table 4.3. Attitude Towards Using Instructional Videos and Flipped Learning

Subscale Item	<i>M</i>	<i>SD</i>
Using instructional videos as part of flipped learning in mathematics is a good idea.	3.88	0.95
Using instructional videos as part of flipped learning makes teaching math more interesting.	3.86	0.94
Instructional videos in mathematics are fun.	3.97	0.86
I like using instructional videos to teach mathematics.	4.09	0.89

The beliefs towards teaching subscale was designed with items to probe teachers' subjective norms. Table 4.4 shows the results of the three items of this subscale.

Teachers' beliefs tended to indicate that they would be supported by people who influence their teaching practice even though it was the lowest ($M = 3.51$, $SD = 0.96$). More teachers indicated that they believed the district would support them ($M = 3.74$,

$SD = 0.95$).

Table 4.4. Beliefs Towards Teaching

Subscale Item	M	SD
I believe that people who influence my teaching behaviors will think that I should use instructional videos as part of flipped learning model.	3.51	0.96
I believe that people who are important to me will think that I should use instructional videos as part of a flipped classroom model.	3.62	1.00
I believe the district will support the use of instructional videos as part of a flipped classroom model.	3.74	0.95

A subscale to explain teachers' perceptions of the use of instructional videos for flipped learning in mathematics instruction was included in the survey. Items focused on ways that instructional videos and flipped learning can support teachers to increase access to mathematics. Teachers perceived the possibility of using videos as part of a flipped learning model to remove passive learning lower than the other items ($M = 3.19$, $SD = 0.99$). The highest scoring item in this scale indicates that teachers perceive instructional videos as an aid for struggling students because they can re-watch what they don't understand ($M = 4.33$, $SD = 0.77$). Table 4.5 shows the results for each of the five items in this subscale.

Table 4.5. Perceptions of Success with Instructional Videos for Flipped Learning

Subscale Item	M	SD
Absent students benefit from instructional videos as part of a flipped classroom model.	4.07	1.0
Using instructional videos as part of a flipped learning model removes passive learning from the classroom.	3.19	0.99
Instructional videos aid struggling students because they can re-watch portions of lessons they do not understand.	4.33	0.77

Subscale Item	<i>M</i>	<i>SD</i>
The flipped learning classroom allows teachers to have increased interaction with students.	3.69	0.97
Flipping the classroom creates time for direct instruction through instructional videos, active in-class learning activities, and content coverage.	3.79	0.91

In addition to exploring successes, teachers were asked to respond to statements in a subscale designed to understand what challenges teachers associated with the use of instructional videos and flipped learning. The data gathered from this subscale is presented in Table 4.6. Their responses indicate that challenges are present with this type of learning. The item with the most agreement was that instructional videos will be difficult for some students because they do not have the technology they need to access them outside of school ($M = 4.18$, $SD = 0.88$). The lowest score ($M = 3.25$, $SD = 1.11$) indicates that teachers perceive that students lacking a sense of responsibility is a challenge but not as great as the others.

Table 4.6. Perceived Challenges with Instructional Videos and Flipped Learning

Subscale Item	<i>M</i>	<i>SD</i>
Instructional videos are difficult for some students to access due to the additional technology required outside of school.	4.18	0.88
In a flipped classroom, students lack a sense of responsibility for their learning and do not come prepared to class.	3.25	1.12
Preparing to use instructional videos as well as other flipped learning materials is time consuming.	3.30	0.98
It is difficult to ensure that students truly watch the instructional videos as part of the flipped learning model.	3.67	0.96
There is a lack of professional development related to the use of instructional videos.	3.74	0.95
There is a lack of professional development related to flipped learning designs.	3.95	0.95

Subscale Item	<i>M</i>	<i>SD</i>
Students lack self-regulation skills to complete video related tasks at home.	3.83	0.89

Teachers' intentions towards using instructional videos and flipped learning were measured. Table 4.7 presents the findings of the three items in this subscale. Although teachers' overall responses indicated that there are intentions towards future use, the standard deviation for each item was also greater than one. Teachers' prediction of future use was the highest item in this scale ($M = 3.88$, $SD = 1.02$). The lowest ($M = 3.27$, $SD = 1.22$) item referred to teachers having actual plans to use instructional videos as part of a flipped learning model in the future.

Table 4.7. Intentions Towards Instructional Videos and Flipped Learning

Subscale Item	<i>M</i>	<i>SD</i>
I intend to use instructional videos as part of a flipped learning model in my future teaching.	3.51	0.96
I predict I would use instructional videos as part of a flipped learning model in my future teaching.	3.62	1.00
I have an actual plan to use instructional videos as part of a flipped learning model in my future teaching.	3.74	0.95

The last subscale in the survey sought to examine the facilitating conditions teachers felt were available and accessible. Table 4.8 presents their responses to items designed to analyze current conditions as well as anticipated needs to support success with the use of instructional videos as part of a flipped learning model. Teachers responded the least favorably to having the knowledge necessary to use instructional videos in a flipped learning model ($M = 3.18$, $SD = 1.18$). The highest item in this scale

shows that teachers would need additional time to prepare lessons that incorporate flipped learning ($M = 4.11$, $SD = 0.88$).

Table 4.8. Facilitating Conditions

Subscale Item	<i>M</i>	<i>SD</i>
I believe that I have the resources necessary to use instructional videos as part of a flipped learning model.	3.21	1.26
I have the knowledge necessary to use instructional videos in a flipped learning model.	3.19	1.18
I believe that a specific person or group will be available for lesson design assistance with difficulties using instructional videos as part of a flipped learning model.	3.74	1.09
I would benefit from professional learning on the use of instructional videos.	3.95	0.97
I would benefit from professional learning on the use of flipped learning.	3.95	1.04
I would need additional time to prepare lessons that incorporate instructional videos.	4.07	0.88
I would need additional time to prepare lessons that incorporate flipped learning.	4.11	0.87
I would need additional technology resources to incorporate instructional videos.	3.76	1.08
I would need additional technology resources to incorporate instructional videos.	3.74	1.13
I would need assistance in providing student self-regulation strategies to encourage completion of video-related tasks at home.	4.09	0.89

Qualitative Findings and Interpretations

This study used eight one-on-one teacher interviews as the source of qualitative data. Open-ended questions were written prior to conducting the interviews to ensure that participants attitudes and intentions towards the use of instructional videos and flipped learning for mathematics instruction were adequately captured. Each interview was

conducted in the teachers’ classroom when students or other faculty were not present, allowing participants to be authentic in their responses.

Participant Selection

Participants were selected based on their response to the following question on the teacher survey: “Are you willing to answer a few more questions in a one-on-one interview regarding your attitudes and intentions towards instructional videos as a part of a flipped learning model for mathematics teaching?” Teachers could select a yes or no response. A spreadsheet of teachers that selected yes was created, and convenience sampling was used to select possible interviewees. Teachers from across grade bands and with varying amounts of tenure were selected and follow-up emails were used to communicate and schedule one-on-one interviews. Seven of the eight initially selected participated in the interview. One teacher selected fell ill during the research window so an alternate teacher that had also responded yes was interviewed in their place. See table 4.9 for interviewee pseudonym and demographic information. On average, teachers had fifteen years of tenure, and this ranged from two years to thirty-one years of teaching experience.

Table 4.9 Interviewee Demographic Information

Pseudonym	Tenure in Years	Years Teaching Math	Current Grade Taught
Ava	31	26	1 st
Betty	24	24	4 th
Claire	28	21	Kindergarten
Dan	3	3	8 th
Edna	2	2	5 th
Fran	22	22	2 nd
George	6	6	5 th

Pseudonym	Tenure in Years	Years Teaching Math	Current Grade Taught
Helen	3	3	3 rd

Analysis of Qualitative Data

The qualitative data analysis was conducted using an inductive thematic approach (Creswell & Cresswell, 2018; Mertler, 2020). To ensure privacy of the participants, pseudonyms are used in this section. All interview recording files were transcribed by importing the recordings into Temi, a transcription service available online. Then the data analysis software Delve was used to determine first and second cycle codes. There were multiple iterations of coding conducted in each cycle consisting of open coding, in vivo coding, value coding and structural coding (Saldana, 2016). A detailed description of the coding cycles and strategies follows.

First Cycle Coding

Initial coding was conducted using open coding. Open coding allows researchers to begin qualitative analysis in a way that allows for authentic interpretations (Charmaz, 2014). Using the Delve tool, interview transcripts were reviewed sentence-by-sentence and question-by-question, and codes were applied. Codes generated were linked to each participant and notes, and descriptions of codes were tracked using tools available within the Delve platform.

In addition to open coding, in vivo coding methods were applied. This coding method was used in the initial analysis to gain a clear picture of participants' voice and because it is a coding method that works flexibly for any type of study (Saldana, 2016). In vivo codes are generated directly from the participants words which allowed the analysis to capture the expertise of the teachers and get a glimpse into the instructional

practices found at the site. For example, two participants shared that they regularly use instructional videos to frontload information, so *frontloading* was added as a code. Figure 4.1 shows the way this in vivo code emerged in Delve.

Showing 3 results, appearing in 2 transcripts.

Fran.docx
So **front loading** a lesson before I actually teach a concept on whatever the skill is for the day with our Eureka math, you know, how it goes, it goes in, you know, modules. So everything builds.

Fran.docx
Speaker 2: 08:59 I think some, a lot of it could be **front loading** and then just coming in the next day, knowing, you know, this is what we're gonna learn about and they can even share out with the class what they got from the video, so that it's, you

Dan.docx
That would be my goal and, and my wish, but even as sort of a **front loading** kind of thing, so we can go over it in some way. I would love to make it somehow that it's their homework beforehand, not as a homework afterwards.

4.1 Frontloading as an In Vivo Code in Delve

Structural coding was used in the next phase of the initial coding process to explore the data as responses to each question. Saldana (2016) suggests that structural coding is ideal for the analysis of interview transcripts when multiple participants contribute to the data set. Structural coding made the connections between codes, across participants' responses, as well as their relation to the research questions easier to align.

During this cycle, codes like that emerged in the first cycle like *frontloading* were used throughout the data analysis when teachers talked about using videos to preteach, address vocabulary development prior to teaching content, and when they talked about videos as part of a flipped model. *Frontloading* was linked to nine additional instances

across transcripts. Figure 4.2 provides an example of the different types of language found in some of the transcripts that were linked to this code.

Frontloading (12)

Appears in 7/8 transcripts Code added by Jessica Lambert

Ava.docx (2) Betty.docx (1) Claire.docx (1) Dan.docx (1) Edna.docx (3) Fran.docx (1) George.docx (3)

When teachers talk about using a video to preteach, teach vocabulary, or as a part of flipped learning

Edit

Sort By Most Recent

Edna.docx

So usually starting with that and then like teaching mm-hmm <affirmative> so kind of usually an intro piece, I guess I would say.

Frontloading

George.docx

I guess I pre-teaching some of the concepts that we're gonna be covering, so it allows them to know some of, especially some of those academic languages that our kids don't have yet.

Frontloading

George.docx

So, and I know that a lot of 'em do use it for like rewards for early finishers that are done with everything they go, all right, now you go ahead and hop on Khan academy and learn about what we're gonna be learning about in the future mm-hmm <affirmative> and those instructional videos are also extremely helpful as well.

Frontloading

Figure 4.2 Frontloading as a Structured Code in Delve

Second Cycle of Coding

A second cycle of coding was conducted to review first cycle codes for links that could allow for codes to be merged or for codes to become categories and categories to themes. The goal of this cycle was to combine codes into categories and subcategories

which would then become themes (Saldana, 2016). The nesting feature within the Delve software was used to combine codes. Pattern coding was used to group similar codes (Saldana, 2016). As codes were grouped, categories and subcategories began to emerge. It remained clear that there was a marked difference between instruction during Covid distance learning and hybrid learning compared to instruction since school returned to in person.

During the second cycle of coding, codes were moved into categories that showed the impact of Covid-19 school closures. When teachers referred to the use of instructional videos during school closures and hybrid learning, codes like *helped during school closure*, *district support*, *technology support*, *grown-up support* became the categories *Covid support*, *equipped with technology*, and *equipped with internet access*. Teachers found that instructional videos really helped them to engage students in online learning. A review of the snippets in Delve related to these codes led to the creation of the following categories: *helped during Covid-19* and *equipped with tech*. Figure 4.3 which shows the descriptions of the categories and codes as well as the frequency of codes in the data analyzed in Delve.

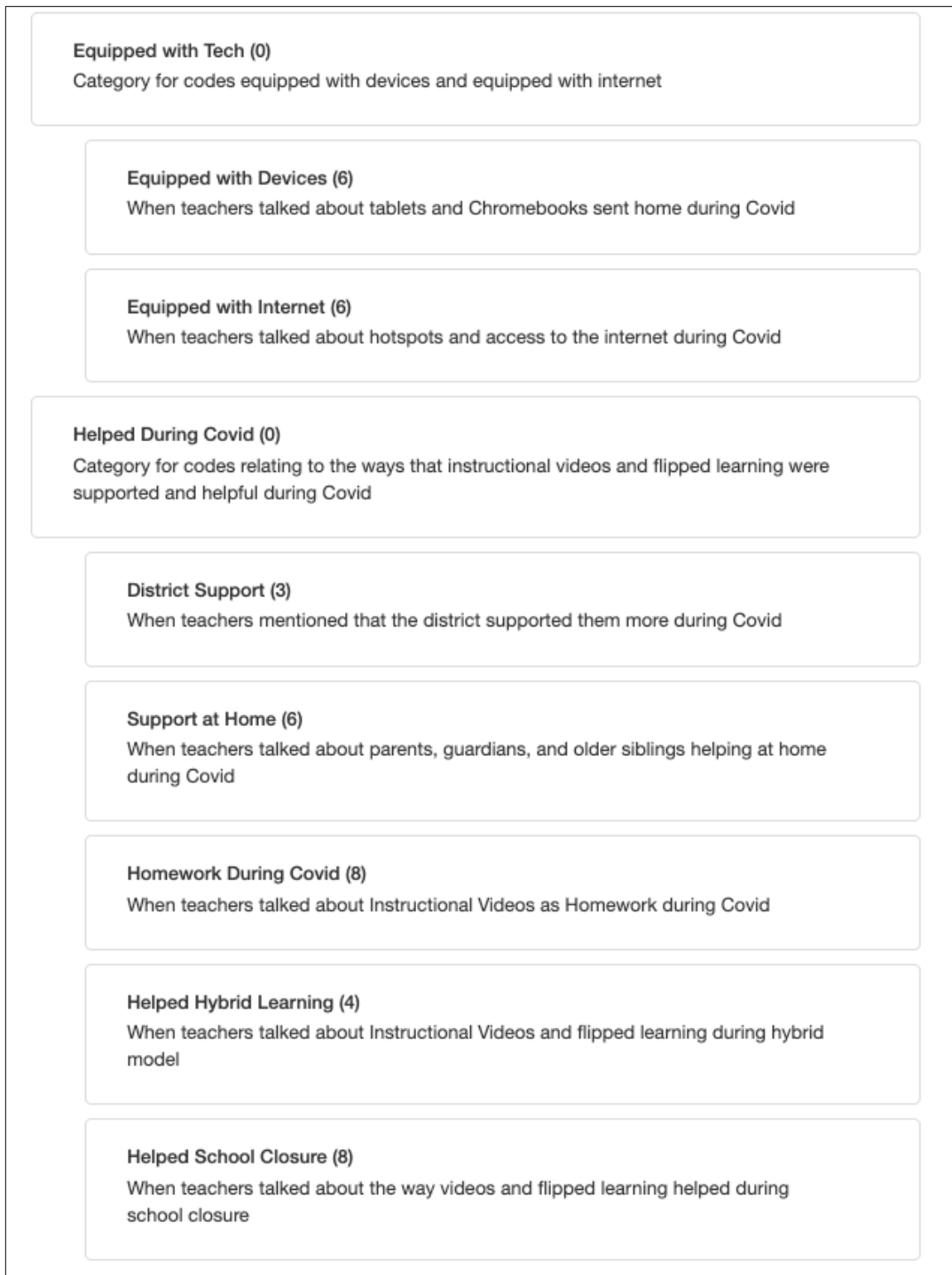


Figure 4.3 Descriptions of Categories and Codes in Delve

The codes that emerged later become categories that combined to make the second theme, contrasted with the codes that emerged when teachers referred to their

current situation and the use of instructional videos and flipped learning. Codes like *lack motivation, passive learning, no devices, no internet, no district support, and accountability* became the categories *need technology at home, and need study skills*.

