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THE USE OF INSTRUCTIONAL VIDEOS IN K-12 CLASSROOMS: A MIXED-METHOD STUDY

A Dissertation

Submitted to the School of Graduate Studies and Research

in Partial Fulfillment of the

Requirements for the Degree

Doctor of Education

Carleen Allison

Indiana University of Pennsylvania

May 2015

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Title: The Use of Instructional Videos in K-12 Classrooms: A Mixed-Method Study

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The purpose of this study was to explore the use of instructional videos in K – 12 classrooms. This study sought to determine how often the use of instructional videos occurred in K - 12 classrooms, how the instructional videos were used, teachers' perceptions of the advantages and disadvantages of using instructional videos, and the frequency with which the cognitive theory of multimedia learning recommendations were included in the design of the videos that were being used.

A mixed-method study was used to answer the research questions. The superintendents at two different school districts in southwestern Pennsylvania distributed an online, researcher-created survey via a mass e-mail system. A total of 324 classroom teachers were invited to participate in the study, and 73 teachers responded to the survey creating a 23 % response rate.

Based on the findings, 85 % of the K – 12 educators who responded used instructional video technology for educational purposes. The frequency of use results indicated that the teachers used instructional videos frequently and maintained a collection of different video titles. Teachers reported using instructional videos to *reinforce*, *motivate, meet student needs,* provide *authentic content,* and *demonstrate*. Advantages to using instructional videos included *maximize instructional time, teacher and student control, multi-modal instruction,* and *motivation.* Teachers reported the

following disadvantages to using instructional videos: *lack of access, full group viewing, lack of interaction,* and *learning barriers.*

The cognitive theory of multimedia learning is a theory of how people learn from multimedia messages and defines specific design features that, based on empirical research, improve learning. This study investigated the use of the design principles recommended by the cognitive theory of multimedia learning. Although the principles of voice, politeness, pre-training, personalization, and signaling were present the majority of the time in the instructional videos used by K – 12 teachers, the principles of redundancy, spatial contiguity, temporal contiguity, coherence, and segmentation were used less frequently.

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I am also very grateful for the assistance that was given to me by the administration at the participating schools, which was necessary to even make this research happen. The pilot study team and panel of experts were instrumental in allowing me to refine my survey. A special thank you goes to the teachers who took their time to respond to my survey. Without their willingness to participate and provide extensive qualitative data, the study would not have been successful. Megan Cicconi, both a friend and member of my cohort, provided her expertise and professional network to assist me in accomplishing my goals. I appreciate her generosity.

I want to thank my husband and children for all of their support throughout this entire program. I spent countless hours away from my amazing children to pursue this endeavor. My husband kept our home running and our children happy.

Sadly, I lost my mother to cancer while working on this study. Her courage, strong work ethic, and dedication to her family provided me with the strength to complete this project. I dedicate this dissertation to my mother, Norma Jean Dellemonache.

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CHAPTER 1

THE PROBLEM

Educators are constantly searching for instructional methods that help to meet the needs of all students. The use of technology for educational purposes is one such method that impacts teaching and learning. Instructional video technology provides an avenue for reaching students. Instructional videos are relatively short videos that contain instructions and/or demonstrations on how to complete a specific task (Shipper, 2013). The use of instructional videos in the classroom could make a significant impact on instructional practices and, likewise, student learning. However, implementing the technology effectively becomes the challenge. This chapter identifies the problems associated with the implementation of instructional video technology, the research questions designed to study the problems, the purpose for the study, and a brief introduction to the research design. Key terms are defined, assumptions are identified, and delimitations and limitations for the research are included.

With the advent of Web 2.0 tools, the creation and sharing of instructional videos is expanding (Sherer & Shea, 2011). Web 2.0 tools are Internet websites that allow users to not only view content but also contribute to the content online (Manning & Johnson, 2011). Videos are available on websites, such as YouTube, that allow the viewer to learn how to do anything from assembling a car to presenting Common Core Standards. Although not all videos available on YouTube are worthwhile and reliable for educational purposes, it is still a powerful resource available to the educational community, and other academic websites offering instructional videos have emerged subsequently (see Appendix A for sources for instructional videos). The problem with

the plethora of instructional videos being available to educators is that the videos being selected for use in the classroom may not be designed well. The challenge for teachers becomes selecting videos that are created effectively and include research based design characteristics that have been shown to maximize learning. This study includes a thorough review of instructional video design features that, when employed, show promise for improving learning. This research also seeks to determine whether or not the videos that teachers select to use in the classroom include such design features.

In addition to the availability of online instructional videos, teachers and students are now able to create their own instructional videos. Video editing technology used to be considered expensive, time consuming, and difficult to operate; however, it has become a user-friendly and cost-effective instructional tool (Berk, 2009; Donker, 2011; Girod, Bell, & Mishra, 2007; Hernandez-Ramos, 2007; Rias & Zaman, 2011; Majekodunmi & Murnaghan, 2012). These recent developments in technology make the sharing of information through video practical and within reach of every teacher.

Conversely, the ease with which instructional videos can be made may actually pose a problem for educators. Teachers may create videos that lack the design characteristics necessary to make a video effective. Extensive empirical research on learning through multimedia can help educators to develop instructional videos that improve learning based on the way people learn. If teachers are not aware of these design characteristics, the videos created by educators may not be designed to maximize learning. This study investigates whether or not teachers are creating their own instructional videos and if such videos are developed according to the design recommendations.

Instructional videos are used extensively when teachers employ the flipped classroom, which is an instructional method that is gaining in popularity. When teachers use this practice, students are directed to watch instructional videos at home in order to prepare for class the next day. Then, the students apply their learning in the classroom thus allowing the teacher to assist the students with any questions concerning the content and, likewise, engaging students in active learning (McCammon, 2011; Pierce & Fox, 2012; Roehl, Reddy, & Shannon, 2013; Tucker, 2012). The classroom can be flexibly grouped so that the teacher can truly differentiate instruction and meet the needs of all learners (Brunsell & Horejsi, 2013; Cobb, 2010). This innovative approach takes the somewhat inefficient lecture out of the classroom by using the video lectures as homework.

The use of instructional videos in a flipped classroom allows accelerated students to continue learning and growing (Tucker, 2012). The possibilities are limitless for the highest achieving students who need to be challenged beyond the regular curriculum or pace. High-achieving students are regressing toward the mean as a result of the emphasis being on the low achievers due to standardized tests (Lewis, 2007). Payne-Tsoupros (2010) states, "If the achievement gap is closing by what means is that happening? Is the gap closing from the bottom up or top down?" (p. 472). For curriculum to be appropriate for gifted learners to show growth, it must be engaging, challenging, creative, and exploratory in nature (Rakow, 2008). Instructional videos allow motivated, high-achieving students to progress without being held back by the constraints of the traditional classroom.

The flipped classroom also benefits students who are struggling. Students receive the individual attention necessary during class as well as the opportunity to review the videos multiple times without holding back anyone else in the classroom (Flumerfelt & Green, 2013). This practice can be established easily with technology available today. A major benefit to using the flipped classroom is that an environment is created during class time in which all students' needs are met.

Online learning is another area that uses instructional videos, and it has exploded with popularity (Mandernach, 2009). Over 4 million students in public schools were enrolled in some form of formal online learning environment in 2010 ("Learning Technology Research Taxonomy," 2011). This number includes students enrolled in fulltime online learning environments as well as students participating in online learning for a portion of their schooling, which is referred to as blended learning. Blended learning offers a combination of traditional instruction with an online environment. Instructional videos are often necessary for online teaching and are typically required to be included in online courses, which reveals yet another reason for educators to create well-designed multimedia messages.

Although flipped classrooms and online learning environments present appropriate uses of instructional video technology, these two thoroughly researched instructional practices may not be the only practical uses for instructional videos in the classroom. Educators may be harnessing this technology for additional uses, which could lead to improvements in learning once uncovered. This research seeks to identify practical uses of instructional videos that are working for educators.

Statement of the Problem

Research indicates that the use of instructional videos serves as a promising instructional tool to meet the needs of students (Berk, 2009; Donker, 2011; Girod, Bell, & Mishra, 2007; Kay & Edwards, 2012). However, the actual extent to which this technology is used across grade levels in public schools is unknown. The uses of instructional videos, a few of which are mentioned above, may not be limited to flipped classrooms and online learning environments. Additionally, instructional videos that are being used in the classroom may not be designed to maximize learning according to the cognitive theory of multimedia learning (Mayer, 2001; Mayer & Moreno, 2003). Research on how instructional video technology is being used in K - 12 educational environments is limited. Information regarding the design characteristics of the instructional videos currently in use is lacking in the research as well.

Purpose

The purpose of this study was to explore the use of instructional video technology in K - 12 classrooms. The study sought to determine how often the use of instructional videos occurs in K - 12 classrooms as well as how teachers were using instructional videos. The research delved into the design features of the instructional videos that were being used to determine the effectiveness of the videos based on the cognitive theory of multimedia learning. Also of interest were the teachers' perceptions of the advantages and disadvantages of using video.

Research Questions

This study addressed the following research questions:

1. What percentage of teachers report using instructional videos in grades K - 12?

2. How frequently are teachers in grades K - 12 using instructional videos?
3. In what ways are instructional videos being used in K - 12 classrooms?
    a. Are instructional videos being used in a flipped classroom environment?
    b. Are instructional videos being used in an online learning environment?
4. What are teachers' perceptions of the advantages and disadvantages of using instructional videos in the classroom?
5. Do the instructional videos used in K - 12 classrooms meet the design recommendations set forth by the cognitive theory of multimedia learning?

This research aimed to provide the educational community practical uses of instructional videos in K - 12 classrooms directly from the field. It also intended to provide research-based recommendations for the design of instructional videos so that this technology can be used most effectively.

Significance

A major benefit to using instructional videos is that the teacher is able to meet each child's educational needs (Shabani, Khatib, & Ebadi, 2010). Instructional videos allow student-centered learning to occur, which creates the opportunity for learning to be individualized so that each child is challenged but not frustrated. The use of instructional videos can create an environment in which all students are able to reach the next level of learning, thus meeting students' needs in a diverse learning environment.

Studying the effectiveness of instructional videos is important because it is a delivery method that is becoming more and more popular not only with online learning but also with face-to-face classes (Shipper, 2013). Research shows that this form of

learning is not only preferred by students, but also leads to deeper learning (Mayer, 2009; Ibrahim, 2012; Smith & Smith, 2012).

Teachers who use instructional videos may find value in the present study because of the wealth of empirical research on the cognitive theory of multimedia learning. The qualities of instructional videos that are being used have the potential to be improved when the recommendations of the cognitive theory of multimedia learning are followed. The theory's research-based video design elements may improve learning. The present study also contributes a collection of practical uses of instructional videos in K – 12 classrooms. The resources gained through this study are resources that work for teachers, thus improving knowledge and practice for educators. By examining the advantages and disadvantages to using instructional videos, educators may approach this practice with knowledge of the benefits and challenges. This information provides educators with the opportunity to avoid what does not work and reap the benefits of using instructional videos. Teachers who do not currently use instructional videos may find the results useful because instructional videos may serve as a valuable supplement to teacher-led instruction.

Research Design

This descriptive, mixed-method study resulted in both quantitative data from a survey and qualitative data from open-ended questions on the survey. The results of the survey yielded quantitative data in descriptive form concerning what percentage of teachers used instructional video technology, the frequency with which the technology was used, and how the instructional videos were designed. Qualitative data were gathered through open-ended questions on the perceptions of the teachers concerning the

advantages and disadvantages of using the technology as well as how the instructional videos were being used.

The survey instrument was unique to this study and was developed by the researcher. Reliability and validity were established through pilot testing and expert review with the assistance and expertise of the Applied Research Lab at Indiana University of Pennsylvania's School of Graduate Studies and Research. The survey included a variety of demographic questions, technical questions, and pedagogical questions (see Appendix B for the instructional video survey).

The sample included all of the teachers employed at two school districts numbering 324 educators. The districts were both located in southwestern Pennsylvania. The sample was selected based on convenience. The sample included all teachers from all grade levels in both of the districts to include the following: grade level teachers, special education teachers, elective teachers, online teachers, blended learning teachers, and specialists.

The superintendents at both school districts sent the survey link to the professional staff through the mass school e-mail system. The survey tool Qualtrics was used to administer the online survey (© Qualtrics Labs, Inc. 2015). The qualitative data were analyzed using inductive qualitative analysis (Hatch, 2002).

Theoretical Framework

With the changes in the educational landscape to include practices like flipping classrooms and online learning, the need to create and use instructional videos effectively is growing. Learning through instructional videos is a form of multimedia learning. The cognitive theory of multimedia learning emerged through extensive empirical research on

human cognition and multimedia learning. According to Mayer (2001), this theory includes three major assumptions that correspond to the way people learn. First, dual channels exist in the brain, which allow individuals to process information through both visual and auditory means. Next, working memory in the brain has a limited capacity, which can be overloaded and prevent learning from occurring. The third assumption is that active processing integrates visual and verbal information with prior knowledge and commits learning to long-term memory (Mayer & Moreno, 2003). Theories on how people learn such as Sweller's cognitive load theory and Paivio's dual coding theory support the cognitive theory of multimedia learning (Sorden, 2005).