Figure 4.4 shows the codes and categories as well as the descriptions used to identify the codes.

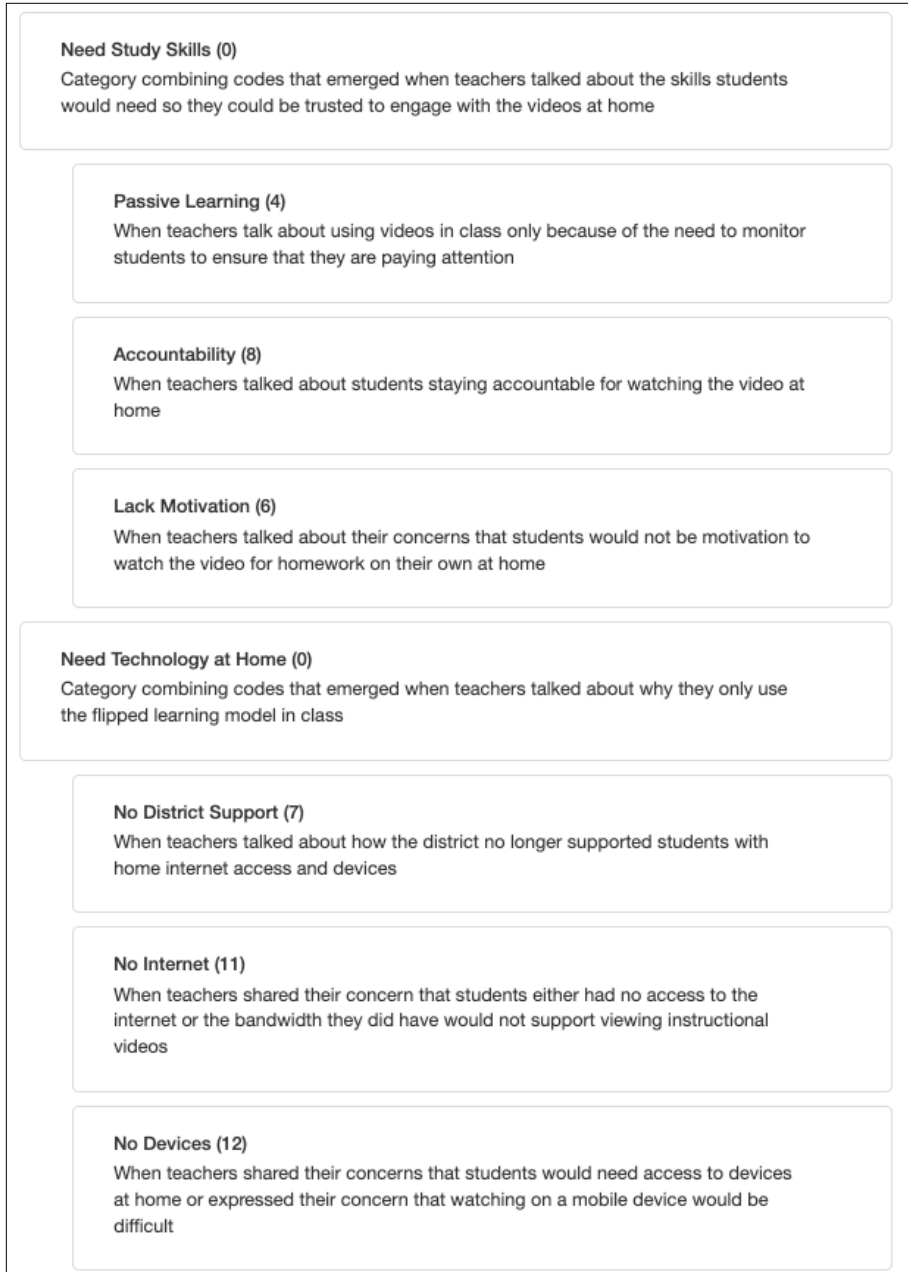


Figure 4.4 Descriptions of Categories and Codes in Delve

Pattern coding (Saldana, 2016) also helped to see trends in the data that overall teachers had a positive perspective of instructional videos and flipped learning. Codes like *could free up time*, *great idea*, *frontloading*, *reteach*, *increase collaboration*, and *successful when tech provided* emerged. After reviewing the snippets related to these codes, the categories *valuable* was used to group these codes. Figure 4.5 shows the way these came together in Delve.

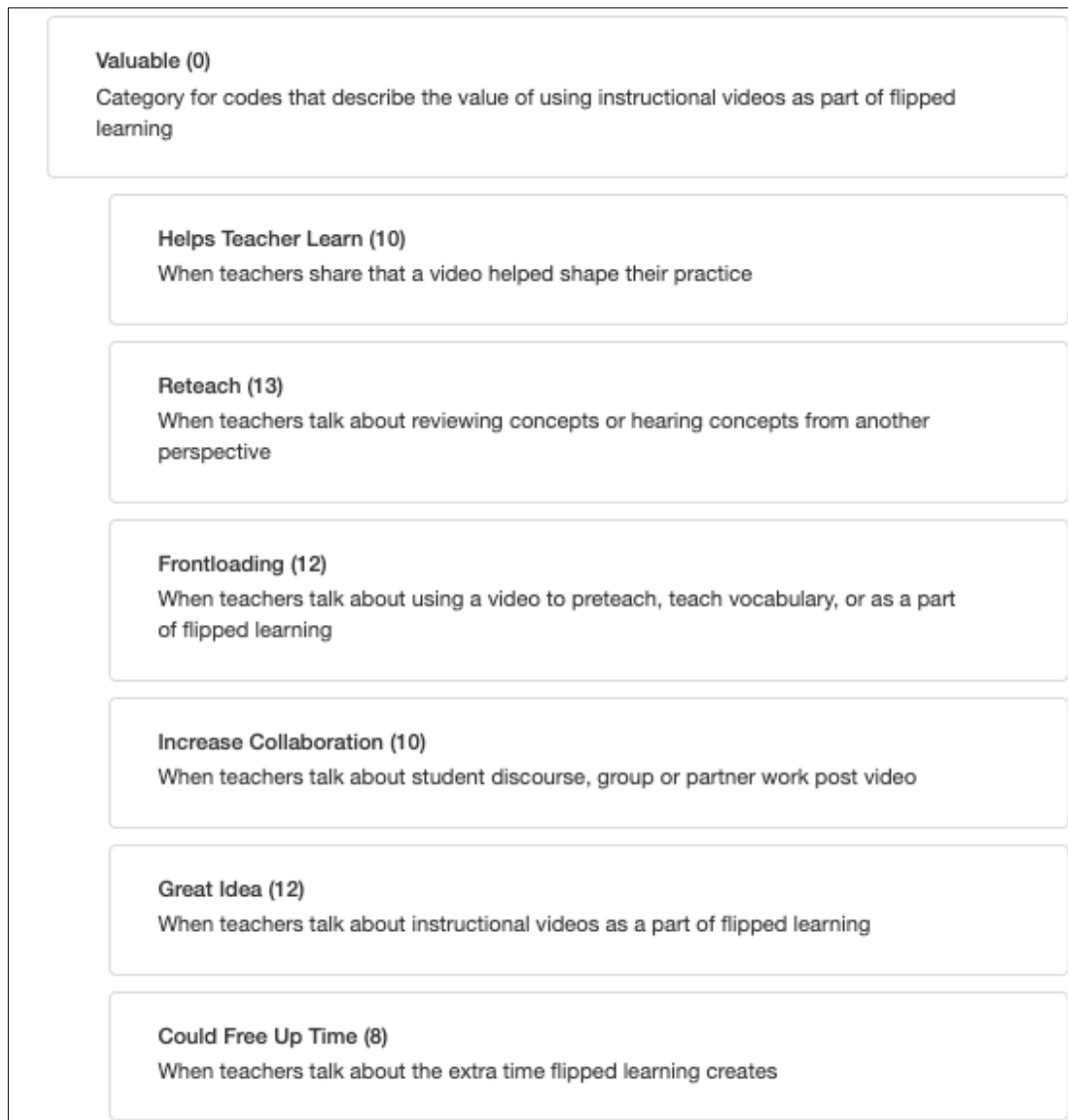


Figure 4.5 Descriptions of Codes in Delve for the Category Valuable

The code *kids capable* came about as the number of times that teachers expressed their beliefs that their students were capable were considered. In addition to this, the code *willingness to try* was used when teachers expressed confidence in their abilities to teach using this model. Figure 4.6 shows how these codes came together to make the category *doable* as these codes led to the idea that using instructional videos as part of a flipped learning model would be doable.

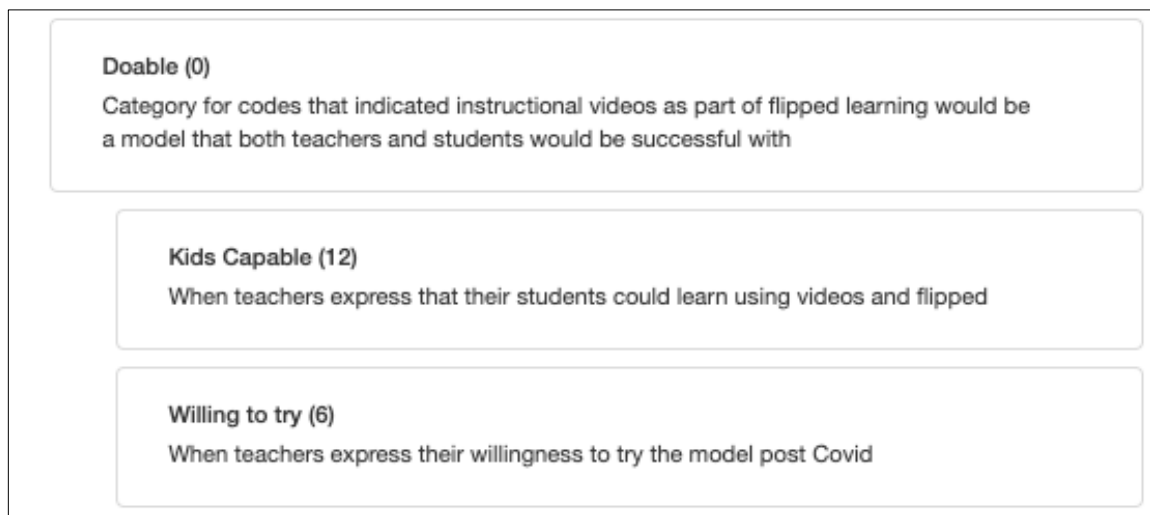


Figure 4.6 Descriptions of Codes in Delve for the Category Doable

Teachers' responses to questions focused on their predictions for future use of instructional videos for flipped learning led to the codes: *kids love videos*, *engaging*, *higher test scores*, *going to use*, and *would continue*. The codes were organized into the categories *plan to use* and *effective*. The category *effective* emerged as teachers discussed why they would be open to using instructional videos as part of flipped learning in the future. The category *plan to use* emerged as teachers talked about their future plans to use or continue using. Figure 4.7 provides insight into how these codes and categories emerged.

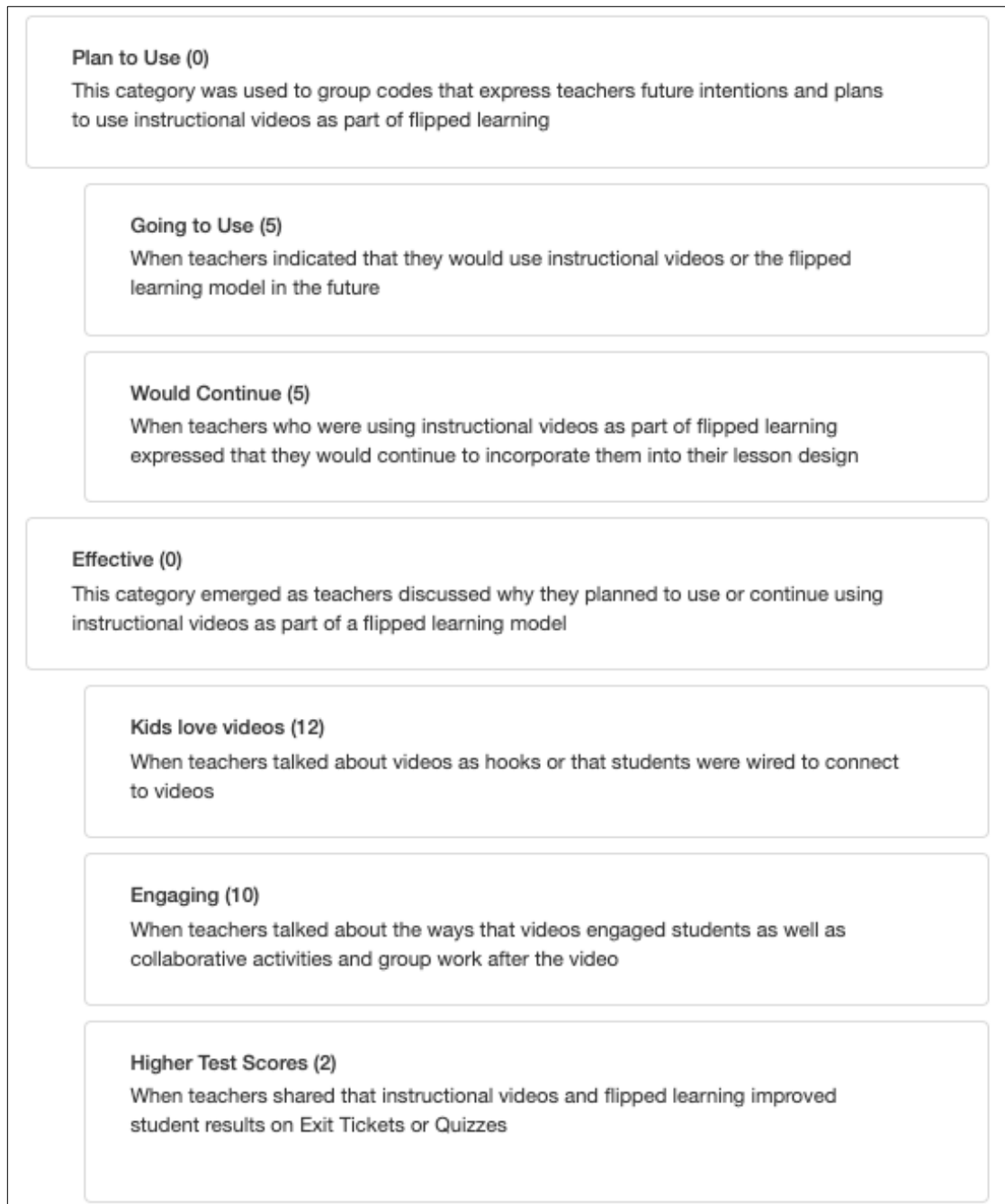


Figure 4.7 Descriptions of Categories and Codes in Delve

In the second cycle of coding, it also became clear that a number of codes could be linked to the idea that teachers need support to be successful. The categories *support at home*, *support from colleagues*, and *support from administrators* emerged. Figure 4.8 shows how the categories emerged from codes through the data analysis cycles.

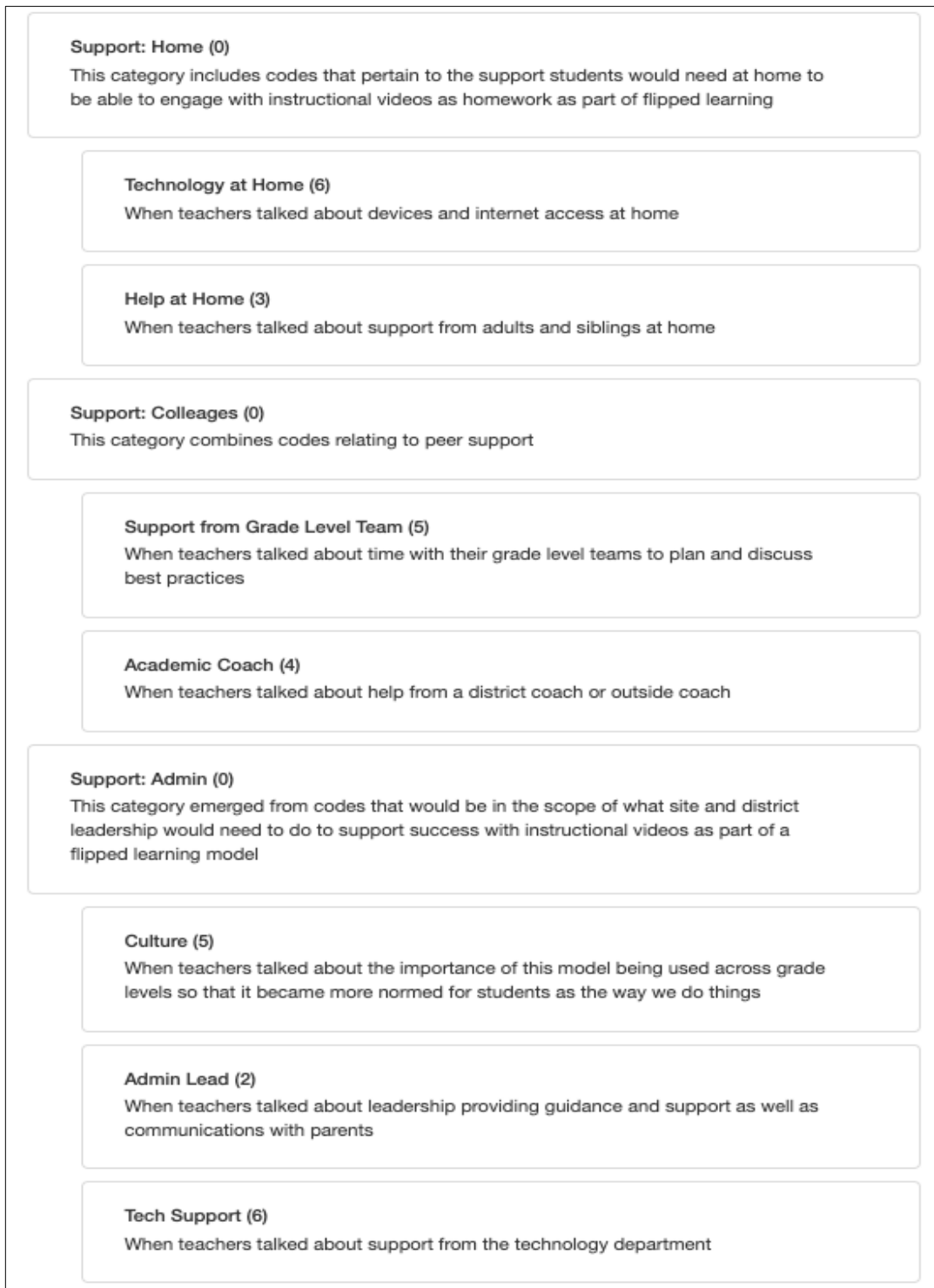


Figure 4.8 Descriptions of Category and Codes in Delve

The second cycle of coding also revealed that teachers would need specific conditions met to feel supported and successful using instructional videos as part of a flipped learning model for mathematics instruction. The following categories were developed after the merging of similar codes to show that *quality video*, *accessible*, *aligned*, and *professional development* were conditions that teachers identified. Figure 4.9 shows the descriptions of the codes that were grouped to become the category *quality video*.

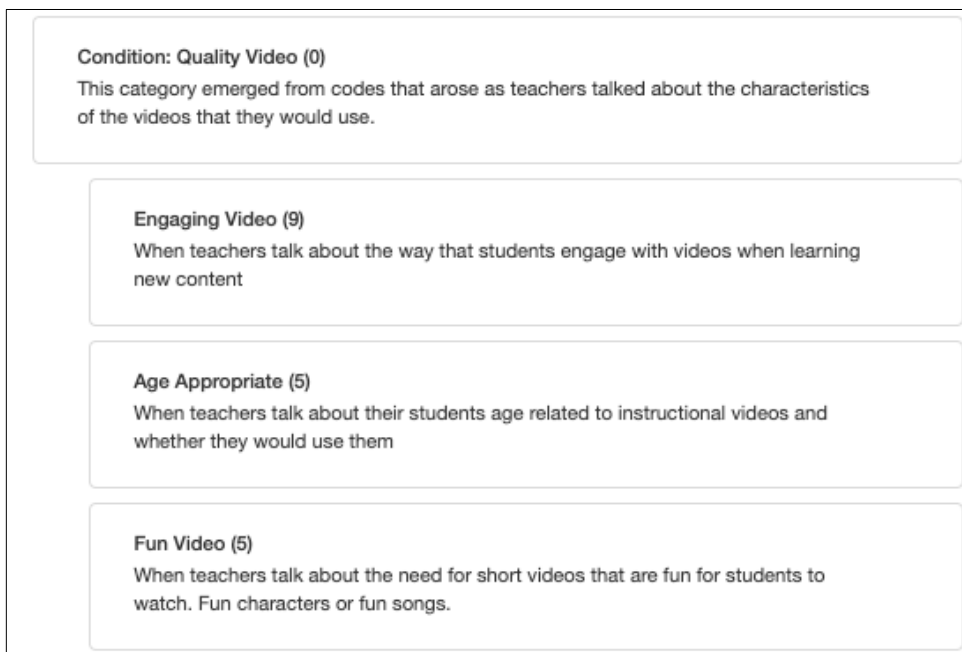


Figure 4.9 Descriptions of Codes in Delve for the Category Quality Video

The code *quick access* was combined with the code *convenient* after a review of the snippets in Delve revealed similarities in the statements. When these codes were linked teachers were talking about the time it would take to plan activities and locate effective instructional videos. The code *easy access* was merged with the code *available* since these two were used when teachers talked about the availability of videos and how

some required subscriptions and enrolling students through Clever. Figure 4.10 shows how the codes were nested under the category *accessible* in Delve.

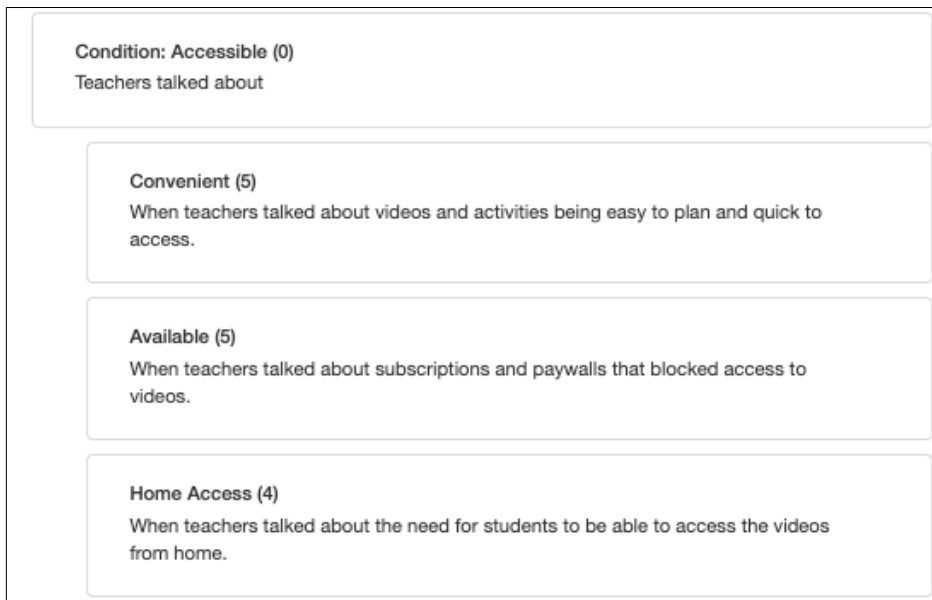


Figure 4.10 Descriptions of Codes in Delve for the Category Accessible

There were also codes that emerged relating to the importance of videos that matched the way the mathematics content was taught in both the standards and the curriculum. The codes *aligned to curriculum* and *aligned to standards* emerged. Figure 4.11 shows the way these codes were defined and grouped to create the category *aligned*.

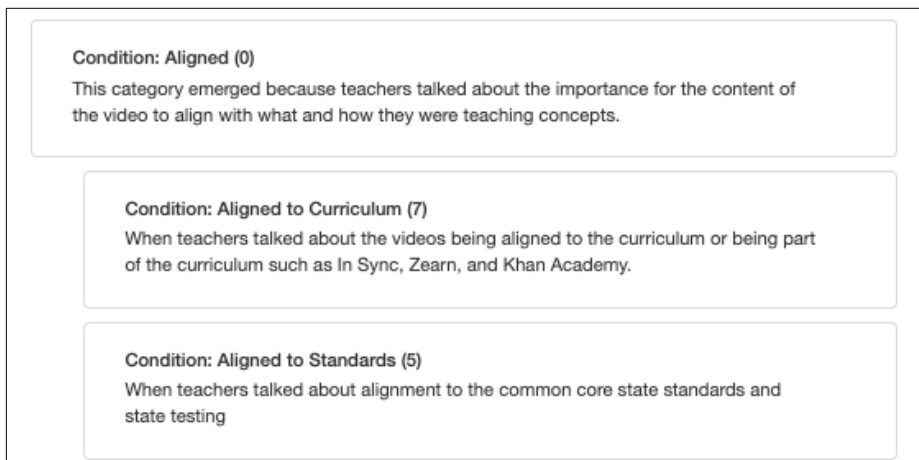


Figure 4.11 Descriptions of Codes in Delve for the Category Aligned

Another set of codes that emerged in the second cycle of coding centered on teachers expressed need for some type of professional learning related to the use of instructional videos as part of flipped learning for mathematics instruction. The codes *feedback*, *training*, and *modeling* were linked to participant answers across transcripts. Figure 4.12 shows how these codes were grouped to create the category *professional development*.

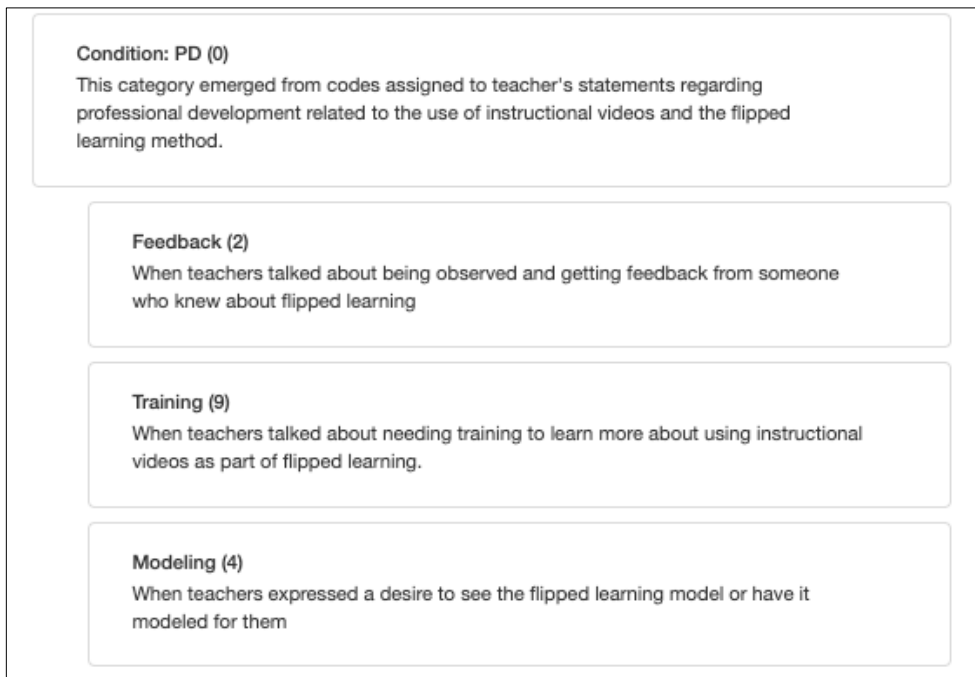


Figure 4.12 Descriptions of Codes in Delve for the Category Professional Development

Another example of this is that codes related to various challenges that teachers anticipated were grouped. Four codes were combined under the subcategory *student challenges*, four codes under the subcategory *teacher challenges*, and six codes under the subcategory *technology challenges*. The categories *management challenges* and *technology challenges* and emerged. Figure 4.13 shows the way these codes were organized into individual categories.