Mayer's (2001) cognitive theory of multimedia learning suggests that the design of instructional videos impacts the learning that takes place. Basically, learning is maximized when specific techniques are employed in instructional videos. These techniques are consistent with research-based findings grounded in how the mind works.

The cognitive theory of multimedia learning supports a set of principles that contribute to better student learning when employed. Five of these principles contribute to reducing extraneous processing, which is necessary since extraneous processing results in cognitive overload and hinders the learning process (Mayer, 2009). The coherence principle, signaling principle, redundancy principle, spatial contiguity principle, and temporal contiguity principle all work to reduce extraneous processing. The coherence principle refers to the inclusion of only relevant information and the exclusion of extraneous media in an instructional video (Moreno & Mayer, 2000). The signaling principle refers to the process of providing cues or highlighting information to make the information stand out as significant (Mayer, 2010). The redundancy principle refers to

cognitive overload that occurs when information is presented through narration, animation, and on-screen text (Moreno & Mayer, 2002). The spatial contiguity principle refers to the placement of words as text and pictures on a screen (Moreno & Mayer, 1999). Temporal contiguity is the simultaneous presentation of words in audio format and pictures (Mayer & Anderson, 1991).

Three principles contribute to managing essential processing, which allows the viewer to process the content without straining working memory capacity (Mayer, 2009). The segmentation principle, pre-training principle, and modality principle help the viewer to manage essential processing. The segmentation principle offers students the ability to pause a video, essentially controlling the pace of instruction (Mayer & Chandler, 2001). The pre-training principle refers to the process of providing students background knowledge on a topic prior to viewing an instructional video (Mayer, 2010). The modality principle includes the use of pictures and narration (Mayer & Moreno, 1998).

The three principles of personalization, politeness, and voice foster generative processing (Mayer, 2009). Generative processing includes the processing in which the learner is organizing and integrating the material to allow for deep learning. The personalization principle refers to the narrator personalizing the message through narration in the video (Mayer, Fennell, Farmer, & Campbell, 2004). The politeness principle means that the narrator uses polite cues throughout the narration (Clark & Mayer, 2011). The voice principle is the use of a human voice over the voice of a computer (Mayer, 2010).

Research suggests that the inclusion of these principles when designing and creating instructional videos results in better learning (Clark & Mayer, 2011; Mayer,

2010; Mayer & Anderson, 1991; Mayer & Chandler, 2001; Mayer, Fennell, Farmer, & Campbell, 2004; Mayer & Moreno, 1998; Moreno & Mayer, 1999; Moreno & Mayer, 2000; Moreno & Mayer, 2002).

Definition of Terms

Blended learning – Traditional face-to-face instruction combined with an online component (Adkins, 2011).

Cognitive Load Theory – A learning theory that purports that working memory has a limited capacity (Sweller, 1994).

Cognitive Theory of Multimedia Learning – A theory of how people learn from multimedia messages, specifically through words and pictures (Mayer, 2009).

Coherence principle – An instructional video design principle that supports the idea that extraneous sounds in instructional videos hinder the learning process (Moreno & Mayer, 2000).

Contiguity principle:

Spatial contiguity principle – An instructional video design principle that supports the idea that the presentation of text and graphics should be presented in close proximity (Moreno & Mayer, 1999).

Temporal contiguity principle – An instructional video design principle that supports the idea that the presentation of visual elements and the spoken word should be done synchronously (Moreno & Mayer, 1999).

Dual-coding Theory– A theory consisting of the idea that one's cognitive processing works on two distinct channels: one of the channels is visual and one of the channels is auditory (Paivio, 1986).

Flexible grouping – The reassignment of students to groups based on their needs (R. DuFour, DuFour, & Eaker, 2008).

Flipped classroom – An instructional method in which students view instructional videos at home and then engage in active, hands-on learning activities in the classroom (Herreid & Schiller, 2013; McCammon, 2011).

Instructional videos – Relatively short videos that contain instructions and/or demonstrations on how to complete a task (Shipper, 2013).

Khan Academy – A website containing a collection of instructional videos in various academic areas, primarily in math (Khan, 2013).

Modality – A channel used to process information such as a visual or an auditory channel (Moreno & Mayer, 2002).

Modality principle – The presentation of pictures and words as speech in a multimedia message (Mayer, 2010).

MOOC – Massive Open Online Course are courses open to the public via the Internet (Ruth, 2012).

Multimedia – The use of various types of media to include video, audio, images, text, and color to communicate (Beckwith & Cunniff, 2009).

Multimedia instruction – The presentation of words and pictures for the purpose of teaching and learning (Mayer & Moreno, 2003).

Multimedia learning – Learning that occurs through the combination of words and pictures (Mayer & Moreno, 2003; Mayer & Sims, 1994).

> *Words* – In regard to multimedia, words are considered to be on-screen text or the spoken word in the form of narration (Mayer & Morena, 2003).

Pictures – In regard to multimedia, pictures may be static, which includes illustrations, graphs, charts, and photos. Pictures could also be dynamic, which includes animations, videos, and interactive illustrations (Mayer & Morena, 2003).

Multimedia messages – Using words and pictures to communicate with the purpose of promoting learning (Mayer, 2009).

Online learning – An educational system through which the majority of instruction is done via the Internet (Picciano & Seaman, 2009).

Retention – The ability of a learner to explain a concept that was learned (Mayer, Moreno, Boire, & Vagge, 1999).

Personalization principle – An instructional video design principle that supports the idea that when the narrator of an instructional video uses conversational style rather than formal style speech, students learn better (Mayer, 2009).

Politeness principle – An instructional video design principle that supports the idea that when the narrator speaks politely, the learner feels more connected to the narrator and the learner feels more appreciated (Mayer, 2009).

Redundancy principle – Providing text visually in an instructional video at the exact same time as speaking the text vocally (Moreno & Mayer, 2002).

Screen-capture video – Video created from software that allows everything on a computer screen to be recorded with the addition of voiceover and annotation (Drumheller & Lawler, 2011; Flumerfelt & Green, 2013).

Segmentation principle – An instructional video design principle that supports the idea that people learn better when they have control over the pace of an instructional video (Mayer, 2009).

Signaling principle – An instructional video design principle that supports the idea that people learn better when the important elements of a multimedia message are highlighted in the instructional video (Mayer, 2009).

Simple learner interaction – Modest user control over the pace of a multimedia presentation. This is the ability for the learner to pause or continue an instructional video (Mayer & Chandler, 2001).

Split-attention – On-screen text combined with other visual material results in a negative impact on learning because of competing visual modes (Moreno & Mayer, 2002).

TeacherTube – A website containing a collection of instructional videos specifically for educators.

Transfer – The ability for a learner to use learning to solve other problems (Mayer, Moreno, Boire, & Vagge, 1999).

Voice principle – An instructional video design principle that supports the idea that people learn better when the narration is done in a human voice rather than a computer-generated voice (Mayer, 2009).

Web 2.0 tools – Internet websites that allow users to not only view content but also allows them to contribute to the content online (Manning & Johnson, 2011).

Worked example videos – A recorded worked-out solution to a problem for teaching purposes (van Gog & Rummel, 2010).

YouTube – A website containing a collection of videos produced by consumers (Manning & Johnson, 2011).

Assumptions

It is assumed that teachers will participate in the study with honest and accurate input concerning their use of instructional videos in the classroom. It is assumed that teachers will be interested in contributing to the field of educational research.

Delimitations

Although many different types of videos may be used in the classroom, the researcher is restricting the type of videos used in this study to specific formats. This study will focus on instructional videos that are used for worked example, screen capture, demonstrations, and classroom lecture purposes. Instructional videos can be created by screen capture, in which every move on a computer screen is recorded for students to view. Narration and points for emphasis can be included in screen capture videos (Drumheller & Lawler, 2011; Winslow, Dickerson, & Cheng-Yuan, 2012). Worked example videos are also instructional videos, which can be recordings of the modeling of a specific example (Kay & Edwards, 2012; van Gog & Rummel, 2010; van Gog, Paas, & Sweller, 2010). This type of instructional video could be anything from demonstrating brick laying skills to solving mathematical equations.

Limitations

Because the study will be conducted with a convenience sample of teachers in two school districts, the results may not be generalizable to a greater population of teachers. The researcher is a member of the teaching staff at one of the school districts as well.

Summary

Technology has certainly had an impact on education. The use of instructional videos shows promise as well as options for all students. Whether or not teachers are taking advantage of this powerful resource, and if they are, exactly how they are implementing this practice remains to be determined.

This chapter has described some uses of instructional video technology along with the problems that exist with the use of instructional video in K – 12 classrooms. It also included a glimpse of the theoretical base for this study and a brief description of the methodology. Chapter 2 will include a summary of the relevant literature regarding the use of instructional video technology in schools.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Chapter 2 begins with a background of the use of instructional videos. Then, this literature review provides extensive documentation of the theoretical framework supporting the effective design of instructional videos, which include specific principles for reducing extraneous cognitive processing, managing essential processing, and fostering generative processing. Next, advantages to using instructional video technology are discussed. Various uses of instructional videos to include unique learning experiences, flipped classrooms, and online learning environments are detailed. Finally, disadvantages to using instructional videos are included.

Background

Web 2.0 tools—free online applications for sharing information and collaborating online—provide the opportunity for educators to create Internet content and disseminate it through blogging, podcasts, and streaming media (King, 2011; Sherer & Shea, 2011). The use of instructional videos to deliver multimedia educational messages has emerged as a result of these modern technological advancements. The use of instructional videos in education, however, is not completely new. This instructional practice has been around for over 40 years (Clark & Mayer, 2011). The use is more common now that Web 2.0 tools allow easy access for everyone as opposed to the instructional videos of the past that had to be stored on mainframe computers or even film. The instructional videos have also undergone a great evolution from simple words on a screen in the past to complex graphics, animations, and simulations that are often included in multimedia messages today (Clark & Mayer, 2011).

Multimedia, as defined by Beckwith & Cunniff (2009), consists of various forms of media to include video, audio, graphics, and color. Although many visually pleasing special effects, such as transitions and interesting video clips, can be used in instructional videos, the use of these tools may not always be recommended based on what is known about human cognition (Clark & Mayer, 2011). Well-designed instructional videos provide numerous benefits to the educational community and can serve as a stimulus for learning (Mandernach, 2009; Shipper, 2013). Figure 1 shows a pictorial of the elements of multimedia.

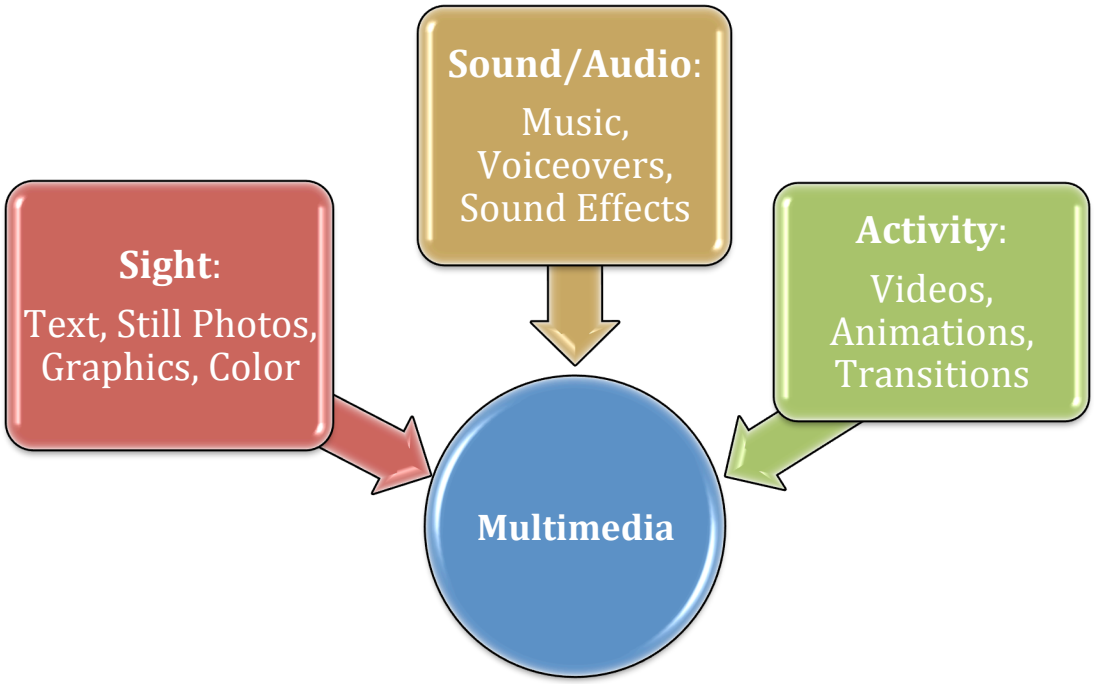

Figure 1. The elements of multimedia.

Cognitive Theory of Multimedia Learning

Clearly, educators and students alike are using technology to convey multimedia messages. The use of technology to enhance learning has become expected in education (Wong, Leahy, Marcus, & Sweller, 2012). However, the use of instructional videos in education is occurring while educators may have little or no knowledge of the design techniques that actually improve learning (Mayer & Anderson, 1991; Sorden, 2005). Fortunately, however, empirical research conducted over the past 20 years suggests specific design techniques for creating multimedia messages or instructional videos that improve learning.