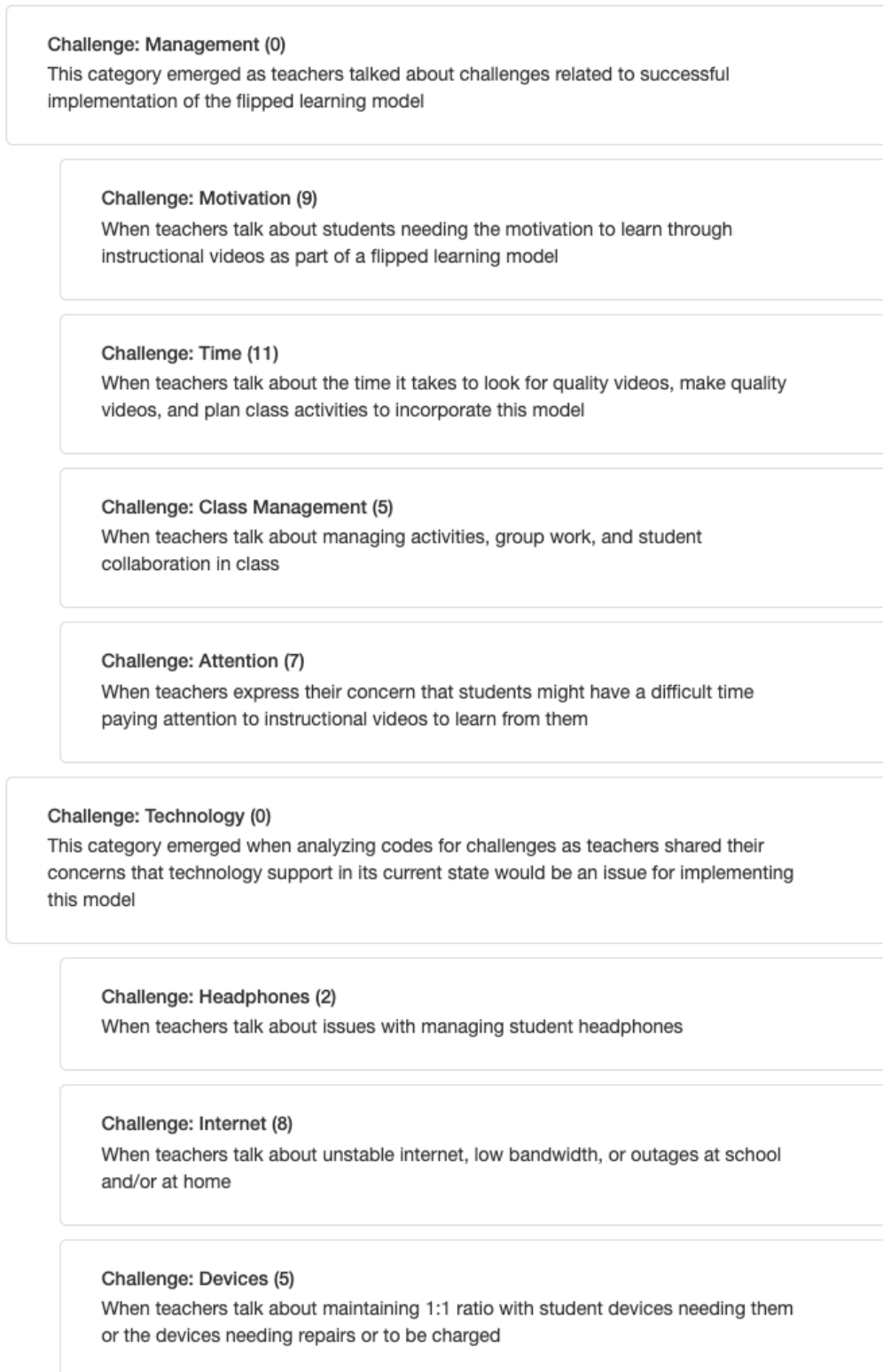


Figure 4.13 Descriptions of Categories and Codes in Delve

Peer Debriefing

Multiple cycles of feedback occurred throughout the research process. Peer review (Mertler, 2019) was conducted with the help of my dissertation chair and feedback received from my dissertation committee. My dissertation chair helped me to refine the description and flow of my qualitative analysis. Through cycles of feedback and iteration my dissertation chair helped me define the categories and the way the codes related to them so that I was better able to make sense of the themes that emerged.

The feedback I received from the committee was applied to reconsider codes, categories, and themes to eliminate redundancy. For example, the codes *part of school culture* and *systemwide* were combined because they were similar and referenced the same responses. A committee member expressed that the category *willing to try* was very similar to the category *doable*. A review of the snippets caused me to make *willing to try* a code that was grouped with the category *doable* rather than a category on its own. Through rounds of feedback and suggestions from my dissertation chair and committee members, qualitative themes, categories, and codes were reconsidered, revised, and realigned.

Identifying Themes

In each cycle of coding, an inductive analysis was performed to gain a better understanding of teachers' attitudes and intentions towards the use of instructional videos as part of a flipped learning model for mathematics instruction. An inductive approach to qualitative analysis allows a researcher to determine themes based on their interpretation of the trends in the data (Creswell & Clark, 2011). To identify themes in the data, raw

codes were organized and condensed to generate categories which led to the development of themes.

After an initial review of the transcripts, Delve was used to support the initial analysis. The Delve tool allows researchers to link codes directly to transcripts and has features that allow for nesting and filtering by code to see responses. The codes and snippets generated by Delve were exported into Microsoft Excel® where categories were analyzed to generate themes. See Table 4.10 for the themes that were identified, the categories and codes they were generated from, and quotes taken from the transcripts.

Table 4.10. Themes, Categories, Codes, and Quotes

Theme	Categories	Codes	Quotes
School closures during Covid 19 shifted teachers attitudes towards instructional videos and flipped learning. (RQ1)	<ul style="list-style-type: none"> • Helped During Covid • Equipped with Tech 	<ul style="list-style-type: none"> • Helped School Closure • Helped Hybrid Learning • Homework during Covid • District Support • Support at home • Equipped with internet access • Equipped with devices 	<ul style="list-style-type: none"> • Claire: My experience with this started after the Covid period when we had to go completely a hundred percent digital. • Edna: It was helpful during the pandemic. • Helen: I assigned when we were teaching online. Each household has a Wi-Fi connection and a device for each kid in the home.
Videos and flipped learning in class only post Covid. (RQ1)	<ul style="list-style-type: none"> • Need technology at home • Need study skills 	<ul style="list-style-type: none"> • Lack Motivation • Passive Learning • No Devices • No internet • Accountability • No District Support 	<ul style="list-style-type: none"> • Dan: If they don't have internet access at home, they can't do it. • Helen: Are you going to watch the whole thing and listen carefully? • George: If they're not motivated to learn, they're not going to be able to learn that way.

Theme	Categories	Codes	Quotes
			<ul style="list-style-type: none"> Edna: For that student that is not focusing, it can be a very passive time.
Positive attitudes towards instructional videos as a part of flipped learning. (RQ1)	<ul style="list-style-type: none"> Valuable Doable 	<ul style="list-style-type: none"> Could free up time Great idea Frontloading Reteach Increase collaboration Successful when tech provided Kids capable Willing to try Helps Teacher Learn 	<ul style="list-style-type: none"> Helen: You could free up more time to actually practice the skill. Fran: I think it's a great idea. The more they get to talk, the happier they are. Edna: I think it would be 100 percent positive for five-year olds. Ava: When we sent tablets home, it was great. I could see value in parts of the day being flipped learning.
Teachers predict future use of instructional videos for flipped learning. (RQ2)	<ul style="list-style-type: none"> Effective Plan to use 	<ul style="list-style-type: none"> Kids love videos Higher Scores Engaging Would continue Going to use them 	<ul style="list-style-type: none"> Helen: I would just continue using. George: I'm going to continue using them. Claire: So my experience is when we have short videos, they're glued to them, it gives a foundation to start from... and it's very effective. Dan: I could just stick one or two videos as homework.
Support from colleagues, administration, and adults at home is needed for flipped	<ul style="list-style-type: none"> Support from admin Support from colleagues Support from home 	<ul style="list-style-type: none"> Tech support Academic coaches Administrators lead Help at home Support from grade level team Culture 	<ul style="list-style-type: none"> Helen: Well if we were totally a hundred percent flipped, then we would need a lot of technology support, administrative support, just like it was when the school was shut down.

Theme	Categories	Codes	Quotes
learning. (RQ3)			<ul style="list-style-type: none"> • Betty: When it's been shared with me, I use it. My team has to teach me. • Dan: It has to be a bigger cultural thing within. Even a district wide kind of level. • Fran: I think if we started it at upper grades and saw it work then, then we push it, you know to K-2 as time goes on and we get better at it.
Conditions need to be met for teachers to feel successful. (RQ 3)	<ul style="list-style-type: none"> • Quality Video • Easily Accessible • Aligned to Standards and Curriculum • Professional Development 	<ul style="list-style-type: none"> • Fun video • Quality Video • Age Appropriate • Home Access • Aligned to Curriculum • Aligned to Standards • Convenient • Available • Training • Modeling • Feedback 	<ul style="list-style-type: none"> • Ava: It needs to be fun to watch. The person doing it needs to be funny to a degree. And I would need it to be already set with what the curriculum is. • Betty: The easier it is, the more likely I would be to use things. If they were user friendly, accessible and it was basic. • Edna: Having somewhere to go, a trusted resource, or maybe if it aligned with the curriculum. • Fran: I think it would take a little more training on my part. • Ava: And I'd need some training. I'd need, you know to read something, then to see it.
Challenges with	<ul style="list-style-type: none"> • Technology Challenges 	<ul style="list-style-type: none"> • Home Internet • Home Devices 	<ul style="list-style-type: none"> • Ava: I see classroom control being an issue.

Theme	Categories	Codes	Quotes
instructional videos for flipped learning are anticipated. (RQ 4)	<ul style="list-style-type: none"> • Management Challenges 	<ul style="list-style-type: none"> • Headphones • Motivation • Attention • Class Management • Time management 	<ul style="list-style-type: none"> • George: So that's been the challenge, I'm like we're trying to help you by showing you these videos and you're not paying attention to them. • Helen: I think that now in this situation we're in, not all kids have access to internet and technology at home that's reliable.

Themes

Themes began to emerge throughout the first and second cycle of coding that provided some clarity around teachers' attitudes and beliefs towards the use of instructional videos as part of a flipped learning model for mathematics instruction. There were common threads that also helped get a better idea of supports that teachers would need to be successful with this model as well as anticipated challenges. This section will expand on the themes that emerged as they relate to the research questions.

RQ 1: Teachers' Attitudes

Theme 1: School Closures During Covid-19 Shifted Teachers' Attitudes Towards Instructional Videos and Flipped Learning. The first four prompts and questions that teachers were asked to respond to during the one-on-one interviews were designed to determine teachers attitudes towards the use of instructional videos as part of a flipped learning model. When discussing their experience with instructional videos, six of the eight teachers referred to a shift towards using instructional videos more often because of school closures and the hybrid model upon reopening. Ava shared:

I think that, especially last year, I used them mostly for math. I know last year because of being online, they were much more useful, and it was something that I could pose, for students to watch when we weren't in live class or just for homework. I really liked them, especially when the students were at home for parents as well.

Along these lines, Claire stated "My experience with this started after the Covid period when we had to go completely one hundred percent digital." Results also showed that teachers used instructional videos as assigned homework during school closures. For example, Helen shared "I did when we were teaching online." Similarly, Ava said "I kind of see using videos as homework and home learning kind of as a little branch off of what distance learning was."

Helped during Covid-19. The circumstances surrounding the Covid-19 school closures including funding and district support allowed for each student to be equipped with their own device as well as an internet hotspot so that instructional videos were accessible at home allowing teachers to maximize their use. Teachers expressed that these supports were in place during the school closures and throughout the hybrid learning during the 2020-2021 school year. The category emerged from the codes *district support, support at home, homework during Covid, helped hybrid learning, helped school closure*. Ava shared "I had very good success with it during distance learning, with parents support, I didn't have an issue." Others also indicated that parent support and district support during school closures helped them to use this model more effectively.

George shared that he no longer uses instructional videos for homework because students don't have the access to computers like they did during school closures saying "I

used them for homework when we were distance learning, but right now I don't use them for homework because most of them don't have access to a computer at home.”

Similarly, Edna stated “I didn't use them as much for homework this year.”

Equipped with tech. Teachers were provided the technology to support students during school closures. Poly Studio video bars were available to teachers, additional monitors, as well as training and support. Students were also supported with devices. K-2 students were provided tablets and 3rd – 8th grade students were given Chromebooks to use at home. If students were part of the hybrid return models, they were allowed to bring their devices to and from school. When asked about using instructional videos for homework as part of flipped learning Claire responded “I mean, that was their home assignment, to be on Seesaw and do the videos at home because they all had their own tablet.”

During the Covid school closures and hybrid learning models, the district also ensured that all students would have internet access. The district provided hotspots for families that did not have home access to internet. Students were able to connect to live class sessions as well as access assignments through the Google Classroom platform for 3rd through 8th grade and through Seesaw for Kindergarten through 2nd grade. Teachers' descriptions were coded as *equipped with internet* and *equipped with devices*. Dan shared that he only uses instructional videos in class this year because he isn't sure if students have access to the internet at home. He stated “I use them in class, especially this year, because I don't know if they have internet at home to make it homework.” Helen shared that during Covid “Each household had a WiFi connection and a device for each child in

the home.” These supports allowed them to successfully use instructional videos as part of flipped learning during distance and hybrid learning.