Extensive work done by Richard E. Mayer and his colleagues in the field of multimedia learning provides empirical research, which examines the cognitive process of learning through instructional videos. This research has led to an educational and scientific theory called the cognitive theory of multimedia learning (Mayer, 2009). This study seeks to determine if the instructional videos that are being used in K – 12 learning environments in public schools meet the design standards set forth by the cognitive theory of multimedia learning.

Mayer and his colleagues have made significant breakthroughs in research on learning through numerous and extensive empirical studies of various designs of instructional videos. This work builds on the work of other influential educational theorists including John Sweller who developed the cognitive load theory (Sweller, 1994). This theory involves the concept of working memory having limited capacity. Three types of cognitive load exist. Intrinsic cognitive load refers to the complexity of the content that is being learned and the experiences of the learner. Extraneous cognitive

load refers to the information in a multimedia message that is not essential to the learning causing undue cognitive load. Germane cognitive load is essentially the characteristics of the individual learner and how the learner's working memory processes the information for deep learning (Sweller, 2010). Sweller (2010) believes that if instruction is organized effectively, the learner is able to focus on the material and not use cognitive resources on extraneous information, which leads to cognitive overload.

Another theory that supports the cognitive theory of multimedia learning is Allan Paivio's dual coding theory. The theory is based on the premise that dual coding occurs by the brain processing information through two channels, one being auditory processing and the other being visual processing (Paivio, 1986). The dual-coding theory purports that learners learn better if both channels are being used during learning instead of just one. Thus, the cognitive theory of multimedia learning, which includes that people learn better from words and pictures rather than just words alone, is supported by the dual-coding theory. The cognitive theory of multimedia learning includes design features to minimize the effects of cognitive load on the learner while adhering to the dual coding assumption. This theory also supports a number of principles that if considered in creating or selecting instructional videos, could significantly improve the learning process.

The practical result of the cognitive theory of multimedia learning is that educators have a framework to help guide the selection, design, and development of multimedia messages. Mayer's research, along with that of many other researchers, supports several design features that improve student learning and should be considered when developing instructional videos. This study seeks to determine how frequently the

instructional videos that are being used in classroom across grade levels include the design characteristics.

Principles to Reduce Extraneous Cognitive Processing

In order to use design principles that improve learning, it is important to have an understanding of what actually interferes with learning. Mayer (2009) describes extraneous cognitive processing as that processing which occurs during learning that does not contribute to the learning. It is the processing that occurs due to distractions or confusing information, which are not necessary for accomplishing the learning objective. Poor instructional design can contribute to extraneous cognitive processing. If the brain is working to process information that does not serve a purpose in the learning, then less cognitive capacity is available to perform the processing that is necessary to accomplish the objective. The coherence principle, redundancy principle, spatial contiguity principle, temporal contiguity principle, and signaling principle all include design features that help to reduce extraneous processing if considered while educators are developing multimedia messages (Mayer, 2009).

Coherence principle. The coherence principle refers to the inclusion of only necessary sounds and visuals in instructional videos. A study conducted by Moreno and Mayer (2000) revealed interesting results concerning the use of background music in instructional videos. The researchers created various instructional videos teaching the concepts of weather and lightning. The videos consisted of different elements of design to include those with narration alone, those with narration and background music, and those with narration and sound effects. The participants included 75 psychology students with a median age of 18 years, who were split up into the three groups. Students

performed significantly worse on retention and transfer tests after viewing the instructional video that included narration and background music than those who watched the same video without background music. Significant differences in performance did not occur when sound effects were included in the video compared to those receiving just narration. Therefore, appropriate sound effects may not overload the auditory channel while listening to an instructional video; however, this research suggests that music does create a negative learning experience for students (Moreno & Mayer, 2000). Another study showed a negative impact on learning when sound effects were used in an instructional video on hydraulic braking in cars (Moreno & Mayer, 2000). All sounds should be relevant to the learning so that auditory capacity is available to make connections.

Pittman (2013) found the use of multimedia in modern courses to yield the same results. When multimedia messages were "enhanced," learning was less efficient than when "standard" multimedia messages were used (p. 27). In practice, according to the coherence effect, educators should avoid the use of background music when creating multimedia messages and cautiously use sound effects since extraneous sound creates an auditory cognitive overload that hinders the learning process.

Rodicio (2012) also found validity in visual coherence, meaning leaving out extraneous visual information that is not necessary to the learning. An instructional video on plate tectonics was presented to one group of students with real images, and another video was presented to a different group of students containing sketches. The entire sample consisted of 36 undergraduate students, who were randomly assigned to one of the two groups. The sketches contained only the information and diagram of the

information that the students needed to understand the message. The real images contained many colors and visuals that were not necessary for the objective at hand. Students who watched the video with the sketches significantly outperformed students who viewed the video with the real images.

Jabbour (2012) takes this principle a step further by suggesting a design technique built in to prevent extraneous graphics. This research suggests that the creator of the multimedia messages should develop the words and graphics together to prevent any unnecessary visual overload. This research supports the coherence effect in that excluding extraneous visual information results in better learning outcomes.

Redundancy principle. The redundancy principle refers to the presentation of content through the visual modality such as on-screen text at the same exact time as the auditory modality such as narration (Moreno & Mayer, 2002). A study done by Moreno and Mayer (2002) suggests that a combination of modalities improves learning through multimedia. When verbal and visual modalities are in place, students have better comprehension than when verbal is presented alone.

However, an important element to the redundancy effect is that the visual material should not consist of words as on-screen text and pictures along with narration. When on-screen text is used with pictures and narration, another effect is created, which is referred to as the split-attention effect. This is known as the split-attention effect because students are forced to split their attention in the same modality, in this case, trying to read the text and view the pictures at the same time splits the learner's visual modality. This type of redundancy has a negative impact on learning. Working memory performs better

when two channels are working together and one of the channels is not overloaded (Moreno & Mayer, 2002).

Aldalalah (2012) found on-screen text and images to create a split-attention effect while studying multimedia learning in a grade three music theory course. The sample for this study included 269 students from primary schools. Students were randomly assigned into groups. One group viewed an instructional video that included images and audio. A second group viewed an instructional video that contained images and text. Students who viewed the video with images and audio significantly outperformed the students who viewed the video with images and text. The researcher attributes these results to the split-attention effect, which likely occurred for the students who were attempting to view the images and the text through the visual channel resulting in cognitive overload of the visual channel. Additionally, the significantly better results from students viewing images and hearing audio support the redundancy principle.

When developing instructional videos, educators should consider the importance of redundancy. Educators should avoid the use of images and on-screen text at the same time, which creates the split-attention effect. The use of narration and images results in better learning.

Spatial and temporal contiguity principle. Contiguity refers to the proximity of information. In the instructional video realm, two different forms of contiguity exist when designing videos. Spatial contiguity refers to the placement of text and pictures close to each other in an instructional video. The use of spatial contiguity may create the split-attention effect in which the visual channel is overloaded when too much visual information is presented (Moreno & Mayer, 1999). Temporal contiguity refers to the

visual word presented as on-screen text simultaneously with the spoken word as narration. Students who receive information presented with temporal contiguity outperform students who receive information through images and on-screen text or spatial contiguity. Receiving information through the dual channels creates a deeper understanding of the material resulting in more connections being made with prior knowledge (AbuSaada, Lin Lee, & Fong, 2013; Aldalalah, 2012; Mayer & Anderson, 1992; Moreno & Mayer, 1999). Mixed modality presentations yield the best results known as the modality effect. Once again, the practical applications of these principles imply that educators should use visual images and verbal narration to maximize the learning opportunities.

Signaling principle. Signaling refers to the use of cues in a multimedia message, which draw the attention of the viewer to the essential information in the instructional video. The cues can be presented in various formats such as highlights, arrows, distinctive colors, graying out unnecessary information on an image, voice emphasis, etc. (Mayer, 2009). Using outlines, headings, or graphic organizers to help the viewer follow the presentation without unnecessary extraneous processing are also considered part of the signaling principle.

A study conducted by Mautone and Mayer (2001) consisted of two groups of college students. One group watched an instructional video on how airplanes lift off of the ground that did not include any signaling in the design. The other group watched an instructional video containing the same content as well as signaling. Text was included to emphasize the main points through headings and subheadings. Additionally, the narrator emphasized significant terms throughout the message. The students who viewed

the video with signaling included in the design performed significantly better on transfer tests than students who viewed the video that did not include signaling (Mautone & Mayer, 2001).

This study addresses the design features of coherence, signaling, spatial contiguity, and temporal contiguity. These principles for reducing extraneous cognitive processing are pictured below in Figure 2.

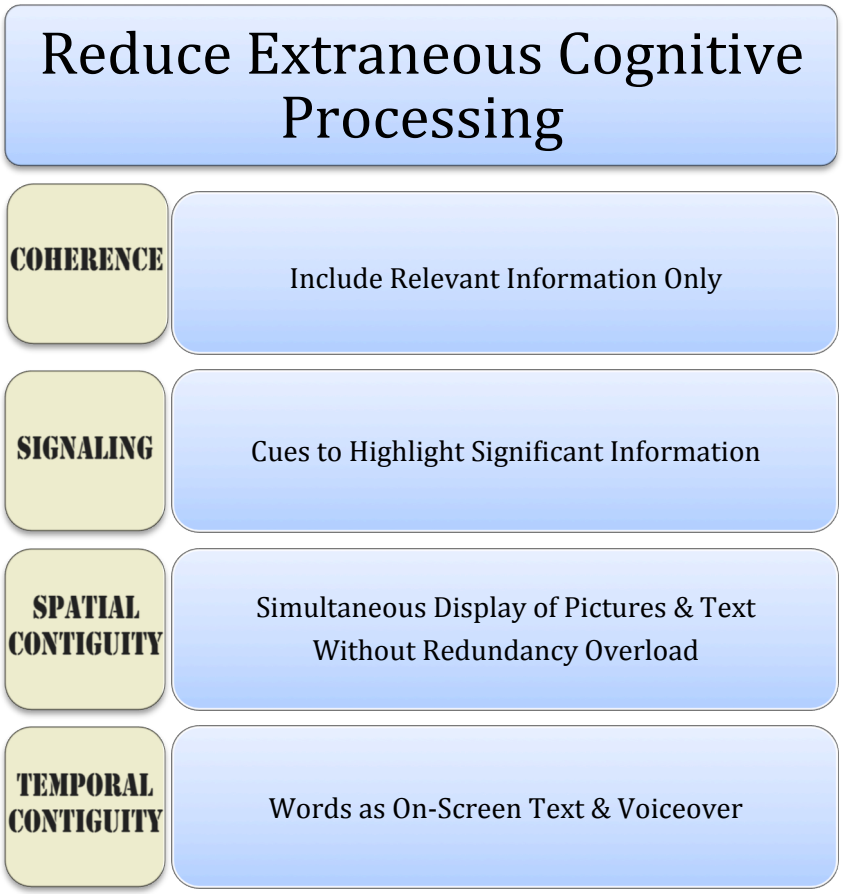

Figure 2. Design principles to reduce extraneous cognitive processing.

Principles for Managing Essential Processing

To use the design principles to manage essential processing, understanding what can go wrong with instructional video design is important. Essential processing can become overloaded if the material to be learned is so complex that the material cannot be

used for deeper thought processes. In this situation, all of the cognitive capacity is involved in simply gathering the information and no capacity is left for organizing the information and making connections with prior knowledge. This problem often occurs when the material is demanding, the learner is a novice, and/or the presentation of the information is fast paced (Mayer, 2009). The segmentation principle, pre-training principle, and the modality principle can contribute to managing essential processing if considered while multimedia messages are being designed and developed by the educator.

Segmentation principle. Through Richard Mayer's research on multimedia learning, he also explored the effect of segmentation. Segmentation refers to the ability of the learner to control the pace of instructional videos by basically breaking it up into segments. Alternatively, instructional videos can also be segmented if the designer simply presents information in shorter segments.

Mayer and Chandler (2001) studied whether or not having the control of the instructional video in the form of starting and stopping the video when needed would impact learning. Fifty-nine college students served as the participants and were split up between two groups. One group viewed an instructional video on the formation of lightning in one whole segment without the ability to stop, advance, or review at any point in time. The other group watched the same instructional video but had control over continuing the video. Students had to click to continue the multimedia message 16 different times. The researchers found that the user having simple, modest control over the instructional video in the form of a button allowing one to pause and click to continue does impact learning. Students who had the option to control the pace of an instructional

video performed better on transfer tests than students who were not given the option to control, or watch in segments, the instructional video. The option did not have a significant impact concerning student retention, but did show a significant difference in applying the knowledge gained (Mayer & Chandler, 2001).

Tabbers and Koeijer (2010) replicated Mayer's work and found similar results; when students could control the pace of the multimedia message, they performed better on posttests than those who could not control the pace. Two groups of 26 college students in each group viewed instructional videos on the study of the formation of lightning. The researcher noted a significant increase in the amount of time the learners took on task when they had control through segmentation to be 60 % longer than their counterparts. Although providing the learner with control over the pace of a multimedia message shows better learning outcomes, this researcher recommends that educators consider the cost of time-on-task when offering the learner the power of segmentation. When students control the pace of the instructional video, the amount of time devoted to the task may result in adjustments in instructional planning as well as the content included in the curriculum.

Wong, Leahy, Marcus, and Sweller (2012) also tested the segmentation effect and found that when too much information is presented in animated formats, working memory is overloaded and the benefits of using multimedia are negated by too heavy a cognitive load on the learner. Sixty-six students ages 10 to 11 were the participants in a study on how to make origami. One group of students viewed short, animated segments of video on making origami, and another group viewed short, static segments of video on making origami. Yet another group of students viewed long, animated segments of video

on making origami, and an additional group viewed long, static segments on making origami. The results showed that animation was superior to static images in learning origami when the video presentation was viewed in short, animated segments. However, long animated segments likely exceeded working memory capacity resulting in the inability of students to integrate the information.

Ibrahim (2012) found similar results when combining segmentation, signaling, and coherence while studying insects with 226 undergraduate college students. The mean age of the participants was 20 years, and the participants included 132 males and 94 females. A professionally published version of an insect movie was viewed by one group of students. The researchers, with permission, edited the original video by inserting 5 segments where natural breaks occurred. These segments included introductory slides of text as well as summary slides of text for each of the segments. Visual cues were added to the video by using text to highlight the main points. Unnecessary information was removed from the video. This edited version of the video was viewed by another group of students. The students who watched the edited video containing the three elements of segmentation, signaling, and coherence in the design significantly outperformed the students who viewed the original version of the video. The students who viewed the edited version of the video also perceived the material as less difficult than the students who viewed the original version.

Mayer and Chandler (2001) believe that segmentation allows a learner time to make connections with prior knowledge. Controlling the pace of an instructional video reduces the cognitive overload that may occur when too much information is presented without any breaks. It reduces the cognitive load on working memory. Therefore,

educators should consider allowing the learner to have control over the pace of the instructional videos.

Pre-training principle. The pre-training effect includes the idea that multimedia messages will be more effective if the learner has knowledge of the major concepts and terminology prior to watching the video (Mayer, 2010). If the learner has prior knowledge, then the acquisition of the new information requires less cognitive processing ultimately leading to better learning.

In a study conducted by Mayer, Mathias, and Wetzell (2002), students were split into two different groups. One group of students received pre-training on the terminology related to braking systems in cars. The other group did not receive pre-training. The group that received the pre-training outperformed the group that did not receive pre-training on transfer tests. Pre-training shows benefits to student learning and should be considered when material is complex, new to the learner, and fast paced (Mayer, 2009).

Modality principle. The modality principle holds that people learn better when pictures are presented with the spoken word as opposed to when pictures are presented with the printed word (Mayer, 2009). The visual channel becomes overloaded with processing both the pictures and the written words. If the words are spoken, the visual channel and the verbal channel are working at the same time creating less likelihood of either channel being overloaded. The modality principle can be used to manage essential processing. Mayer (2009) refers to the use of narration in place of on-screen text as "modality off-loading" (p. 201). The visual channel is being off-loaded by some of the processing occurring on the auditory channel.

Segmentation, pre-training, and modality design features are included in this study to determine the effectiveness of the videos in use in K – 12 classrooms. The principles for managing essential processing are included in Figure 3 below:

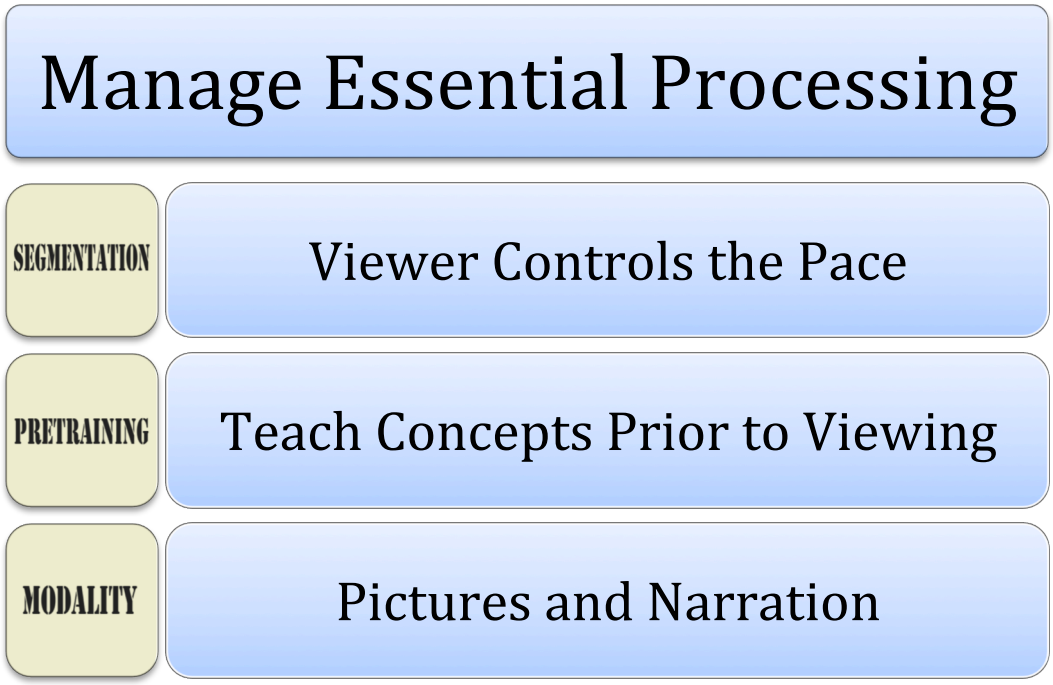

Figure 3. Design principles to manage essential processing.

Principles for Fostering Generative Processing

Generative processing refers to the processing that occurs when the learner is making sense of the information. The learner is organizing the new information and integrating the new information with prior knowledge (Mayer, 2009). This is precisely the type of processing that needs to occur in order for deep thinking to take place. Similar to extraneous cognitive processing and essential cognitive processing, techniques exist that help to foster meeting the objective and minimize the design features that interfere with the learning process. The personalization principle, politeness principle, voice principle, and gender principle help to promote generative processing. Mayer (2009) refers to these principles as social cues.

Social cues and personalization principles. Mayer, Sobko, and Mautone (2003) propose that when social cues are included in multimedia messages, the learner's social nature is activated. This ultimately results in the learner feeling like the messenger is a social partner rather than a voice simply disseminating information. The researchers explain that when people feel more connected to the narrator as a social partner, they find relevance in the message and work harder at making sense of it leading to deeper thought and better outcomes on transfer tests. Social cues can include using conversation style narration, personalizing the message, speaking with politeness, using a human voice over a computer-generated voice, and speaking in a standard accent rather than a foreign accent. Shipper (2013) also recommends that videos used for instruction should be created or selected with a personal delivery method.

When the narrator personalizes the multimedia message, the personalization effect is in place. The personalization effect includes the type of language that is used by the narrator. The narration can be spoken in conversational style, which includes first and second person language and directs the conversation toward the viewer. In contrast, formal style language could be used, which includes third person language and does not make any reference toward the viewer (Mayer, Fennell, Farmer, & Campbell, 2004). Mayer and his colleagues conducted three studies on students learning about the respiratory system. One group of 33 students with a mean age of 18.9 watched an instructional video that was created in formal style and another group of 29 students with a mean age of 18.5 watched an instructional video in which the narration was conversational. Thirty-eight percent of the participants in the conversational video group were male, and 33 % of the participants in the formal video group were male. The main

difference between the two videos is that the word "the" was replaced with "your" in the conversational video, which personalized the video. All three studies resulted in the students who watched the conversational style video scoring significantly better than the formal style group on transfer tests but not on retention tests. Mayer and his colleagues' explanation of these results is that a conversational style narration provides the viewer with more cognitive capacity to attend to the message. The viewer experiences connections with the speaker and the information creating interest and relevance in the message when the narration is personalized. Attending to the voice without any personal connection increases cognitive load, thus the students have less cognitive capacity to apply the learning in a transfer situation (Mayer, Fennell, Farmer, & Campbell, 2004).

Additional researchers conducted studies that offer support of the personalization effect while others show a completely different effect. Rey and Steib (2013) replicated the personalization study referenced above. Of the 210 participants in the study, 95 were females and 115 were males. The students, ages 10 through 14, watched instructional videos on computer networks in separate groups. One group watched a video that was personalized while the other group watched a formal message. The personalized group outperformed the formal message in both retention and transfer. These results are similar to those conducted by Mayer and his colleagues with the addition of the students performing better on retention as well as transfer. This study also contributes a younger age of student to the personalization effect (Rey & Steib, 2013).

Kartal (2010) found similar results when studying the personalization effect with use of the Turkish language. Two different groups of college students in Turkey viewed three different instructional videos on stellar evolution. The style of narration for each of

the three videos was considered neutral-formal, personalize-informal, and personalized-formal. Interestingly, the personal-informal viewers performed significantly better than neutral-formal on both retention and transfer and both formal videos were rated as more difficult by the users than the personalized-informal message.

In contrast, Kurt (2011) found the personalization effect to not make a positive difference in learner outcomes when studying scientific research methods in conversational style language. Twenty-two college students viewed videos in formal style, and 23 college students viewed videos in conversational style. The formal group consisted of 4 females and 18 males, and the conversational style group consisted of 6 females and 17 males. Although the participants reported enjoying the conversational style and found it more motivational, they demonstrated higher cognitive load while learning in conversational style on a cognitive load scale. The researcher attributes this to the students possibly not being familiar with the informal approach since all learning is typically done in formal style in a Turkish classroom setting.

Politeness principle. The politeness effect goes hand-in-hand with the personalization effect. The politeness effect refers to "the idea that people learn more deeply when words are in polite style" (McLaren, DeLeeuw, & Mayer, 2011, p. 1). The researchers found that when politeness was used in a study of chemistry students, those who received polite cues from a web-based intelligent tutor performed significantly better than students who received formal feedback in the same environment. However, the politeness effect only occurred when the learners were novices. Students with a high degree of prior knowledge in chemistry did not benefit from the polite message. This research adds a boundary condition to the politeness effect, which includes the use of the

technique for students who lack prior knowledge in the content area. These learners benefit from the polite voice by trying harder, seeing the speaker as a partner, and helping them engage in deep thinking. The researchers hypothesize that the students who have more experience may find the politeness of the message to be bothersome or patronizing since they have the knowledge in place to build the connections from the content alone (Clark & Mayer, 2011; McLaren, DeLeeuw, & Mayer, 2011). Therefore, the designer of multimedia messages should consider the prior knowledge level of the audience and use the politeness effect in narration with novice learners.

Voice principle. Continuing with the principles applying to the narrative in multimedia messages is the voice effect. The voice effect refers to the impact of a computer voice versus a human voice on learning as well as a human voice spoken in a standard accent versus a foreign accent (Mayer, 2010). Two groups of students viewed two different videos on the formation of lightning, one with a machine voice and one with a human voice. Forty participants with a mean age of 19 years made up the two groups. Twenty-one college students viewed the video with the human voice, and 19 students viewed the video with the machine voice. The students viewing the video with the human voice performed better than students viewing the video with the machine voice. Interestingly, students also perceived the information as being more difficult when they listened to the machine voice (Mayer, Sopko, & Mautone, 2003). This could be because of the demands on the cognitive capacity. These researchers believe that the cognitive processes are a factor, but that also, the social processes are part of the learning scenario (Linek, Gerjets, & Scheiter, 2010; Mayer, Sopko, & Mautone, 2003).

The second part of the voice effect involves the accent or lack of an accent in the narration (Mayer, 2010). In a study conducted by Mayer, Sopko, and Mautone (2003), students performed better when presented a narration in a standard accent rather than a foreign accent. Sixty-eight college students studying lightning formation were split into two equal groups of 34 students in each. One group viewed an instructional video with a native-English narrator while the other group viewed an instructional video with in which the narrator had a Russian accent. The students in the native-English narrator group significantly outperformed the Russian accent group on transfer tests.

In contrast to the findings from this study concerning a standard accent to be better, Rey and Steib (2013) found the opposite to be true in a study involving the German language. Students received a multimedia message in their own specific dialect and another group received the same message in a standard German accent. Students performed significantly better on retention tests when they listened to their own dialect, but performed much worse on transfer tests. These findings conflict with the voice effect, which supports a familiar accent as superior than an unfamiliar accent. The researchers believe that these results may have occurred because students are used to hearing standard German in a learning situation. Developers of multimedia messages should consider this research when planning and delivering the narration in instructional videos.

Gender principle. Research on the gender of the speaker is also available. The research is, however, limited and conflicting. Linek, Gerjets, and Scheiter (2010) found that students performed better when the narrator was a female when German students were studying probability. The students not only performed better at problem solving,

but they also rated the female voice as more attractive and worked harder at understanding when given a female voice over a male voice. Additionally, when given a choice between a male or female narrator, significantly more participants chose a female speaker by preference. However, Rodicio (2012) found conflicting results when studying the effect of gender of the speaker in multimedia messages on plate tectonics while teaching students with limited prior knowledge on the topic. This research revealed that students learned more deeply when exposed to a male voice as narrator based on tests of transfer. No significant difference existed on retention tests between a male or female voice. Gender bias and culture could have an impact on this research, but the gender of the narrator could be considered in the development of instructional videos.