Theme 2: Videos and Flipped Learning in Class Only Post Covid. This theme arose as simultaneous codes were generated from the responses to the four interview questions discussed in the previous theme. Although teachers favored the use of instructional videos as part of a flipped learning model where students would watch the video at home prior to class, this sentiment did not carry over into the instructional models in place post Covid. When asked whether instructional videos as part of flipped learning were used in class or for homework, Betty immediately responded “Oh, in class!” and made a face that I interpreted as disgust. A follow up question was asked about her emotional response. Betty responded “Why the heck would you give something like that for homework? Why? They don’t need homework. They need to be kids.” Other responses allowed me to determine that videos as part of a flipped learning model were only being used in class. Most of these referenced issues with technology and devices at home now that the district was no longer ensuring access for all families.

Need technology at home. Since the return to regular in person learning, not all students have the technology they need at home to access and watch instructional videos as part of a flipped learning model. The codes *no district support*, *no internet*, and *no devices* emerged as teachers talked about their current level of support and their current use of instructional videos as part of flipped learning. Dan shared “If they don’t have internet at home, they can’t do it.” Helen replied similarly “So I guess that’s my concern, as far as this demographic, with assigning them videos as homework and things like that, because I don’t know if they would be able to access them.”

Need study skills. This category emerged as teachers discussed that students seem to lack motivation when it comes to completing homework assignments in general. This sentiment was cited multiple times and became the code *lack motivation* to describe one of the reasons teachers preferred to use instructional videos and flipped learning in class rather than having students watch a video for homework the night before and come prepared for discussion and collaboration. George expressed concern by saying “If they’re not motivated to learn, they’re not going to be able to learn that way.”

When teachers talked about motivation, they often also talked about being able to hold students accountable while they are in class which became the code *accountability*. Fran expressed that to use instructional videos as homework now that students are in class every day, that she would need some way to know they were watching it. She said “I would say one thing would be accountability. Because unless there’s something to turn in at the end of the video it would be hard to know.”

Passive learning became a code that described teachers’ thoughts regarding students watching the videos but not really engaging with them to learn. Others across grade levels shared in this sentiment. Edna had shared that video hooked students but as she considered her current practice with instructional videos and flipped learning, she shared “So as much as it can be an attention grabber, for that student that is not focusing it can be a really passive time.” In a later statement, that was coded for both *passive learning* and *accountability* Edna said “So maybe not being interested and then if you are using it in that time where it’s like, oh, okay, like you should have watched it on Google classroom, ensuring that it happened.”

Listening to teachers and analyzing their responses helped to get a better understanding of their willingness to use instructional videos as part of flipped learning in class only given the current constraints. These codes and categories led to the creation of this theme because it became clear that Covid-19 was the impetus for many to use instructional videos as part of flipped learning for mathematics as evidenced by the codes and categories in the first theme. However, since returning to in person instruction teachers shared that they had continued using a form of the model but that instructional videos were shown in class rather than as homework.

Theme 3: Positive attitudes towards instructional videos as a part of flipped learning. Although only two teachers shared that they had used instructional videos as part of a flipped learning model post Covid, seven of the eight teachers interviewed responded favorably to the idea of using instructional videos as part of flipped learning. Helen said “You could free up more time to actually practice the skill.” While Fran stated “I think it’s a great idea. The more they get to talk [in class] the happier they are.”

Valuable. Teachers expressed that they could see value in using instructional videos to flip learning for multiple aspects of both teaching and learning. *Helps teacher learn* was coded ten times throughout transcripts as teachers talked about how using instructional videos improved their teaching. Ava, a veteran teacher shared “I can see it being a plus both for the kids and the teachers, you know, the video might show me a whole new way to do something.” Similarly, George discussed the impact of videos on his teaching repertoire stating “Sometimes they [videos] help me see, like, oh, maybe I should just teach it this way instead of the way that I’ve been teaching it.” Edna who will be moving from fifth grade to teach first grade next year said “I need to look at seeing

what first grade would have because with fifth, I was new to this math and so a lot of it, I noticed I was watching those videos for my own learning.”

The code *great idea* was first developed as an in vivo code because teachers used the words great and great idea often as they considered using instructional videos as part of flipped learning. Ava a first-grade teacher, shared “When we sent tablets home, it was great. I could see value in parts of the day being flipped learning.” She also expressed that students “Like to feel like they are in charge of their learning, and they like to teach their peers.” Other similar statements led to the code *increase collaboration*. Many aligned with what Fran shared about students’ ability to preview learning which helps build confidence and increases participation in class. Fran said:

Just coming in the next day, knowing, you know, this is what we’re gonna learn about and they can share out with the class what they got from the video, so that it’s, you know, very collaborative and they can really show off what they’ve learned from that.

Dan shared from experience that “The biggest benefit is they’re ready to try more stuff in general.”

The codes *frontloading* and *reteach* were included in this category as teachers shared the positive effects that videos have as options for previewing and reviewing content to help students learn. Fran shared a statement that is part of the codes for *frontloading* where she talked about using instructional videos “So frontloading a lesson before I actually teach a concept on whatever the skill is for the day with our Eureka Math.” Helen considered using instructional videos for frontloading and reteaching and

shared “Well, I think for any subject, especially math, it’s helpful to hear the concept told from multiple people in multiple voices.”

Doable. Every teacher interviewed felt that although they were not using instructional videos for flipped learning since returning to regular school days post Covid, the model is doable. Teachers across grade levels expressed that they felt that their students would benefit from it and that it would be relatively easy for them to incorporate this model. Fran, a second-grade teacher, also expressed that her students could learn this way, saying “I think it’s doable. I think the teachers would be on board and it would enhance their [students] learning.” Claire talked about her kindergarteners’ abilities to engage with technology and this model and expressed confidence that even the youngest of learners would be capable of engaging with technology this way. She shared:

They come in knowing how to use technology so if we’re not using that technology then we are wasting their valuable time because it’s just not a world where using textbooks and workbooks can accomplish what these kids need to be able to do... technology is the future of what they need to be able to do independently and successfully.

Another category that originally emerged as part of this theme was *willingness to try* but this was later changed to a code and grouped with the code *kids capable* under this category. Teachers who had not used the flipped learning model since returning to a regular school day expressed that they were open to the idea. Helen specifically stated “I’m open to trying new things.” When considering future use of instructional videos and flipped learning Claire affirmed her willingness to try saying “I think it would be a

hundred percent positive for five-year-olds. They need that direct instruction, and the videos help focus their attention.”

RQ2: Teachers’ Intentions

Theme 4: Teachers predict future use of instructional videos for flipped learning. To learn teachers’ perspectives for future or continued use of instructional videos for flipped learning, four of the one-on-one interview questions were designed to gather information. Teachers were prompted to share their future intentions, asked to predict future use of instructional videos for flipped learning, asked how they thought their colleagues would react, as well as how easy they thought it would be to use instructional videos as part of a flipped learning model. Seven teachers responded that they would use instructional videos for flipped learning and one teacher responded that they were not sure because they would need their colleagues to do it first, then teach them.

Effective. In many instances teachers expressed that instructional videos as part of a flipped learning model are effective. Claire shared that she felt her kids were wired for technology. She shared “When we have short videos, they’re glued to them, it gives a foundation to start from and it’s very effective.” Often videos allow teachers to provide students with a visual representation which is very important for grasping concepts in math. Five teachers expressed that videos were effective for teaching students about fractions because videos really help students see the part to whole nature of fractions.

Plan to use or continue. Two teachers shared that they regularly use instructional videos as part of a flipped learning model for mathematics instruction. When asked about

future use, Dan said “I could just stick one or two videos as homework.” While George stated with certainty “I would just continue using them.”

Teachers that had not engaged students with instructional videos as part of flipped learning since the Covid-19 school closures also shared that they could see themselves using this model in the future. When asked about future intentions, Fran stated “I think I could. I think the hook for kids is that’s where they want to be, on a computer.” Helen said “I would love to.” And Edna responded “I think it could be very useful.” Statements like these showed that teachers could see themselves using instructional videos as part of a flipped learning model in the future.

RQ 3: Supports Needed for Success

Theme 5: Support from colleagues, administration, and adults at home is needed for flipped learning. This theme began to emerge in reviewing the transcripts as teachers shared about times that they experienced success with the use of instructional videos for mathematics instruction. Teachers were also asked what type of assistance or support would be needed to incorporate the flipped learning model. Three types of support that were discussed throughout the interviews became the categories *support from admin*, *support from colleagues* and *support from home*. Teacher responses were fairly aligned as they considered what led to success with the use of instructional videos and what support would be needed to incorporate the flipped learning model.

Support from admin. The technology department as well as school site leaders rely on direction and funding from the district office to make decisions. Teachers often referenced these entities as they considered support, and it was coded *administrators lead*. Helen’s words capture this insight “Well if we were totally one hundred percent

flipped, then we would need a lot of technology support, administrative support, just like it was when the school shut down.” Another aspect of leadership is to create a culture and systems so that students’ learning experiences are coherent across grade levels (Muhammad & Cruz, 2019). When teachers talked about the need to use the flipped learning model across grade levels it was initially coded *system wide* and *school culture* which were combined into the code *culture* since they described the same phenomena. Helen talked about this as she considered moving forward with flipped learning “So that would be more extensive, less, you know, rogue teacher doing their thing.” Dan considered the impact on students and said:

I don’t know that it would work very well on a school level unless it was maybe in elementary school. To start it at middle school is difficult because then they’ve built their habits already about well, homework is the night after, not the night before.

Support from colleagues. All eight teachers shared that they felt their colleagues would be supportive of efforts to use instructional videos as part of flipped learning for mathematics instruction. Teachers felt that support from their grade level colleagues would be imperative to shifting their current instruction towards the use of this model. Statements related to this category were linked to the codes *support from grade level colleagues* and *academic coach*. Helen shared “It would be good to have colleagues to work with and discuss that with or even an academic coach.” Helen wasn’t sure if her colleagues would really want to, but Betty felt that hers would so she said “I would need planning with my team, time to plan with my team.”

Support from home. When considering the use of instructional videos as part of a flipped learning model, all teachers were clear that students would need support at home to be successful. Responses included many factors from support from grown-ups to support with technology as far as access to internet and devices at home. Helen said “That could be a benefit too, is that they’re watching the video and potentially their parent or they’re grown up is able to support them.” In an earlier statement she said “Each household has a Wi-Fi connection and a device for each child in the home.” Fran expressed similar concerns “If they don’t have internet in the household, making sure they have some kind of hotspot or something like that.”

Theme 6: Conditions need to be met for teachers to feel successful. Given that six of the eight teachers interviewed were considering the use of flipped learning outside of the realm of Covid-19 school closures and hybrid learning for the first time. This theme came from asking teachers to consider what type of assistance or support would be needed to integrate instructional videos into their lesson design as well as to use the flipped learning model. Teachers responded with conditions that videos would need to be fun and engaging for students as well as easily accessed and aligned to the curriculum. They talked about needing to trust the source and that it would be important to be able to easily access them both at school and at home. They also talked about wanting training as well as wanting to see it modeled.

Quality video. Teachers shared that the videos need to be developmentally appropriate and engaging. In addition to being fun to watch, videos would need to be able to keep students’ attention by being designed to convey content concisely. The codes *engaging video*, *age appropriate*, and *fun video* together led to the category for the types

of videos that teachers anticipate using. Ava spoke to this as she considered her first-grade students “Generally, if they’re short and kind of precise, concise, the kids will be able to stick with it too.” Fran shared that “They [videos] are not so like for little kids, sometimes they’re too sing-songy, too babyish.” She was referring to a need for videos that are age appropriate.

Accessible. There are many factors that teachers discussed that would make videos easy to access. They talked about having a video library for themselves as well as the ability to make the videos easy to access for students by sharing them through a learning management platform like Seesaw or Google Classroom. The codes *convenient*, *available*, and *home access* began to form a clear picture that instructional videos would need to be *accessible* to teachers in the classroom as well as to students at home. Betty spoke to *convenience* and *accessibility* saying “The easier it is, the more likely I would be to use things. If they were user friendly, accessible, and basic.”

Teachers also talked about the importance of students being able to access the videos at home. George addressed this condition saying “What would be helpful is having kids having access at home where they’re able to actually watch them at home.” Others talked about how it would be hard to assign videos for homework when they really couldn’t be sure if students would be able to access them. Helen also talked about the reality that she knew some of her students face at home that would be a barrier to accessing the video and watching it for homework. She said “Well, the technology challenge, access to Wi-Fi at home. Also like a non-chaotic environment... I think a lot of kids are helping take care of the younger ones that are in the home.”

Aligned. There are many videos that teachers can access on the internet. However, not all video offers instruction that is aligned to the state standards and the mathematics curriculum that is being utilized by the district. The codes *aligned to the curriculum* and *aligned to standards* were linked to statements where teachers emphasized that to use instructional videos as part of flipped learning, they would need to align with the content they are teaching. George talked about this as it related to fifth grade standards. Fifth grade standards no longer require students to simplify fractions but some of the videos he has used in the past direct students using this language. That can be confusing for students. Edna shared similar experiences and talked about how it takes time to find good videos. She said “I think having a resource that is trusted, because YouTube is great, but that takes a lot of time searching.” George also talked about how it is important to be certain the videos that he uses are aligned to the curriculum so that students do not get confused. He said “They’re not always necessarily aligned to our curriculum, unless, I mean if you’re certain, yes, those are gonna be directly aligned.”

Professional development. All teachers expressed that they would need some type of professional development. Some felt that reading about it would help, but all teachers felt that training, modeling, or coaching would be needed for them to feel successful. Fran expressed “I think it would take a little more training on my part.” Even George who has implemented the model said “I probably need some more training to know how it would look successfully.” Betty expressed a need for ongoing professional development that would consist of seeing flipped learning modelled as well as receiving feedback after trying it. She stated these conditions “To see it used consistently by someone else. To be able to go in and watch multiple times and then maybe get some

feedback after I've tried it and have that person come in and see how I'm doing and give me some feedback." Every teacher expressed that some form of professional development would be something that they would need to feel confident with their use of instructional videos as part of a flipped learning model.