The principles of personalization, politeness, voice, and gender are investigated throughout this study. The principles that foster generative processing are listed below:

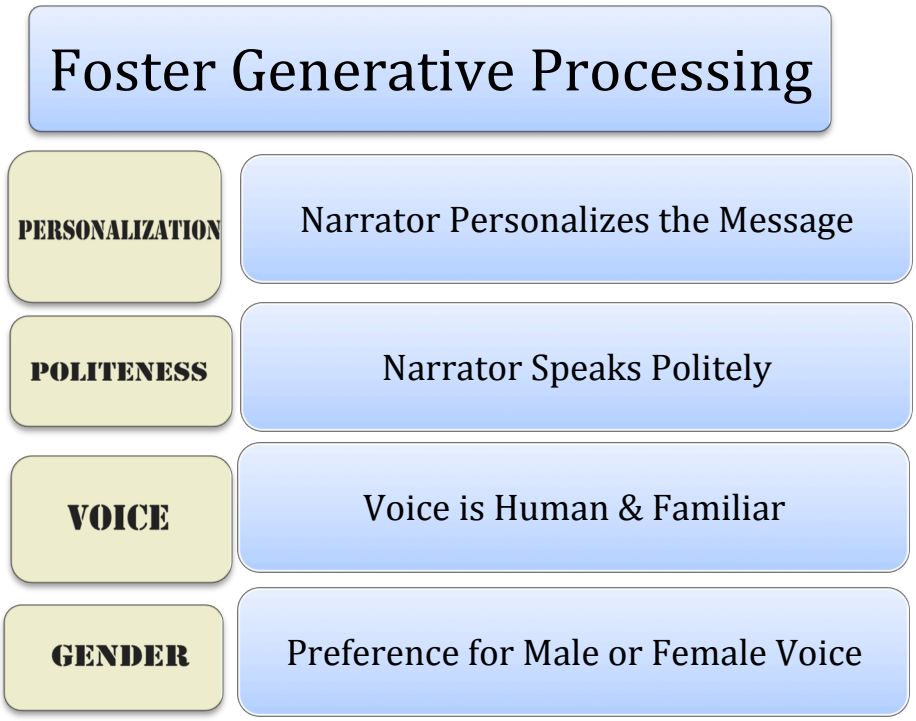

Figure 4. Design principles to foster generative processing.

Advantages to Using Instructional Videos

When instructional videos are available online, students do not need to wait for instruction from the teacher. Instead, they may engage in self-directed learning. Often more time is spent on task, and formerly disengaged students become actively involved in their learning (Ellis, 2011). "The combination of pictures, music, narration, video clips, interesting overlays and transitions will hold even the most disinterested student's attention" (Lucking, Al-Hazza, & Christmann, 2011, p. 78). Research suggests that the use of instructional videos increases student engagement through a student-centered approach (Giannakos, Chorianopoulos, Ronchetti, Szegedi, & Teasley, 2014; Sherer & Shea, 2011).

With multimedia applications and the increasing popularity of handheld devices such as smartphones, tablets, and iPods, the opportunity to learn is no longer confined to the classroom walls. Students can engage in learning in "short bursts", when time is available at home, at school, or anywhere, thus taking multidimensional learning to another level (Ellis, 2011).

Sever, Oguz-Unver, and Yurumezoglu (2013) found several advantages to using instructional videos when studying student achievement and student attitude regarding scientific experiments. The researchers conducted a study in which the participants viewed either a live demonstration of a scientific experiment or a video presentation containing the same content. The participants in the study were 149 pre-service teachers in the second year of college and were divided randomly into two groups. The control group consisted of 71 students who received instruction through the traditional demonstration method. The other 78 participants watched instructional videos of the

experiments. Although the quantitative data from the study showed no significant difference in student achievement when comparing instruction done by a live teacher versus a video presentation, the qualitative piece of the study revealed several advantages to using video in the classroom.

One advantage was that when a class size is large, instructional videos could serve as an invaluable tool. All students would be able to view the video, but all students may not be able to view a demonstration in a crowded classroom. Additionally, if materials are scarce, instructional videos could serve as economical resources. Scientific experiments that are long can be shown in a timely manner when using video. Students are generally drawn to the video stimulation; the researcher observed highly motivated students in the video group. Teachers have the capability of editing the video to meet the needs of the specific group of students. Demonstrating scientific experiments always leaves room for unforeseen issues to arise. The use of instructional videos can create a more predictable learning environment specifically when scientific experiments are involved. Using instructional videos to teach scientific experiments yields many advantages from motivation to classroom management (Sever, Oguz-Unver, & Yurumezoglu, 2013).

Pai (2014) reported many advantages to using video in the science classroom at the collegiate level. Instructional videos can save instructional time. Videos may be short and to the point. Concise instructional videos consume much less time than reading text. Instructional videos created through multimedia accommodate the learning preference of today's students who have been exposed to multimedia extensively through both academic and personal uses. Video resources available through the Internet can

easily be shared with students through Internet links. Websites like YouTube can even be interactive when viewers leave comments on the website. These messages assist instructors in preparing for questions and comments that may emerge in the classroom.

Pai (2014) identified past obstacles to using videos that have been minimized due to video-sharing websites. The issue of instructional videos being outdated quickly is becoming a problem of the past. Current videos are uploaded to websites such as YouTube daily. The timeliness of the videos allows instruction to be enhanced. For example, if a science class is studying a contagious disease, a newscast of a recent outbreak of the disease being studied could be captivating and create relevance with real-world applications.

The cost associated with purchasing instructional videos has also been eliminated since many videos available on the Internet are free of charge (Pai, 2014). Free, online instructional videos can be easily scanned in find specific information, which was also a problem with videos made in the past. Viewing only specific segments of a lengthy instructional video was a difficult process that has been simplified with today's technology.

Kay (2014) suggested that instructional videos can be used as a tool for eliminating "gaps in student knowledge" and were preferred by students (p. 22). A study of 856 pre-calculus students in their first year of college revealed extensive qualitative data concerning student attitude toward instructional videos as well as a student self-assessment of knowledge gained through the use of the videos. Two math instructors created 59 worked example instructional videos. Practice videos were made and analyzed for consistency and included specific design recommendations. The videos

were made available to the students enrolled in pre-calculus courses. Eighty-one percent of those who used the videos agreed or strongly agreed that the videos led them to a better understanding of the content. Ninety-one percent agreed or strongly agreed that the videos were easy to understand. Seventy-three percent agreed or strongly agreed that the videos were preferred over using a textbook. Students also rated their own performance and knowledge gained after two weeks of using the videos. Significant gains were noted by student self-assessment of knowledge in five different areas of pre-calculus. Pre and posttests were used. These results suggested that students generally have a positive attitude concerning learning through instructional videos (Kay, 2014).

The benefits discussed above, such as no wait time, student-centered learning, improved student engagement, increased time on task, increased interest, easy sharing, preferred learning method, and learning anywhere at anytime, are not the only reasons why instructional videos have infiltrated the educational setting. The use of instruction through multimedia messages has penetrated the educational landscape for somewhat unique reasons as well.

Uses of Instructional Videos

Instructional videos have various uses in the classroom. Videos are often used in unique learning situations in which traditional learning is not practical. Instructional videos have also emerged as necessary tools for educators to utilize the flipped classroom. Additionally, instructional videos are vital for use in online learning environments.

Unique Learning Experiences

Hartland, Biddle, and Fallacaro (2008) describe an educational dilemma, which is how to teach nursing anesthesia to dispersed students. This particular learning situation must be sensitive to patient care and safety. So, the content is difficult to handle as a hands-on approach because humans could be harmed. To add to the complexity of the content, the students are studying at a distance and are in completely different locations. How does high-quality instruction occur in this scenario? The dilemma was solved through the creation of multimedia instructional videos demonstrating patient safety that can reach everyone virtually everywhere. The benefits include that the needs of all learners are met and no patients are harmed in the learning process. Multimedia messages are also used in other fields with similar challenges such as aviation, nuclear power, and military operations.

Consider the quandary of Japanese students trying to learn technical Chinese when the Chinese language teachers themselves have no technical knowledge and no books exist on the topic. The solution is the creation of web-based instructional videos. Students are able to learn from the online instructional videos anywhere and at anytime. A real solution is now possible for what once seemed to be a difficult situation to overcome. The instructional videos provide a convenient opportunity to deliver instruction when there is a high demand for the learning and limited resources exist (Jin-Hua, Chun, Hui, & Shumei, 2009). This is a very unique situation in which instructional videos serve as a viable delivery system.

The Khan Academy website is an academic-based, instructional video website. This website can be accessed by anyone, including teachers and students alike, interested

in learning math skills from already created, easy-to-follow instructional videos. When Salman Khan, a man who was trying to help his cousins with math from across the country, decided to record his explanations of math concepts with a video camera, he got a surprise. His cousins actually preferred his instructional videos to working with him in person (Khan, 2013). They enjoyed the videos because they could watch the instruction multiple times as well as revisit a previously learned topic if necessary without any embarrassment. Khan's idea to help his cousins quickly became a resource accessible for all people interested in learning math skills.

Flipped Classroom

When Jonathan Bergmann and Aaron Sams, science teachers from Colorado, decided to create instructional videos to help teach students who are chronically absent, they got a big surprise. All of the students found value in the videos, even those who were present daily (Tucker, 2012). This practice quickly evolved into what is known as the flipped classroom, in which students watch instructional videos at home and engage in classroom activities while with the teacher in class (Herreid & Schiller, 2013; McCammon, 2011; Tucker, 2012). If students miss class for any reason including absences, athletic events, extracurricular activities, illness, educational travel, pull-out programs, etc., the content is always available in the instructional videos. Remediation is often necessary when students miss school; therefore, the instructional videos also serve as a tool for remediation (Flumerfelt & Green, 2013; Giannakos, Chorianopoulos, Ronchetti, Szegedi, & Teasley, 2014; Herreid & Schiller, 2013; Tucker, 2012).

Many benefits have emerged as a result of instructors using the flipped classroom model that go beyond mitigating poor attendance and remediation. In the flipped

classroom, the teacher uses the precious commodity of time wisely. The teacher is able to engage all students in the subject matter because the teacher is no longer spending the majority of the class time talking at the students. Teachers make better connections and develop learning relationships with the students, which leads to increased student engagement in the subject area (Brunsell & Horejsi, 2013; Flumerfelt & Green, 2013; Herreid & Schiller, 2013; Tucker, 2012). Teachers are able to speak individually with every student and work extensively with students who are struggling while advanced students continue to move ahead according to their pace (Tucker, 2012). The model promotes active, student-centered learning that is truly differentiated for the needs of all students (Brunsell & Horejsi, 2013; Herreid & Schiller, 2013; Pierce & Fox, 2012).

The flipped classroom model has been shown to increase teacher job satisfaction (Brunsell & Horejsi, 2013). In the traditional secondary classroom, teachers lecture class period after class period, repeating the same information multiple times a day. When instructional videos are made, the teacher literally goes through the instructional piece of the lesson one time yet students may benefit from the instructional video time and time again. The flipping of the classroom makes efficient use of the teacher's time. Additionally, teachers may become more efficient and improve their teaching practices (Brunsell & Horejsi, 2013; Tucker, 2012). When making instructional videos, the teacher must analyze the importance of every word spoken; therefore, the teacher tailors the video to the needs of the students leaving out unnecessary information that often wastes class time. Teachers also view themselves or hear themselves in the video, which results in the ultimate reflection tool, allowing for improvements in instruction to be made.

The benefits of the flipped classroom reach beyond the classroom walls. The practice promotes learning outside of the classroom (Herreid & Schiller, 2013). The process of watching videos outside of the classroom caters to today's students, known as *digital natives* (Mills, 2010). *Digital natives* are people who were born after 1980 and are used to the multimedia digital world due to the ubiquitous use of technology (Pai, 2014). The ability to watch videos online through handheld devices makes learning convenient for millennial learners since they can watch when and where they want (Herreid & Schiller, 2013; Pierce & Fox, 2012; Roehl, Reddy, & Shannon, 2013). The flipped classroom also provides parents a first-hand view of what is being learned in school, thus increasing parental awareness (Brunsell & Horejsi, 2013). Administrators can also watch the videos leading to better trust with faculty and more faculty accountability (Brunsell & Horejsi, 2013).

Educators find that the use of a flipped classroom results in improved student performance (Brunsell & Horejsi, 2013; Pierce & Fox, 2012; Roehl, Reddy, & Shannon, 2013). Flumerfelt and Green (2013) report impressive results of a study done with 23 at-risk high school students in a government class. Once the flipped classroom was put in practice for these students, homework completion and online engagement increased from 75 % to 100 %, resulting in no failures. Because of the success of this small-scale study, the district implemented the practice throughout the entire 9th grade. As a result, discipline issues decreased by 66 % and failure rates decreased in the following content areas: science by 22 %, math by 31 %, English by 33 %, and social studies by 19 %. These results show promise for the flipped classroom model, a relatively new instructional practice.