RQ 4: Anticipated Challenges

Theme 7: Challenges with instructional videos for flipped learning are anticipated. Teachers cited everything from classroom management to motivation to issues with technology as they responded to questions relating to the potential challenges associated with the use of instructional videos and flipped learning for mathematics instruction. The categories *technology challenges* and *management challenges* emerged as two clear types of challenges that teachers anticipated.

Technology challenges. Every teacher mentioned some type of anticipated issue with technology. From internet connections, to devices, to issues with headphones. One teacher pointed to her own lack of skills when it comes to using instructional technology. The biggest challenge with using instructional videos as part of a flipped learning instructional model was student access to technology and devices at home. The codes *headphones, internet, and devices* emerged and were later changed to include *challenge* so that the codes were linked throughout when these elements came up as part of teachers' responses to questions that asked them to anticipate challenges. Helen's sentiments were matched by the others when she said "Not all kids have access to internet and technology at home that's reliable."

Management challenges. Classroom management came up as a concern. A review of the codes in the *management challenges* category led me to combine *control*

issues and *classroom management* keeping the name classroom management for the code since the control issues that teachers were referring to had to do with managing students during class. Ava expressed this concern clearly “I see classroom control being an issue.” This statement led to the creation of the code *control issues* which I later combined with *classroom management* since this sentiment carried similar meanings to the description of that code. Helen talked about using a district provided tech tool, Securly, to monitor and manage student Chromebooks “So that means, you know, be watching the Securly that lets me watch their screens.” Classroom management concerns appeared in five different transcripts.

Teachers shared that it would be important to set clear expectations so that students know what to do. It would be important to demonstrate how to learn from videos to participate in class discussions and group work the next day. Some students would even need support with self-regulation skills to make sure that they learned the content from the video and are prepared to participate in class. Dan stated “The biggest challenge is the fact that they’re on their own device and can get distracted somewhere else.” Concerns like this about students’ attention were coded seven times across transcripts.

Another code associated with this category was *time*. Teachers talked about the time that it would take to find good instructional videos as well as the time it would take to plan classroom activities. Edna stated “I have spent time where I watched a ten minute video and I’m like, okay, that’s not gonna work.” Dan specifically talked about prep time saying “But then it’s the prepping for the two and all that other stuff.” The fact that time would be a challenge was coded eleven times.

Triangulation of Quantitative and Qualitative Data

The teacher survey data was compared to the one-on-one interview data for triangulation of the quantitative and qualitative findings. Triangulation between the two sources of data was done to ensure trustworthiness (Mertler, 2020). Which ensures the credibility, transferability, dependability, and confirmability of the analysis of this mixed methods action research study (Mills, 2007). The themes that emerged from the qualitative analysis were compared to the quantitative survey data. Table 4.11 was created to show the alignment between the two sets of data.

Table 4.11. Quantitative and Qualitative Alignment

Themes	Quantitative Evidence	Qualitative Evidence
School closures during Covid 19 shifted teachers attitudes towards instructional videos and flipped learning. (RQ1)	Although survey questions did not directly reference Covid 19, the survey was administered post Covid 19 school restrictions and the results of the perceived usefulness measures were above average with the lowest $M = 3.86$ and the highest $M = 4.09$. The attitude towards using instructional videos and flipped learning scale also had above average means with the lowest $M = 3.90$ and the highest $M = 4.09$.	<ul style="list-style-type: none"> • Claire: My experience with this started after the Covid period when we had to go completely a hundred percent digital. • Edna: It was helpful during the pandemic. • Helen: I assigned when we were teaching online. Each household has a WiFi connection and a device for each kid in the home.
Videos and flipped learning in class only post Covid. (RQ1)	See above	<ul style="list-style-type: none"> • Dan: If they don't have internet access at home, they can't do it. • Helen: Are you going to watch the whole thing and listen carefully? • George: If they're not motivated to learn, they're not going to be able to learn that way. • Edna: For that student that is not focusing, it

Themes	Quantitative Evidence	Qualitative Evidence
Positive attitudes towards instructional videos as a part of flipped learning. (RQ1)	Survey results showed above average means for attitudes towards as well as the perceived usefulness of instructional videos and flipped. The lowest $M = 3.86$ and the highest $M = 4.09$.	<p>can be a very passive time.</p> <ul style="list-style-type: none"> • Helen: You could free up more time to actually practice the skill. • Fran: I think it's a great idea. The more they get to talk, the happier they are. • Edna: I think it would be 100 percent positive for five-year olds. • Ava: When we sent tablets home, it was great. I could see value in parts of the day being flipped learning.
Teachers predict future use of instructional videos for flipped learning. (RQ2)	Survey results showed above average means for intentions towards the use of instructional videos as part of a flipped learning model in the future. With intended use $M = 3.59$, predicted use $M = 3.88$, and an actual plan to use $M = 3.27$.	<ul style="list-style-type: none"> • Helen: I could see myself doing flipped learning. • George: I'm going to continue using them. • Claire: So my experience is when we have short videos, they're glued to them, it gives a foundation to start from... and it's very effective. • Dan: I could just stick one or two videos as homework.
Support from colleagues, administration, and adults at home is needed for flipped learning. (RQ3)	Survey results show above average means in all the supports for success subscales. $M = 3.76$ was the average for support in the form of additional technology. $M = 4.09$ for home support.	<ul style="list-style-type: none"> • Helen: Well if we were totally a hundred percent flipped, then we would need a lot of technology support, administrative support, just like it was when the school was shut down. • Betty: When it's been shared with me, I use it. My team has to teach me.

Themes	Quantitative Evidence	Qualitative Evidence
Conditions need to be met for teachers to feel successful. (RQ 3)	Survey results from the perceptions of flipped learning indicate that there is a need for professional development $M = 3.95$.	<ul style="list-style-type: none"> • Dan: It has to be a bigger cultural thing within. Even a district wide kind of level. • Fran: I think if we started it at upper grades and saw it work then, then we push it, you know to K-2 as time goes on and we get better at it. <hr/> <ul style="list-style-type: none"> • Ava: It needs to be fun to watch. The person doing it needs to be funny to a degree. And I would need it to be already set with what the curriculum is. • Betty: The easier it is, the more likely I would be to use things. If they were user friendly and it was basic. • Edna: Having somewhere to go, a trusted resource, or maybe if it's aligned with the curriculum. • Fran: I think it would take a little more training on my part. • Ava: And I'd need some training. I'd need, you know to read something, then to see it.
Challenges with instructional videos for flipped learning are anticipated. (RQ 4)	Survey results from the perceptions of flipped learning subscale indicate that access to technology at home would be an issue $M = 4.18$. The survey showed $M = 3.67$ for ensuring that students watch the video and $M = 3.83$ that students lack self-regulation skills to	<hr/> <ul style="list-style-type: none"> • Ava: I see classroom control being an issue. • George: So that's been the challenge, I'm like we're trying to help you by showing you these videos and you're not paying attention to them.

Themes	Quantitative Evidence	Qualitative Evidence
	complete video-related tasks at home.	<ul style="list-style-type: none"> • Helen: I think that now in this situation we're in, not all kids have access to internet and technology at home that's reliable.

RQ 1: Teachers' Attitudes

The quantitative data revealed that teachers had positive attitudes towards the use of instructional videos and flipped learning. Four subscales were used to determine teachers' attitudes: (1) perceived usefulness to teaching, (2) attitude, (3) subjective norm, and (4) perception of flipped learning. In each of the scales, all items had above average means. The perceived usefulness to teaching the lowest mean was ($M = 3.86$). On the attitude subscale the lowest mean ($M = 3.90$). The subjective norm scale's lowest mean was ($M = 3.50$) and the perception of flipped learning had the lowest mean ($M = 3.69$).

The qualitative data aligned with these results. Teachers identified many benefits to using instructional videos as part of flipped learning. A review of the value codes generated in the first cycle reveals nine instances where teachers refer to this model of teaching as a good idea for both teaching and learning in mathematics. Teachers also indicated that their favorable view of this model was enhanced during the Covid-19 school closures that forced teachers to adjust instruction to accommodate distance and hybrid learning needs. Assigning students instructional videos became a common mode of teaching during this time.

RQ 2: Teachers' Intentions

The quantitative data showed that teachers predicted future use of instructional videos for flipped learning. The behavioral intention subscale on the teacher survey was

designed to better understand teachers' intentions and predictions for future use. The lowest mean for the items on this scale was above average ($M = 3.27$) revealing that more teachers see themselves as using this model for instruction than those who do not.

The qualitative data confirms these findings. Every teacher responded that they could see themselves using this model at some point in the future. They pointed out that learning through instructional videos is engaging for their students who seem to be wired to learn this way.

RQ 3: Supports for Success

The quantitative data shows that teachers identify a need for support to be successful with this model. There were ten items on the facilitating conditions subscale designed to determine whether teachers felt equipped to use instructional videos as part of a flipped learning model and whether they would benefit from specific supports the district could provide. Teachers indicated that they felt they had the resources they needed ($M = 3.20$) as well as the knowledge necessary ($M = 3.18$) and even access to people who could help ($M = 3.43$) if they needed coaching or support. They felt that they would benefit from professional learning opportunities ($M = 3.95$) as well as additional time to plan ($M = 4.11$). The results on this subscale indicate that teachers feel equipped for success but that they would also benefit from ongoing support through coaching and training as well as time to plan.

The qualitative results corroborate these findings and provide additional information for support that would lead to success. Every teacher talked about the need for additional training and support from colleagues and coaches. They also discussed the

importance of the videos being engaging to students and aligned to the curriculum as well as support with technology.

RQ 4: Challenges Teachers Anticipate

The quantitative data indicates that teachers anticipate challenges with the use of instructional videos as part of flipped learning in mathematics. Items on the perception of flipped learning subscale reveal that access to technology outside of school is the biggest issue ($M = 4.18$) this concern also dominated the qualitative data as well with specific references to devices or reliable internet occurring seventeen times. The time it takes to prepare for this type of instructional model showed ($M = 3.30$) and this was mentioned by two teachers as an anticipated challenge during the interviews as well. Concerns regarding student motivation were also discussed during the interviews and the quantitative data shows ($M = 3.83$) when teachers were asked if students lacked self-regulation skills to complete video related tasks at home.

Chapter Summary

The quantitative and qualitative data collected during this study was presented in this chapter. Quantitative data from the teacher survey was analyzed using descriptive statistics and Cronbach's Alpha was run for each subscale to determine reliability. All scales except for the facilitating conditions scale had a Cronbach's Alpha score of 0.7 or higher ensuring the reliability of the results.

The descriptive statistics for each of the subscales relating to RQ1 showed above average means and the qualitative analysis also revealed that teachers' attitudes towards using instructional videos as part of flipped learning for mathematics instruction was positive. Teachers' responses in both quantitative and qualitative data sets revealed that

they saw the use of instructional videos and flipped learning as an opportunity to increase engagement and support student learning.

Descriptive statistics for RQ2 indicated that teachers intend and predict future use with above average means for each item in the future use scale. The qualitative analysis supports these findings. Teachers responded that they could and would use instructional videos for flipped learning in the future or that they would continue using them.

Descriptive statistics for RQ3 included two subscales. The subscale for facilitating conditions as well as new survey items that were written to support the survey findings and alignment for the question. The facilitating conditions subscale had a Cronbach's alpha of 0.68 which is slightly below the required 0.7 for reliability. The new items written for facilitating conditions had a Cronbach's alpha of 0.83. The qualitative analysis indicated that teachers would need support in key areas of technology and professional development.

Descriptive statistics for RQ4 showed above average means for perceived challenges from access to accountability. These results were supported by qualitative findings that indicated anticipated challenges consisted of challenges with access to technology, classroom management, as well as student attention and motivation challenges.

CHAPTER 5

DISCUSSION, IMPLICATIONS, AND LIMITATIONS

The purpose of this action research was to evaluate and describe mathematics teachers' attitudes and intentions for integrating instructional videos as part of a flipped learning instructional model. Teachers' perspectives regarding supports needed for success and anticipated challenges were also examined. The following research questions were the focus of this study: (1) What are teachers' attitudes towards using instructional videos as part of flipped learning? (2) What are teachers' intentions towards using instructional videos as part of flipped learning? (3) What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics? (4) What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?

Quantitative data from surveys and qualitative data from interviews were triangulated to gain insight into K-8 teachers' attitudes and intentions towards instructional videos as part of a flipped learning model for mathematics instruction. This chapter includes a discussion of the quantitative and qualitative findings as well as the implications and limitations of this study. The chapter is organized into the following three sections: (a) discussion, (b) implications, and (c) limitations of this research.

Discussion

This discussion positions the results of this study within the larger context of research on the use of instructional videos as part of a flipped learning model for mathematics instruction. Literature on the flipped learning model has found that it increases student motivation, engagement, and performance in mathematics (Almasseri & AlHojailan, 2019; Chen et al., 2016; Wei et al., 2020). There were some indications that the participants in this study see these outcomes as plausible.

There are also inherent challenges to this type of instruction especially for teachers who are tasked with the instructional design and delivery (Bergmann & Sams, 2015; Lo & Hew, 2015). The participants in this study were able to identify anticipated challenges that would need to be addressed as well as conditions that would need to be met in order for them to successfully implement this model of instruction.

Teachers may decide to use instructional videos created by others (Zengin, 2017) or create their own (Bergmann & Sams, 2015; de Araujo et al., 2017). The teachers interviewed for this study all indicated that they would use videos made by others with the exception of one. One teacher felt that students would benefit and pay more attention if the teacher created the video. Bergmann & Sams (2015) felt that creating their own videos was imperative for student engagement. The relationship with the teacher helped to motivate students to watch and learn from the videos.

To incorporate the flipped learning model, teachers will also need to adjust their classroom activities since the video will serve as the direct instruction for a lesson (DeLozier & Rhodes, 2017; Granberg, 2016). Because of this, it is important to understand teachers' attitudes and intentions since their beliefs impact decision-making

processes when it comes to integration of instructional technologies (Agyei & Voogt, 2011; Mertala, 2019; Tondeur et al., 2017).

Research Question 1: What are teachers' attitudes towards using instructional videos as part of flipped learning?

This question was crafted to determine teachers' attitudes towards using instructional videos as part of flipped learning. In this study, teachers' attitudes were defined as a factor that can determine behavior (Ajzen & Fishbein, 1977). Previous studies indicate that teachers' positive attitudes towards the use of instructional technology have the same influence on their decision making as experience and knowledge (Agyei & Voogt, 2011; Hughes, 2005).