Although the use of the flipped classroom shows extensive benefits and possibilities for educational reform in the twenty-first century, some limitations do exist. Herreid and Schiller (2013) suggest that finding high-quality videos that are tailored to the needs of the students are actually hard to find. Teacher created videos may lack the expertise of videos that are created for educational purposes. Additionally, these educators believe that some students will continue to come to class unprepared by having not watched the instructional video outside of class.

Online Learning

Online learning is another area in education in which instructional videos are prevalent. Educators who teach in an online environment often use multimedia messages to relay course content. Beckwith and Cunniff (2009) refer to the use of multimedia by online course instructors "as a matter of course" (p. 107). Online enrollments continue to increase each year making the need for instructional videos even more widespread. The delivery of content through Massive Open Online Courses (MOOCs) continues to play an important role in higher education, while public school enrollments in online courses at the secondary level also continue to rise (Beckwith & Cunniff, 2009; Giannakos, Chorianopoulos, Ronchetti, Szegedi, & Teasley, 2014; Ruth, 2012). An extensive study by Picciano and Seaman (2009) of K - 12 enrollments in online courses during the 2005 – 2006 school year showed over 600,000 students taking online or blended courses. Two thirds of all school districts had students participating in online learning while 20.7 % planned on implementing online programs within the next three years. The responding districts reported expected growth in online learning which has been the trend. A testament to the popularity of online learning is seen through the extensive increase of

online learning providers such as charter schools within school districts, charter schools outside of school districts, state supported virtual schools, state technology service agencies, consortia agencies, and for-profit private virtual schools (Picciano & Seaman, 2009).

Schools may choose to offer online options and students enroll in these courses for many different reasons. Enrichment and advancement opportunities such as advanced placement courses, honors courses, and language courses can easily be available to all students no matter where their brick and mortar school is located (Picciano & Seaman, 2009). This is especially beneficial when schools do not have the expertise in the staff to offer the course. Also, the number of students interested in the course may not be significant enough for schools to financially support these programs (Repetto, Cavanaugh, Wayer, & Liu, 2010). Other reasons students choose online learning include convenience when special circumstances exist. Traveling, athletics, pregnancy, other health concerns, bullying, disciplinary issues, and acceleration are all reasons why students could benefit from the convenience of online learning (Roblyer, 2006). Credit recovery, remediation, disabilities, and social stigmas are additional reasons why online learning is a viable option to students (Repetto, Cavanaugh, Wayer, & Liu, 2010; Roblyer, 2006; Smith & Smith, 2012). In addition, online learning environments are resources for helping schools respond to mandates such as closing the achievement gap and raising graduation rates (Repetto, Cavanaugh, Wayer, & Liu, 2010). Multimedia messages serve as a vital instructional piece for the growing and evolving online learning market.

This study seeks to uncover additional advantages to using instructional videos through the experiences of K – 12 educators. This study also aims to identify additional uses of instructional videos.

Disadvantages to Using Instructional Videos

Some limitations do exist with the use of multimedia and digital learning. Youth today are commonly referred to as *digital natives.* People who were born after 1980 are consider *digital natives* or part of the *Net Generation* since they have grown up in a multimedia world where digital media is commonplace (Pai, 2014). However, a wide divide exists among socioeconomic status in regards to access and use of technology (Mills, 2010). Not all students can be considered part of the *Net Generation* and not all schools are equally prepared to offer the latest in technology. The cost of technology is often problematic, as declining economic conditions result in schools struggling to provide high-quality programs. One possible solution to this challenge is that schools are starting to depend on the students using their own technology tools—tablets, smartphones, iPods, and laptops. This practice, known as Bring Your Own Device (BYOD), is a favorable option for districts where student ownership of these devices is ubiquitous.

Another disadvantage to using instructional videos found on the Internet is that the content provided on websites created by others can easily disappear. DeCesare (2014) describes the Internet as a "moving target" (p. 8). Information that is available on the Internet today may be gone tomorrow. Online instructional videos cannot always be relied upon since the information is not considered to be permanent.

The creation of instructional videos is a time consuming process. In a study done by Kay (2014), worked example instructional videos were developed by experienced math instructors for a pre-calculus course. Each video took 60 to 90 minutes to complete. Additionally, the instructors invested two weeks of training so that they would be skilled in creating the videos. Pai (2014) reports that teachers who are not skilled or trained in making instructional videos would take a significant amount of time to produce an instructional video. Skills that teachers would have to learn include videotaping, audio recordings, narration, and editing skills. Even if teachers are skilled and are able to invest the time into creating the videos, classrooms often do not have the necessary equipment to produce videos or the existing technology is not reliable, which results in the loss of precious instructional time.

Limitations exist with the use of instructional videos. These limitations are valid barriers. However, the benefits of the practice warrant overcoming these obstacles. The educational system can no longer be based on a factory approach when the economy demands that the workforce be equipped with twenty-first century skills (An & Reigeluth, 2011).

Disadvantages to using instructional videos are also of interest to the researcher in this study. Educators who use instructional videos in K – 12 classroom environments will be asked to identify disadvantages to this instructional practice.

Summary

This literature review leaves no doubt that instructional videos currently play a large role in the learning process and will continue to be a driving force in education for years to come. Because of the emergence of Web 2.0 tools and almost universal access

to instructional videos, educators are able to use this learning tool to accomplish various outcomes.

When instructional videos are used, students do not have to wait to learn, students are self-directed learners, more time is spent on task, learning is student-centered, and learning takes place anywhere at anytime (Ellis, 2011; Giannakos, Chorianopoulos, Ronchetti, Szegedi, & Teasley, 2014; Lucking, Al-Hazza, & Christmann, 2011; Sherer & Shea, 2011). Teaching through multimedia messages can be used when the learning environment may not be safe or when qualified instructors are scarce (Hartland, Biddle, & Fallacaro, 2008; Jin-Hua, Chun, Hui, & Shumei, 2009). Instructional video technology is commonly used in an online learning setting. Additionally, use of the flipped classroom has opened many doors for improving instruction in a face-to-face learning environment. Technology is presenting different opportunities for people to learn and multimedia messages present one such opportunity.

Because of the potential power and plethora of benefits of learning through instructional videos, these videos should be designed in ways that maximize learning. The cognitive theory of multimedia learning emerged as a result of extensive empirical research on learning through multimedia messages. Although Richard E. Mayer pioneered the study of learning through multimedia, many researchers have contributed to the field. The majority of the research supports the cognitive theory of multimedia learning while few others dispute the findings of individual principles. Empirical studies support the importance of considering the following principles when creating instructional videos: coherence principle, redundancy principle, spatial contiguity principle, temporal contiguity principle, signaling principle, segmentation principle, pre-

training principle, modality principle, personalization principle, politeness principle, and voice principle (Clark & Mayer, 2011; Mayer, 2010; Mayer & Anderson, 1991; Mayer & Chandler, 2001; Mayer, Fennell, Farmer, & Campbell, 2004; Mayer & Moreno, 1998; Moreno & Mayer, 1999; Moreno & Mayer, 2000; Moreno & Mayer, 2002).

Educators have unprecedented technological tools available to deliver instruction through various learning environments. Teachers have the power to make positive changes in education with the use of these technological tools along with the research that supports the use of these tools. Knowledge of the tools and research arms teachers with the skills necessary to maximize learning and ultimately make a difference in education.

Chapter 3 provides a detailed explanation of the methodology to be used for the current study. The chapter will delve into the methods to be used to investigate the research questions. Details will be provided concerning the population, data collection, instrument development, and data analysis.

CHAPTER 3

METHODOLOGY

The purpose of this study was to determine how often the use of instructional videos occurred in K - 12 classrooms, how the instructional videos were used, teachers' perceptions of the advantages and disadvantages of using instructional videos, and the frequency with which the cognitive theory of multimedia learning recommendations were included in the design of the videos that were being used. The cognitive theory of multimedia learning provided the theoretical base for this research. A concurrent mixed-method design was used to investigate the following research questions:

Research Questions

1. What percentage of teachers report using instructional videos in grades K - 12?
2. How frequently are teachers in grades K - 12 using instructional videos?
3. In what ways are instructional videos being used in K - 12 classrooms?
    a. Are instructional videos being used in a flipped classroom environment?
    b. Are instructional videos being used in an online learning environment?
4. What are teachers' perceptions of the advantages and disadvantages of using instructional videos in the classroom?
5. Do the instructional videos used in K - 12 classrooms meet the design recommendations set forth by the cognitive theory of multimedia learning?

The first research question concerning what percentages of teachers used instructional videos in grades K - 12 was of particular interest since the literature review

from this study did not reveal any specific information concerning the number of educators using instructional videos. Information was available concerning the use of technology in general; however, the specific number of teachers who used instructional videos in K - 12 learning environments was not available. Therefore, this question should contribute to the field of educational research by uncovering statistical information concerning what percentages of teachers used instructional videos in grades K - 12 in two school districts.

Also difficult to discover in the current literature was the frequency with which instructional videos were used in K - 12 learning environments. The second research question investigated how frequently instructional videos were used in the K - 12 classroom. This question revealed not only that instructional videos were used, but also how often the use of this instructional tool occurred in the classroom.

The third research question concerning how instructional videos were used in the classroom should contribute real applications of the use of instructional videos. The literature review revealed flipped classrooms and online learning environments as dominating the instructional video landscape, but the researcher hoped to discover additional uses of instructional videos in K - 12 classrooms.

The advantages and disadvantages that the teachers experienced with the use of instructional videos were explored with the fourth research question. The value of any instructional tool rests with the day-to-day benefits found by the teachers who use the tool. Drawbacks could possibly be avoided or managed better when the disadvantages are known prior to using the tool.

The final research question concerning whether or not the instructional videos that were used met the recommendations set forth by the cognitive theory of multimedia learning allowed the researcher to discover whether or not educators were aware of the design features that should be incorporated into instructional videos in order to enhance learning. This research question led to very specific and extensive instructional video design questions that were included in the survey instrument to determine the frequency with which the design features were present.

This study was important because the appropriate use of instructional videos could contribute to improvements in instruction. This study may provide benefits to educators who used instructional video technology as well as those who did not use the tool. For those who used instructional videos, the research provided empirical research on video creation and design, which was directly linked to improving learning. It also provided educators who did not use instructional video technology with a possible option for future instructional opportunities. The research also contributed to the field of education with examples of content specific uses of technology in the classroom and showed a need for continued research in the field of educational technology.

Population

The population studied consisted of public school teachers in K - 12 learning environments. The sample included all of the teachers employed at two school districts numbering 324 educators in total. Public school districts serving grades K - 12 were included because the researcher was seeking to study the usage of instructional videos in K - 12 environments. Therefore, purposeful sampling strategy was used for this study (Creswell, 2013). The sample was selected based on convenience. The researcher was a

member of the faculty at one of the participating school districts and had access to this professional learning community. Through networking, the researcher was able to secure a second school district to invite to the study.

Both school districts were located in southwestern Pennsylvania. The teachers ranged in teaching grade level from kindergarten to grade 12. The sample included all teachers from all grade levels including grade level teachers, special education teachers, elective teachers, online teachers, blended learning teachers, and specialists. Participants were full-time employees, part-time employees, or temporary employees serving as long-term substitutes. The years of experience in education for this sample ranged from 1 year to 40 years in education. All participants held Pennsylvania teaching credentials. Excluded from the study were teachers in charter schools and private or parochial school teachers. Permission to conduct this research project was requested through the superintendents of both school districts with a written letter (see Appendix C for the site approval request letter). Both superintendents granted the researcher approval to conduct the study with written letters. Approval to conduct the study was also obtained from the Institutional Review Board at Indiana University of Pennsylvania.

Data Collection

This descriptive, mixed-method study resulted in quantitative data and qualitative data. Both quantitative and qualitative data were obtained through a researcher-designed survey instrument created with Qualtrics, which is software designed for online survey creation, distribution, and reporting (© Qualtrics Labs, Inc. 2015). The teachers were invited to take the survey anonymously through a district supported e-mail distribution list. The superintendents at both school districts sent the introduction letter along with a

link to the online survey to the professional staff inviting them to participate in the study (see Appendix D for the letter to participants).

The survey included a variety of demographic questions, technical questions, and pedagogical questions which provided descriptive quantitative data. Additionally, the results of the survey yielded quantitative data in descriptive form concerning what percentage of teachers used instructional video technology, the frequency with which the technology was used, and how the instructional videos were designed. Qualitative data were gathered through open-ended questions on the online survey regarding perceptions of the teachers concerning the advantages and disadvantages of using the technology and how instructional videos were used in the classroom. The qualitative data were collected through the same survey instrument as the quantitative data.

The mixed-method design was used because it was an appropriate method to capture both the statistical information necessary to answer the quantitative questions as well as capture the essence of the educators' experiences with instructional videos through qualitative data. The strengths of both quantitative and qualitative research contributed to this study.