Quantitative data from the teacher survey and qualitative data from the one-on-one teacher interviews indicate that K-8 teachers at Eagle Elementary and Middle Schools have positive attitudes when it comes to using instructional videos as part of a flipped learning model for mathematics instruction. The survey scale designed to measure teachers' attitudes revealed above average means when asked if they thought using this model: (1) was a good idea ($M = 4.09$), (2) made teaching math more interesting ($M = 3.95$), and (3) was fun ($M = 3.90$). They also responded that they liked using instructional videos to teach mathematics ($M = 4.00$). The results on this subscale can be interpreted as an overall positive view towards instructional videos as part of a flipped learning model for mathematics instruction. Unal and Unal (2021) surveyed middle school teachers using this model with the same subscales and found that their participants also perceived that flipped learning allowed for more time in class to engage students in active learning activities and cover more content.

A review of the interview transcripts from the present study revealed similar findings. Participants associated a variety of positive outcomes with using the flipped model for mathematics instruction. They shared that not only was it engaging for students, but it also freed up class time for practice and collaboration which made it valuable for teaching and learning. Other research has also recognized these benefits adding that not only does collaboration increase, but teachers can use the class time to engage students in problem solving activities or provide remediation if needed (D’addato & Miller, 2016; deAraujo et al., 2017).

It is important to have time in class to engage students with the rigor of the CCSSM and the math practices. The National Council of Teachers of Mathematics (NCTM) suggests that a major shift is imperative to effective instruction, which is, “active student engagement in problem solving, reasoning, communicating, making connections, and using multiple representations” (Martin, 2007, p. 7). Flipped learning allows for more time in class to ensure that students have time to actively engage in practice with these skills.

Research Question 2: What are teachers’ intentions towards using instructional videos as part of flipped learning?

This question was based on Azjen’s (1991) research and theory of planned behavior. The basis for this theory is that a person’s attitude towards a behavior is the degree to which their behavioral intentions can be predicted. Relying on Ajzen’s (1988) work, this study defines intentions as a conative response with respect towards a persons’ attitude to an object or idea. A conative response refers to what people say they plan to do or will do.

A review of the literature regarding teachers' intentions towards instructional technology reveals models and frameworks that have been created to study this phenomenon. One of these models is the technology acceptance model (TAM) created to understand factors that influence users' intentions towards using technology (Ibili et al., 2019; Joo et al., 2018; Pittalis, 2020; Teo et al., 2016). This work influenced the design of the survey and interview questions to gain a better understanding of intentionality by assessing teachers' perceptions of using instructional videos as part of a flipped learning model for mathematics instruction.

Triangulation of the quantitative data from the survey and the qualitative data from the one-on-one interviews revealed that teachers' intentions for future use of instructional videos as part of a flipped learning model are favorable. Teachers who participated in the survey predicted future use ($M = 3.88$) and reported that they intend to use instructional videos as part of flipped learning ($M = 3.59$). Some also indicated that they had an actual plan in place to use this model for mathematics instruction ($M = 3.27$). The means indicate that teachers have an overall positive intention towards the use of instructional video as part of a flipped learning model.

Combining the quantitative results with a review of the qualitative data also reveals that teachers could see themselves using the model successfully in the future. The code *going to use* appeared five times and the code *would continue* also appeared in five times. These codes were never double coded. Existing literature indicates that teachers' perceptions towards instructional technology impacts their technology integration decisions (Heitink et al., 2017).

Research Question 3: What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics?

In education, there are often a variety of initiatives being introduced to improve students' overall performance. Teachers bear the responsibility for seeing them through in their classrooms. Research indicates that teachers must shift their approach and adopt new pedagogy to use technology in a way that maximizes student outcomes (Cennamo et al., 2013; Ertmer & Ottenbreit-Leftwich, 2010). It is important to provide teachers with ongoing support and professional learning opportunities that are content focused and collaborative (Desimone, et al., 2013). This research question was designed to gather teachers' input on the supports they feel would be necessary to integrate instructional videos as part of a flipped learning model for mathematics instruction.

The qualitative analysis of teachers' responses to interview questions showed that there were areas identified for support as well as conditions that would need to be met for the use of instructional videos as part of flipped learning to be a successful instructional endeavor. Support from administrators and colleagues was referenced as well as support with technology. Responses to the survey indicated that teachers believed that the district would support them in these areas ($M = 3.74$).

The qualitative analysis also revealed that the interviewed teachers felt that professional development in the form of training, modeling, and coaching would be important for success with this model in addition to a system wide adoption of the practices so that it becomes part of the culture of learning. The codes *training*, *modeling*, and *coaching* were identified across transcripts and led to the category *professional development*. This aligns with Ertmer's (2005) findings that the opportunity to see

student-centered technology modeled and the social culture within a school's environment are critical to successful integration.

The interesting part about these codes is that not only do they indicate a need for professional development, but also illustrate the need for ongoing support. Participants spoke of training and readings but also modeling and coaching to take place over time. This aligns with what Desimone and colleagues (2013) found. Their research showed that professional learning is enhanced when it is followed by ongoing support that is content focused and collaborative.

Research Question 4: What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?

Studies have shown that teachers' beliefs about technology integration can act as barriers, especially if they anticipate challenges that are difficult to overcome (Tondeur et al., 2017). When deciding whether to implement a new initiative, it is important to understand and anticipate these challenges to ensure that the right supports are available and in place to support success. This research question was designed to determine what challenges teachers anticipate with the use of instructional videos for flipped learning in mathematics since these could have negative implications for future use.

Teachers' responses to the survey and one-on-one interview questions revealed a variety of anticipated challenges with the use of this model for mathematics instruction. Access to technology at home in the forms of reliable internet and working devices was cited most often. The survey showed above average means ($M = 4.18$) when participants were prompted to respond to whether they believe that access to technology at home would be an issue.

Another challenge that teachers discussed during the interview that was corroborated with survey data is student accountability. Interviewed teachers felt that it would be important to ensure that students watch the videos. Participants agreed ($M = 3.67$) that a concern was accountability for students watching the video. Survey data also showed that participants felt that students lack self-regulation skills to complete video related tasks at home ($M = 3.83$). This concern was raised throughout the review of existing literature as well (Abeysekera & Dawson, 2015; deAraujo et al., 2017; DeLozier & Rhodes, 2017). Karabatak and Polat (2020) sought to address this challenge through their study and found that incorporating Keller's ARCS model (2010) into the flipped learning approach helped to increase student motivation and accountability.

Implications

The findings of this study have implications for me as the researcher, for the teachers who participated in the survey and interviews, for the Great Minds organization, and for scholarly researchers and practitioners. Kumar and Dawson (2014) suggest that professional practice dissertations can greatly impact professional growth and practice and cite three levels of implications: (1) implications for me, (2) implications for the immediate context, and (3) implications for the field and others. In this section these three levels will be addressed in the following three sections: (1) personal implications, (2) recommendations, and (3) implications for future research.

Personal Implications

Throughout this study, I have learned a lot and grown within my profession as well as in my abilities to engage in scholarly practices. I know that this growth will support my future endeavors in the field of learning design and technology. In this

section I will discuss the implications of this study for me on: (a) my knowledge of action research, (b) my ability to approach a problem of practice with integrity and scholarship, and (c) my growth as a leader.

Knowledge of Action Research

In action research studies, the practitioner is the researcher. Unlike traditional research, action research is conducted to find answers to specific problems of practice that arise within organizations so that findings inform future practice (Herr & Anderson, 2014; Mertler, 2019). Because of this, there is freedom to choose research methods that align with the problem being studied in action research approaches (Mertler, 2019; Rowell et al., 2015). This freedom allowed me to deepen my understanding of experimental and non-experimental research designs as I considered which would best fit for my research problem.

With guidance from my advisor, a descriptive research design was developed. Mertler (2019) suggests that action research is cyclical and recursive in nature but that it typically includes four stages: (1) the planning stage, (2) the acting stage, (3) the developing stage, and (4) the reflecting stage. Working through these stages, I was able to hone my action research skills while connecting theory to practice and creating a two-way flow of the insights gained (Parsons & Brown, 2002).

Approach to Problems of Practice

In any educational setting there are problems that arise and a need for a systematic approach to solving them. Action research provides a systematic and scientific way to approach a problem of practice (Mertler, 2019). When I began designing this study, I was an academic coach for the school district in which this research was

conducted. Shortly into the process, I transitioned out of direct work with public schools to work for Great Minds, PBC which is the parent company of the Eureka Math curriculum.

My role at Eureka Math was to design and create short instructional videos that would support 8th grade teachers and students through the curriculum. The product was created in response to the Covid-19 school closures to ease the disruption of learning caused by distance and hybrid learning models where students were no longer able to learn in person with teachers. However, I knew that there would be opportunities for instructional videos to benefit teachers and students post pandemic.

A teaching model that uses instructional videos that is gaining momentum in K-12 educational circles is the flipped learning model (Bergman & Sams, 2015; Bishop & Verlager, 2013). To design a study that would benefit both my former and current colleagues, with the support of my advisor, a descriptive research model was chosen. A descriptive study would allow for the exploration of teachers' attitudes and intentions towards the use of instructional videos as part of a flipped learning model for mathematics instruction. It was also chosen because I was no longer in a position to support an innovation or experiment with coaching teachers through the design and delivery of a flipped learning for mathematics instruction.

Exploring the extant research helped to define the problem as well as learn about research methods that have been applied to similar problems. The literature review also gave me an opportunity to explore ways other researchers have approached the problems that arise in public schools when integrating instructional technology into lesson design and delivery. I also reviewed several theoretical frameworks that have helped to develop

better understanding of the way attitudes and intentions can work in tandem to determine behavior.

The opportunity to put into practice what I had learned about mixed methods action research design has made a huge impact on me. I am more confident in my abilities to create quantitative surveys and qualitative interview protocols. I know that these skills will allow me to approach problems of practice scientifically and create instruments that are trustworthy, valid, and reliable. Engaging in quantitative and qualitative data analysis served two purposes. I was able to see the importance of having both types of data to increase the trustworthiness of the findings, but most importantly I was able to get a clear understanding of my former colleagues' attitudes and intentions towards the use of instructional videos as part of a flipped learning model.

I did not anticipate that each teacher I interviewed would be so open to the concept of flipped learning. I was pleasantly surprised, especially by the responses of the kindergarten through third grade teachers. They expressed that their students would be capable and that what they had learned through distance learning about instructional videos and flipped learning had shifted their mindsets. Prior to Covid they may have been more reluctant to see the benefits of a flipped learning model for mathematics.

Growth as a Leader

A major characteristic of action research and one that I have learned to embrace through this process is the pursuit of transformative change (Rowell et al., 2015). Kennedy (2005) points out that it is imperative for educational leaders to have a better understanding of research to be able to support teachers with strategies that work for their contexts. There is a lot more to leading change than relying on the phrase *the research*

says (Kennedy, 2005). The action research process allows leaders to explore problems and solutions to enact transformative change in classrooms, grade level teams, schools, and districts.

Through this study I have learned that overall, K-8 teachers are open to the idea of using instructional videos as part of a flipped learning model. As a former leader in the district, I can make recommendations to their leadership team to support the use of this model for mathematics instruction. As a content creator for Eureka Math, I can say with confidence that there is a desire in K-8 mathematics classrooms to use instructional videos as part of a flipped learning model of instruction. With a better understanding of teachers' attitudes and intentions, I can lead the research and development of products to support teacher use and integration.

Recommendations

The results of this descriptive study have led to the development of recommendations for two separate stakeholders. The teachers and leaders at Eagle Elementary and Middle schools and my current colleagues within the product management team at Eureka Math. This section describes: (1) recommendations for K-8 teachers and leaders, and (2) recommendations for colleagues at Eureka Math.

Recommendations for K-8 Teachers and Leaders

The data from the survey and interviews reveal that teachers are open to the use of instructional videos as part of flipped learning. They see the value in using videos to engage students in learning. They also see the benefits of using them for mathematics instruction to free up class time for collaboration and application of skills.

Teachers need the support of site and district leadership to be successful. The district would need to revisit some of the ways that students and families were supported during distance learning and set aside funds to ensure that all students have access to devices and reliable internet connections at home. Efforts to communicate the instructional shift with grown-ups who support students at home should also be made.

The use of this model should be part of a school or district wide initiative where all teachers are supported in making instructional design shifts through ongoing professional development that includes training, modeling, and coaching.

Recommendations for Colleagues at Eureka Math

Instructional videos as part of a flipped learning model for mathematics instruction has shown to increase student engagement, achievement, and motivation (Bond, 2020; Karabatak & Polat, 2020). Because of this, instructional videos should be a part of the design of all future editions of the Eureka Math curriculum.

There is an opportunity to increase our product line by offering support and training to teachers interested in using the InSync suite of videos for flipped learning. The findings of this study indicate that teachers want ongoing professional development in the form of training, modeling, and coaching with feedback. Findings from extant research (Desimone, et al, 2013; Drent & Meelissen, 2008) indicate that teachers are more likely to integrate changes to their instruction that improve student outcomes if professional learning opportunities are provided along with continued support. The Eureka Math success team would benefit from creating a learning experience along with coaching protocols to support the continued use of InSync videos as part of a flipped learning model for mathematics.

Implications for Future Research

At the time of this study, a review of the literature revealed many studies on the effects of instructional videos as part of a flipped learning model on student achievement, engagement, and motivation (Almassari & AlHojailan, 2019; Bergman & Sams, 2015; Lai & Hwang, 2016) but very few studies on teachers' perspectives of flipped learning (Gough, et al., 2017; Unal & Unal, 2021). There is a growing body of research on teacher attitudes towards instructional technology in general that was helpful in designing the survey (Agyei & Voogt, 2011; Mertala, 2019; Tondeur et al., 2017) but more studies specific to the use of instructional videos and the flipped learning model would better inform the field.

There are many pathways that future research could take to add to further develop the use of this instructional model at the elementary and middle school levels. An innovation or evaluation study could explore what happens to teachers' attitudes and intentions when the model is used. This would help develop a better understanding of the supports and challenges that arise and the systemic implications of this model in practice. An evaluation study could be conducted where teachers receive training as well as the supports and conditions that were recognized in this study to determine if there is an increase in benefits to using this model when these factors are addressed.

Limitations

A mixed methods action research study has benefits but there are limitations that should be discussed as well. This section acknowledges the shortcomings of this research to speak to the rigor of this study as well as where there is room for improvement.

Limitations will be discussed in two parts: (1) methodological limitations and (2) limitations with survey measures.

Methodological Limitations

Action research typically occurs within a professional educator's scope of work (Mertler, 2018). Although I began this action research cycle as an academic coach working to improve teaching and learning within the school district, I transitioned to a role at Eureka Math where I work remotely on various products designed to support mathematics instruction. The leadership at my former district allowed me to conduct my research with teachers willing to participate even though supporting them was no longer directly in my scope of work. Their responses and the findings do benefit the research and development teams at Eureka Math where decisions about future products are made.

Because I no longer had direct access within my sphere of influence to a context conducive to the evaluation of an innovation, a descriptive study was designed to explain teachers attitudes and intentions as well as their needs for support and anticipated challenges. Data collection was limited to a survey and one-on-one interviews with eight teachers. It was designed to cause minimum disruption to daily site operations which could have limited the findings.

Convenience sampling was used to select the eight teachers to participate in the interview based on their initial indication of willingness to participate. This may have limited the data gathered. Teachers who were unwilling to respond to follow-up interview questions may have had different attitudes and intentions towards the use of instructional videos as part of a flipped learning model for mathematics instruction that were not obtained in this study.

Limitations with Survey Measures

The survey consisted of 37 Likert scale items that were adapted from other instruments to address the topics of instructional videos and flipped learning. Modifications of survey items may have had an impact on internal consistency. For example, if the original instrument was about recorded lectures this was changed to instructional videos. The survey was designed to give participants an opportunity to self-report their own attitudes and intentions (Adams & Lawrence, 2019; Mertler, 2019). Zerbe and Paulhus (1987) discuss a major limitation of surveys is the tendency for participants to attempt to present themselves favorably. Attempts were made to present the survey in a way that teachers would feel comfortable to self-report their actual attitudes and intentions. In the recruitment letter, teachers were provided with rationale for the research and confidentiality was ensured, see Appendix D. However, my close connections to leadership at this district could still be a limitation of the survey.

Of the 48 teachers eligible to participate in the study, 43 took part in the survey. This was a good representation of the eligible teachers, but a relatively small sample size compared to the district size. Three teachers requested clarification by email to the researcher that they were not sure exactly what flipped learning was which caused them to hesitate on some of their responses, stop the survey, then restart after clarification was received. A review of their responses did not reveal any issues, so their responses were included in the data.

It is important to acknowledge that one of the scales did not meet the Cronbach's Alpha statistical test. Cronbach's Alpha is used to determine internal consistency for items in a survey (Adams & Lawrence, 2019). Reliability coefficients between responses

of .70 or higher are considered acceptable (Cronbach, 1951) and the facilitating conditions subscale scored .68. Adjustments to this subscale will be necessary in future research to ensure reliability.

Closing Thoughts

The National Research Council (NRC) issued a statement in their report *Adding it Up: Helping Children Learn Mathematics*, over twenty years ago that adds clarity to the urgency as well as the relationship between mathematics and technology for 21st century learners. It reads:

Today it is vital that young people understand the mathematics they are learning. Whether using computer graphics on the job or spreadsheets at home, people need to move fluently back and forth between tables and graphs, tables of data, and formulas. To make good choices in the marketplace, they must know how to spot flaws in deductive and probabilistic reasoning as well as how to estimate the results of computations. Public policy issues of critical importance hinge on mathematical analyses (National Research Council, 2001, p. 15).

Considering this, teachers must make decisions for how to structure and present mathematical instruction effectively.

The field of mathematics has been introduced to a variety of effective instructional strategies aimed at improving student achievement. Some well-known strategies include cooperative learning, complex instruction, inquiry learning, problem-based learning, and computer-assisted instruction. Flipped learning is one of the more recent instructional strategies that has shown promise as an approach that increases student engagement and collaboration in mathematics classrooms which can lead to

increased achievement (Almasseri & AlHojailan, 2019; Bond, 2020; Wei et al., 2020). Flipped learning supports students by integrating technology through instructional videos and the flipped learning model which allows for class time that is rich in discourse, collaboration, and problem solving (Bergman & Verleger, 2013). Studies show that combining flipped learning with instruction on self-regulation strategies increases student autonomy for watching the instructional videos at home as well as their motivation to learn (Lai & Hwang, 2016).

Teaching mathematics is a complex activity that requires teachers to make decisions requiring much more than just content knowledge. In 21st century classrooms they must also consider ways to integrate technology to prepare students for a future that continues to be more and more technologically advanced (Magana, 2017). Sanders and George (2017) urge practitioners to keep in mind that educational technology must be incorporated with intentionality and purpose.

The flipped learning model has shown to be an effective use of technology that can increase learning outcomes in mathematics (Bergman & Sams, 2015; Bhagat, et al., 2016; Chen, et al., 2016). The findings of this study and others indicate that teachers' attitudes and intentions towards using instructional videos as part of a flipped learning model for mathematics instruction are favorable (Gough, et al., 2017; Unal & Unal, 2021). Because of this, teachers are more likely to incorporate it into their instructional design (Ertmer, 2005). However, teachers need support to incorporate this model into their instruction. Having positive attitudes and intentions isn't enough. Ertmer and Ottenbreit-Leftwich (2010) found that teachers must also acquire knowledge of the specific ways technology can be used to increase student learning and see it modeled.

NCTM (2020) recommends that professional development be available to teachers that builds their knowledge of technology and the ways it can support learning in mathematics classes. The use of instructional videos as part of a flipped learning model is an effective instructional strategy (Bergman & Sams, 2015; Bond, 2020). This study shows that teachers in this district see benefits of using instructional videos as part of a flipped learning model to increase mathematics learning and support effective instruction. There are opportunities to learn more about the effectiveness of flipped learning in the future. Companies like Eureka Math that create high quality instructional materials, instructional videos, and professional learning services should continue to explore ways to support districts, schools, and teachers to increase effective mathematics instruction using the flipped learning model.

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APPENDIX A

PARTICIPANT SURVEY INSTRUCTIONS

Dear colleague,

Thank you for your willingness to participate in this survey which will serve to inform the researcher of teacher attitudes and intentions for using instructional videos as a part of a flipped learning model for teaching mathematics. For this study, the use of a flipped learning model is defined as the use of instructional videos in place of explicit direct instruction for the transfer of information which frees up class time for practice and application. Instructional videos may be teacher created, curriculum embedded, or found online from platforms like Khan Academy and Zearn. Students may view these videos as homework or as part of a station rotation flipped learning model. The survey was designed to assess teachers attitudes and intentions whether you have used instructional videos as part of a flipped learning model, thought about using, or have not. Please consider and respond to each item in line with your attitudes and intentions.

Please reach out if you have any comments, questions, or concerns related to this survey and your ability to respond accurately to each item.

Sincerely,

Jessica Lambert
Researcher and Ed.D Candidate

APPENDIX B

SURVEY ITEMS AND RESEARCH QUESTION ALIGNMENT

Research Questions	Subscale	Survey Questions
(RQ1)	Perceived Usefulness to Teaching (PT)	(PT1) Using instructional videos and flipped learning makes teaching math easier.
		(PT3) Teaching math is more effective using instructional videos
		(PT6) I find using instructional videos as part of flipped learning useful in teaching math.
		(PT 7) I think using instructional videos helps me explain math concepts more clearly.
		(PT8) I think using instructional videos as part of flipped learning is convenient and time-efficient when used in the classroom.
	Attitude (ATT)	(ATT1) Using instructional videos as part of flipped learning in mathematics is a good idea.
		(ATT2) Using instructional videos as part of flipped learning makes teaching math more interesting.
		(ATT3) Instructional videos in mathematics are fun.
		(ATT4) I like using instructional videos in teaching.
	Subjective Norm (SN)	(SN1) I believe that people who influence my teaching behaviors will think that I should use instructional videos as part of a flipped classroom model.
		(SN2) I believe that people who are important to me will think that I should use instructional videos as part of a flipped classroom model.

Research Questions	Subscale	Survey Questions
		(SN3) I believe the school will support the use of instructional videos as part of a flipped classroom model.
	Perception of Flipped Learning (PFL)	(PFL4) Absent students benefit from instructional videos as part of a flipped classroom model. (PFL12) Using instructional videos as part of a flipped learning model removes passive learning from the classroom. (PFL14) Instructional videos aid struggling students because they can re-watch portions of lessons they do not understand. (PFL19) The flipped classroom allows teachers to have increased interaction with students. (PFL20) Flipping the classroom creates time for direct instruction through instructional videos, active in-class learning activities, and content coverage.
(RQ2) What are teachers' intentions towards using instructional videos as part of flipped learning?	Behavioral Intention (BI)	(BI1) I intend to use instructional videos as part of a flipped learning model in my future teaching. (BI2) I predict I would use instructional videos as part of a flipped learning model in my future teaching. (BI3) I have an actual plan to use instructional videos as part of a flipped learning model in my future teaching.
(RQ3) What supports do teachers need to be successful with integrating instructional videos for flipped learning in mathematics?	Facilitating Conditions (FC)	(FC 1) I believe that I have the resources necessary to use instructional videos as part of a flipped learning model. (FC 2) I have the knowledge necessary to use instructional videos in a flipped learning model. (FC 3) I believe that a specific person or group (e.g. academic coach) will be available for lesson design assistance with difficulties using instructional videos as part of a flipped learning model.
	New Survey Items	I would benefit from professional learning on the use of instructional videos.

Research Questions	Subscale	Survey Questions
		I would benefit from professional learning on the use of flipped learning.
		I would need additional time to prepare lessons that incorporate instructional videos.
		I would need additional time to prepare lessons that incorporate flipped learning.
		I would need additional technology resources to incorporate instructional videos.
		I would need additional technology resources to incorporate the flipped learning model.
		I would need assistance in providing student self-regulation strategies to encourage completion of video-related tasks at home.
(RQ4) What challenges do teachers anticipate that could hinder the use of instructional videos for flipped learning in mathematics?	Perception of Flipped Learning	(PFL 5) Instructional videos are difficult for some students to access due to the additional technology required outside of school.
		(PFL 17) In a flipped classroom, students lack a sense of responsibility for their learning and do not come prepared to class.
		(PFL 18) Preparing to use instructional videos as well as other flipped learning materials was time consuming.
		It was difficult to ensure that students had truly watched the instructional videos as part of the flipped learning model.
	New Survey Items	There is a lack of professional development related to the use of instructional videos.
		There is a lack of professional development related to flipped and blended learning designs.
		Students lack self-regulation skills to complete video-related tasks at home.

APPENDIX C

TEACHER INTERVIEW PROTOCOL

Interviewer: Hello (participant's name). Thank you for taking the time to thoughtfully respond to the survey as well as for meeting with me today. Your expertise, opinions, and experiences when it comes to the use of instructional videos in a flipped model for teaching mathematics is valuable and will help to inform the results of this study. In addition to taking notes, I will be recording this interview. I will be the only one that will listen to your responses so I want to make sure that I understand your responses as they will be used in conjunction with other interview responses to develop themes which will inform the field and future studies. I have purposely left the questions open-ended and want this to be more conversational in nature to elicit your experiences and beliefs.

Do you have any questions about this interview? (Allow time for the participant to ask questions)

Okay, Let's begin. (Hit Record)

Interview Question	Research Question
Tell me about your experience with instructional videos.	RQ1
Did you use them in class or for homework?	RQ1
Tell me what your thoughts are on flipped learning.	RQ1
How do you feel about using instructional videos as part of flipped learning?	RQ1
Tell me about your future intentions when it comes to instructional videos.	RQ2

Interview Question	Research Question
Do you predict that you will use a blended or flipped learning model for mathematics instruction in the future?	RQ2
How do you think your colleagues would react to your use of instructional videos as part of flipped learning?	RQ2
How easy do you think it would be to use instructional videos as part of a flipped learning model in mathematics?	RQ2
What successes do you believe stem from the use of instructional videos in mathematics classes?	RQ3
Tell me about a time that you used instructional videos successfully?	RQ3
What are some benefits to using a flipped model for mathematics instruction?	RQ3
What potential challenges do you associate with the use of instructional videos?	RQ4
What type of assistance or support do you need to integrate instructional videos into your lesson design?	RQ4
What type of assistance or support do you need to use the flipped learning model?	RQ4
What challenges do you think students experience when learning math with flipped learning?	RQ4

APPENDIX D

TEACHER RECRUITMENT LETTER

Dear Math Teacher,

Hello! I hope you are well. I am reaching out to you because you teach math for some, or all of your instructional day and I would like to get your perspective. I am conducting a research study as part of the requirements of my degree in Learning Design and Technology.

I am studying teachers' attitudes and intentions towards the use of instructional videos as part of a flipped learning model for teaching mathematics. If you decide to participate, you will be asked to complete a **6-minute survey** about your perspectives towards the use of instructional videos and flipped learning in mathematics and you may be asked to meet with me for a short interview to share details of your thoughts and/or insights on the topic. You do not have to answer any questions that you do not wish to answer.

Participation is confidential. Study information will be kept in a secure location on a password protected device. The results of the study may be published or presented at professional meetings, but your identity will not be revealed.

I am happy to answer any questions you have about the study. You may contact me on my cell at 559-681-3491 or by email. You can also contact my faculty advisor, Dr. Vasconcelos by email at limadel@mailbox.sc.edu or call the University of South Carolina's Office of Research Compliance at (803) 777-6670 if you have any questions about your rights as a research subject.

Thank you for your consideration. If you are willing to participate, please open the attached survey for more information and begin. Your time and expertise are valued and appreciated.

With kind regards,

Jessica Lambert
559-681-3491
jll9@email.sc.edu

APPENDIX E
IRB APPROVAL LETTER



OFFICE OF RESEARCH COMPLIANCE

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
APPROVAL LETTER for EXEMPT REVIEW

Jessica Lambert
2437 Sierra Ave
Clovis, CA 93611-8917

Re: **Pro00117855**

Dear Jessica Lambert:

This is to certify that the research study **MATHEMATICS TEACHERS' ATTITUDES AND INTENTIONS TOWARDS INSTRUCTIONAL VIDEOS AS PART OF A FLIPPED LEARNING MODEL** was reviewed in accordance with 45 CFR 46.104(d)(2) and 45 CFR 46.111(a)(7), the study received an exemption from Human Research Subject Regulations on **1/11/2022**. No further action or Institutional Review Board (IRB) oversight is required, as long as the study remains the same. However, the Principal Investigator must inform the Office of Research Compliance of any changes in procedures involving human subjects. Changes to the current research study could result in a reclassification of the study and further review by the IRB.

Because this study was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

All research related records are to be retained for at least three (3) years after termination of the study.]

The Office of Research Compliance is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). If you have questions, contact Lisa Johnson at lisaj@mailbox.sc.edu or (803) 777-6670.

Sincerely,

A handwritten signature in blue ink, appearing to read "Lisa M. Johnson".

Lisa M. Johnson
ORC Assistant Director and IRB Manager