Outline of Method

A thorough literature review of the use of instructional videos in the classroom was conducted along with a thorough review of the cognitive theory of multimedia learning, which served as the theoretical base for this study. The literature review showed a gap in the research concerning the use of instructional videos in K - 12 learning environments. Research questions were created to help investigate the use of

instructional videos in K - 12 classrooms. The following procedures were followed to carry out the study:

1. Permission to conduct the study at two school districts was requested (see Appendix C for the site approval request letter)
2. Approval was granted through written letters from the superintendents at both school districts.
3. Approval of the study was requested and granted through the Institutional Review Board (IRB) at Indiana University of Pennsylvania.
4. In order to meet the unique needs of this study, the researcher created a survey instrument aligned with the research questions. Reliability and validity were addressed through an expert panel of reviewers providing feedback on the instrument. Additionally, pilot testing was done to refine the instrument even further.
5. An informed consent letter was developed as an introduction to the survey, which accompanied the survey when it was launched (see Appendix D for the letter to participants).
6. The survey was distributed through Qualtrics (© Qualtrics Labs, Inc. 2015). A link to the online survey was sent to the entire faculty at two school districts through the district supported e-mail systems. The superintendents at each district kindly sent out the introductory letter and online link to the survey.
7. Descriptive statistical analysis was used to analyze the quantitative data received from the survey questions that addressed the following research questions:

- What percentages of teachers reported using instructional video technology in grades K - 12?
- How frequently were teachers in grades K - 12 using instructional videos?
- Do the instructional videos used in K - 12 classrooms meet the design recommendations set forth by the cognitive theory of multimedia learning?

8. Inductive qualitative analysis was used to analyze the qualitative data received from the open-ended questions on the survey instrument that addressed the following research questions:
    - In what ways are instructional videos being used in K - 12 classrooms?
        - Are instructional videos being used in a flipped classroom environment?
        - Are instructional videos being used in an online learning environment?
    - What were teachers' perceptions of the advantages and disadvantages of using instructional videos in the classroom?

Instrument Development

The research instrument was designed specifically to answer the research questions of interest for this study. The researcher used the literature review extensively in the development of the survey questions. The cognitive theory of multimedia learning guided the development of the questions on instructional video design. The open-ended qualitative questions addressed how instructional videos were used as well as perceptions of the advantages and disadvantages of using instructional videos in K – 12 classrooms.

The open-ended questions allowed the educators to provide additional information to help capture the essence of how instructional video technology has been used in the classroom.

Reliability and Validity of Instrument

Experts in instructional media were selected as the panel of experts to review the survey prior to piloting. They were selected based on their extensive experience with educational technology and their supervisory status through their employment. Three experts were selected for the panel. The experts were invited to the expert panel through e-mail and then provided their expert review of the survey document via e-mail. The experts provided written documentation of the recommended changes on a review panel feedback form (see Appendix E for the review panel feedback form). The experts were asked to provide specific feedback on the following aspects of the survey content and design:

1. Clarity of the language – Is the statement understandable in the context of the survey?
2. Appropriateness of survey questions – Is the statement appropriate for the purpose of the study?
3. Comprehensiveness – Reviewers were asked for "comments" concerning each question on the survey.

Experts in the field completed the survey and analyzed the survey for content validity. The experts reviewed the language of the survey questions for clarity. The experts checked a box if the language was "clear" or "not clear." A comment section was provided where the experts expanded upon their rating. They evaluated the questions to

determine whether or not the questions were appropriate in regard to content. They also determined whether or not the questions measured what the study sought to determine.

The responses from the experts in the field were checked for consistency and the survey was refined until recommendations of all three experts were reflected in the final instrument. The experts suggested some changes to include the following:

- The word "titles" was added to the fourth question on the survey to clarify that the researcher was looking for the number of different titles used and not just different types of videos. The wording was changed to help clarify the question.
- The question regarding the frequency with which instructional videos were used was changed from open response to a multiple-choice response in order to make the question clear for the reader.
- A definition of flipped classroom was added to the question concerning using flipped classrooms since the experts thought that some respondents may not be aware of the terminology.
- The survey item concerning students having control of the pace of the video was rewritten. The word "viewer" was changed to "student" so that it was clear who was in control of the pace of the video.
- A question was added to determine the frequency with which students view the videos individually or as a whole class.
- A multiple-choice question regarding signaling was rewritten to be consistent with the Likert style questions in the section that addressed the design techniques based on the cognitive theory of multimedia learning.

- A question asking the respondents about the length of the videos was eliminated from the study since it did not connect to any of the research questions and served no real purpose for the study.
- Two demographic questions concerning years teaching and grade level taught that were originally open-response questions were changed to multiple-choice questions.
- One structural change was made in Qualtrics so that the open-ended questions had a large box for the response to be entered (© Qualtrics Labs, Inc. 2015). This was an improvement from a single line that expanded as needed but did not show all of the text to the respondent as it was being entered.

The feedback provided by the expert panel was extensive and contributed to changes to improve the instrument. These changes were made in structure, clarity, and comprehensiveness. The expert panel assisted the researcher in refining the survey so that the questions were consistent in design and the questions pertained specifically to the purpose of the study.

Pilot Test

A pilot test was conducted in order to further refine the researcher-created survey instrument. Educators employed at public schools in western Pennsylvania were invited to participate in a pilot test of the online survey. The 8 educators who were invited and participated in the pilot study were not employed by either of the two school districts that were included in the actual study. Four of the 8 instructors selected to be in the pilot study were invited to be a part of the pilot because of the likelihood that they have used instructional videos while teaching in K – 12 classroom environments. These educators

were invited because of their experience with the use of educational technology and/or their experience with teaching online. Educators experienced in using instructional videos were able to answer all of the questions on the questionnaire and were able to provide extensive feedback. The other 4 of the 8 educators included in the pilot study were not necessarily familiar with the use of instructional videos. Feedback from these educators was also important for the pilot so that multiple perspectives were included.

The pilot test was administered through the electronic mail system at Indiana University of Pennsylvania using the Qualtrics online survey software (© Qualtrics Labs, Inc. 2015). The educators were invited to voluntarily participate in the pilot study. The individuals were informed that, by completing the survey, they were consenting to be a part of the pilot study. They were also informed through e-mail that their responses would remain confidential and the results would only be used to help the researcher improve the study. They were asked to record the amount of time that it took them to complete the survey.

The educators who participated in the pilot study answered both the quantitative questions as well as the qualitative questions, all of which were intended to be included on the questionnaire for the actual study. The time that it took the pilot test participants to complete the survey ranged from between 5 and 15 minutes.

The pilot test helped to identify any design issues or other unforeseen problems with the instrument. The pilot study also helped to improve reliability and validity of the instrument.

Data Analysis

This was a mixed-method study including both quantitative questions and qualitative questions. Therefore, an analysis of quantitative data was required and an analysis of qualitative data was also necessary.

Quantitative Analysis

The quantitative data were analyzed through descriptive statistics. The results showed the number and percentage of teachers who used instructional videos as well as the frequency of the use of this technology. The quantitative data also showed the design characteristics of the videos that were being used. Each video design question, which was matched to the recommendations set forth by the cognitive theory of multimedia learning, was analyzed. The demographic data were also examined through descriptive statistics.

Qualitative Analysis

The qualitative data were analyzed using inductive qualitative analysis (Hatch, 2002). The responses to the open-ended questions were read collectively over and over again to acquire an understanding of what was included in the data and to begin framing the data into parts for analysis. Domains were created based on the thorough reading of the data and codes were assigned to each domain. The domains were then reviewed for categories within the domains, which were also coded. Then, the domains were reviewed for connections between domains. Themes were identified across domains for all of the open-ended questions, which included teacher perceptions of the advantages and disadvantages of using instructional videos as well as how the instructional videos were

used. Finally, a master outline was created, which identified all domains, categories, codes, and themes.

Summary

Chapter 3 has provided a detailed explanation of the methodology used for the study. Information pertaining to the population, outline of method, instrument development, and data analysis was provided. Chapter 4 details the results of this mixed-method study.

CHAPTER 4

DATA AND ANALYSIS

The purpose of this concurrent mixed-method study was to determine how often instructional videos were used in K – 12 classrooms, the percentage of teachers who reported using the tool, how the videos were being used, and teachers' perceptions of the advantages and disadvantages of using instructional videos. In addition, analysis of the design features of the instructional videos that were in use was of significant interest. Chapter 4 provides the results of the study through an analysis of the survey findings. These findings were directly connected to the research questions, which served as the foundation for this study. This study was designed to answer the following research questions:

1. What percentage of teachers report using instructional videos in grades K - 12?
2. How frequently are teachers in grades K – 12 using instructional videos?
3. In what ways are instructional videos being used in K – 12 classrooms?
    a. Are instructional videos being used in a flipped classroom environment?
    b. Are instructional videos being used in an online learning environment?
4. What are teachers' perceptions of the advantages and disadvantages of using instructional videos in the classroom?
5. Do the instructional videos used in K – 12 classrooms meet the design recommendations set forth by the cognitive theory of multimedia learning?

Participants

A total of 324 public school teachers from grades K – 12 at two school districts in southwestern Pennsylvania were invited to participate in this study. Seventy-nine teachers from grades K – 12 attempted to participate in the study. However, 73 teachers completed the study, which showed that six teachers dropped out of the study after starting to complete the survey. This study yielded a response rate of 23 %.

The participants who use instructional videos were somewhat representative of the general population. The participants who did not use instructional videos were not included in the analysis of the representation of the participants to the greater population since those participants were not asked demographic questions on the survey. The population of teachers invited to the study was 41 % from the K – 5 grade levels, 28 % from the 6 – 8 grade levels, and 31 % from the 9 – 12 grade levels. The respondents who used instructional videos were represented by 31 % from K – 5 grade levels, 36 % from 6 – 8 grade levels, 31 % from 9 – 12 grade levels and 2 % from grades 7 - 12. Grades 9 – 12 were represented precisely with 31 % in the sample and 31 % participating in the survey. Grades K – 5 and grades 6 – 8 were slightly disproportional but were still very close to being representative of the greater population.

The respondents who did not use instructional videos were not asked demographic information and were not included in this analysis even though those participants were included in the response rate of 23 % for the survey. Figure 5 below indicates the percentage of respondents in each grade cluster.

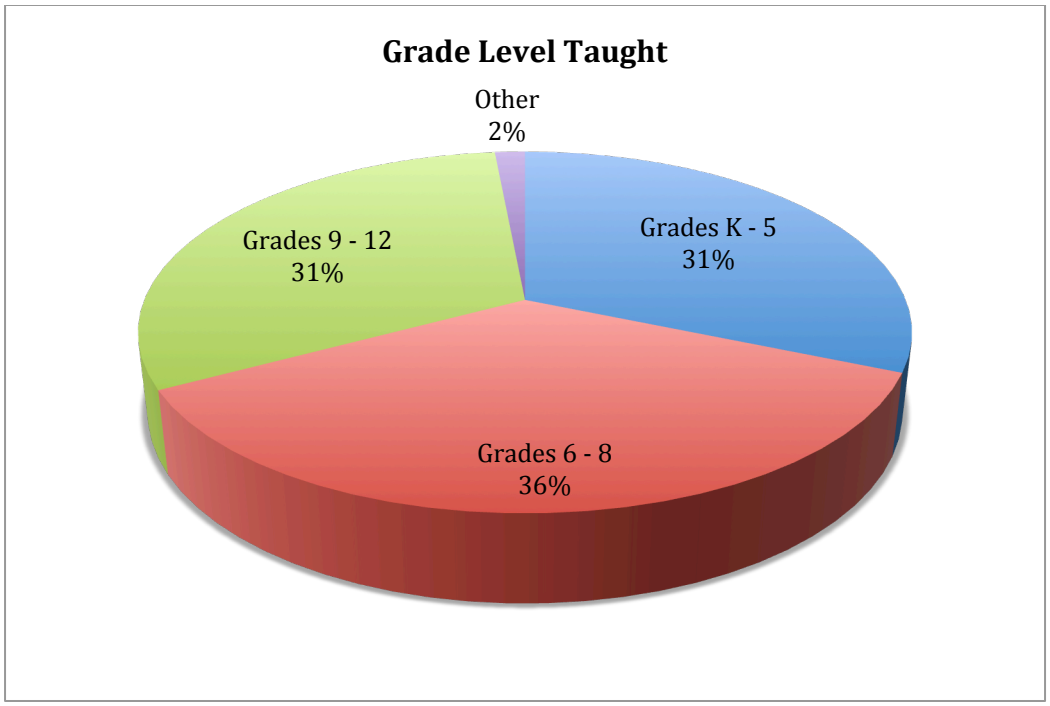

Figure 5. Grade level taught. Responses to survey question number 6, *n* = 62: *What grade level do you teach? Select all that apply.*

The teaching experience of the participants varied. Nineteen percent of the respondents or 12 teachers taught between 1 and 7 years, 36 % or 22 respondents taught between 8 and 15 years, 32 % or 20 participants taught between 16 and 23 years, and 13 % or 8 teachers taught between 24 and 31 years. None of the participants reported teaching for more than 31 years. The respondents reported a variety of years of experience, indicating that the use of instructional videos occurs in classrooms with teachers across the board on experience. Figure 6 indicates the percentage of respondents with teaching experience in each of the year clusters.

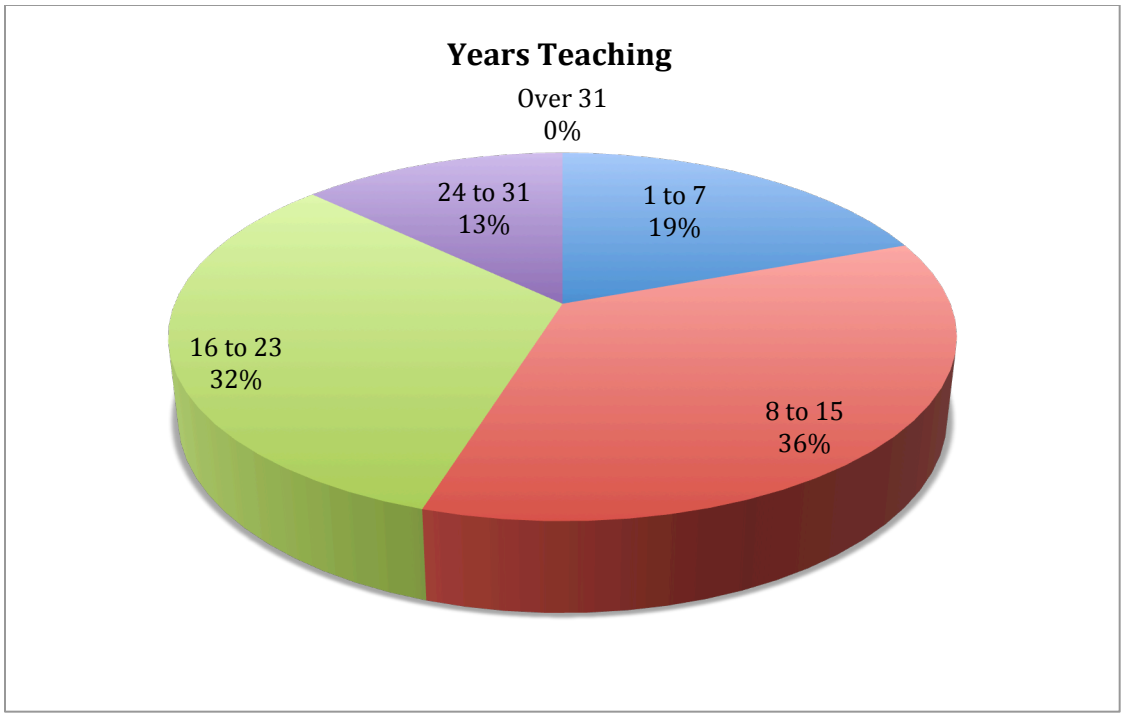

Figure 6. Years teaching. Responses to survey question number 7, *n* = 62: *How many years have you been teaching?*

The participants reported the content areas that they teach, which were representative of a variety of disciplines. The content areas reported by the teachers included all elementary subjects, social studies, math, art, earth science, health and physical education, science, family and consumer science, multimedia, performing arts, English, literacy, technology, library science, Spanish, world history, chemistry, learning support math, biology, visual arts, gifted support, business and technology, music, physics, language arts, reading, social science, and German. Figure 7 below shows the content areas represented along with the number of teachers who responded in each content area.

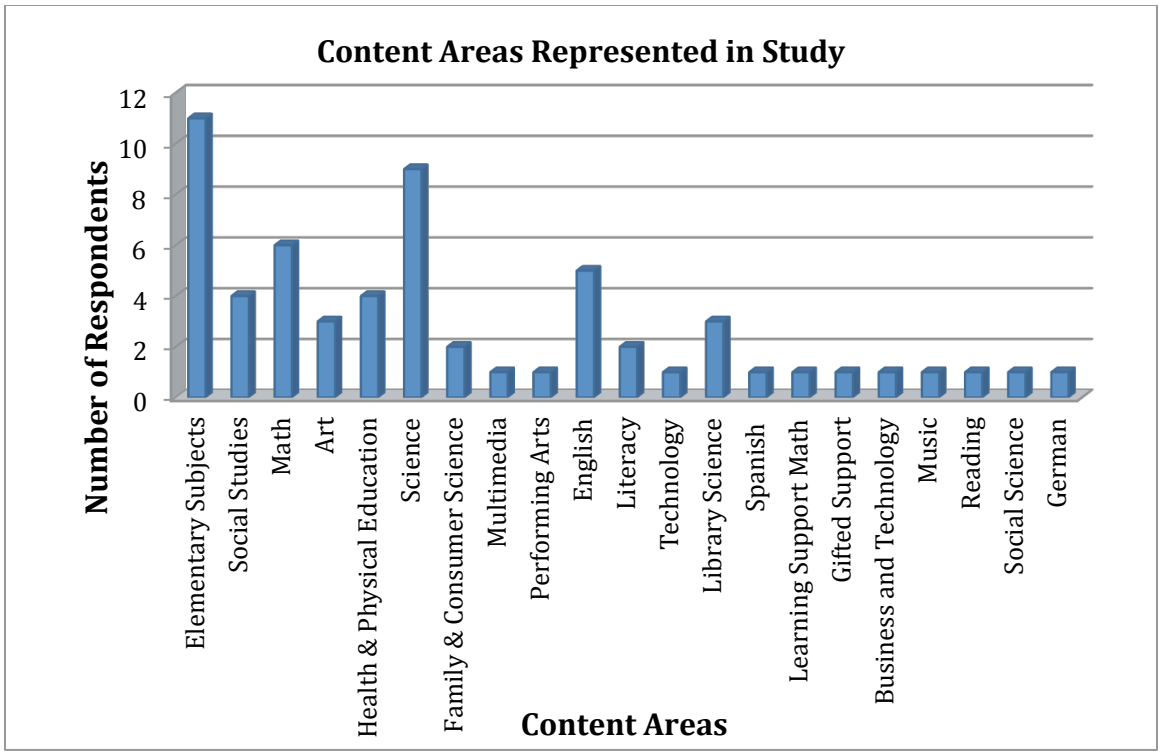

Figure 7. Content areas represented in the study.

Overall, the participants had varied demographic characteristics. The grade levels were represented well with a near balance between grade level participants. Teaching experience was also represented across the board with years in education ranging from many years to a few years of practice for those teachers who reported using instructional videos. Finally, the content areas were also well represented with teachers from a variety of disciplines participating in the study.

Research Question 1

The first research question investigated was the following: *What percentage of teachers reported using instructional videos in grades K – 12?* Although the research reported in the literature review of this study provided examples of uses of instructional videos in the classroom, the research did not provide any indication of just how many teachers in K – 12 environments actually used instructional video technology. Question 1

sought to fill this gap and uncover a snapshot of the percentage of teachers who used this instructional practice. For question 1, $n = 73$. Eighty-five percent of the respondents or 62 individuals reported using instructional video technology. Fifteen percent or 11 teachers reported that they do not use instructional video technology. The survey ended for the participants who reported that they do not use instructional video technology. Teachers who reported that they use instructional videos were presented with additional questions regarding their use of this instructional practice. Figure 8 below shows the percentage of those educators who responded to the online survey indicating that they use instructional video technology for educational purposes as well as those who responded that they do not use instructional video technology for educational purposes.

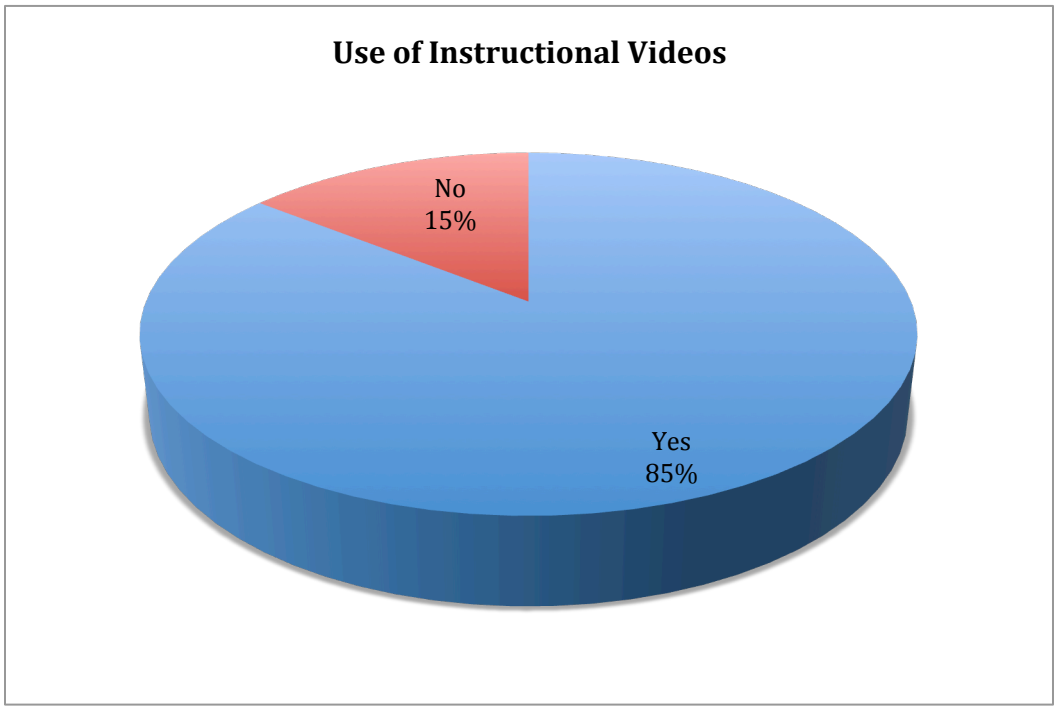

Figure 8. Use of instructional videos. Responses to survey question 1, $n = 73$: *Have you ever used an instructional video for teaching purposes?*

These results showed that a large percentage of teachers used this instructional practice in K – 12 classrooms with 85 % of the respondents indicating the use of instructional videos for educational purposes.

Research Question 2

The second research question investigated was the following: *How frequently are teachers in grades K – 12 using instructional videos?* This question was of interest since the existing research did not indicate the frequency of use of instructional videos. Figure 9 below shows the results for frequency of use.

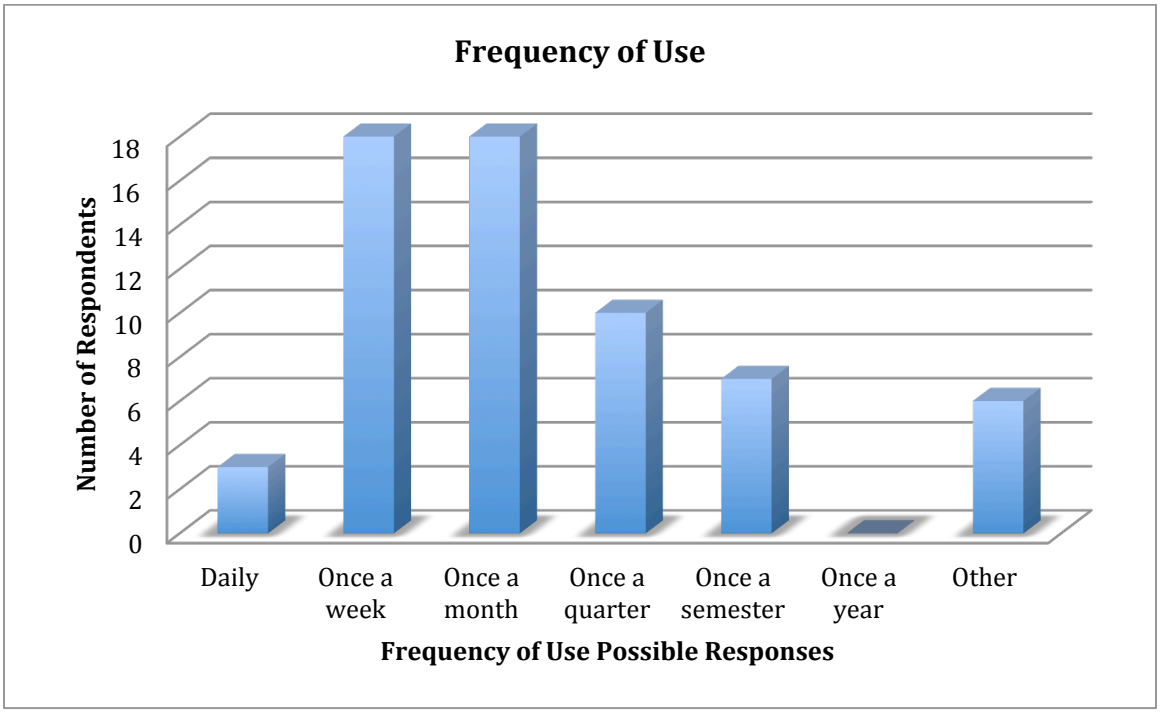

Figure 9. Frequency of use. Responses to survey question 3, *n* = 62: *How frequently do you use instructional videos*?

Teachers who reported using instructional videos daily were 5 % or 3 of the respondents. Twenty-nine percent or 18 teachers reported using videos once a week, 29 % or 18 respondents reported the use of instructional videos once a month, 16 % or 10 teachers indicated once a quarter, 11 % or 7 teachers selected once a semester, and 10 %

or 6 teachers reported a time other than those mentioned above. Of this 10 %, two participants wrote in that they use instructional videos two to three times a month, three participants wrote twice a month, and one reported the use of instructional video technology as appropriate to the lesson topics. These results indicated that educators who used instructional videos were using the videos frequently.

Along with frequency of use, also helpful for answering research question 2 was the investigation into how many different video titles were used. The number of video titles used varied from a range of 1 through 5 to 200. Figure 10 displays the responses by range of number of videos used.

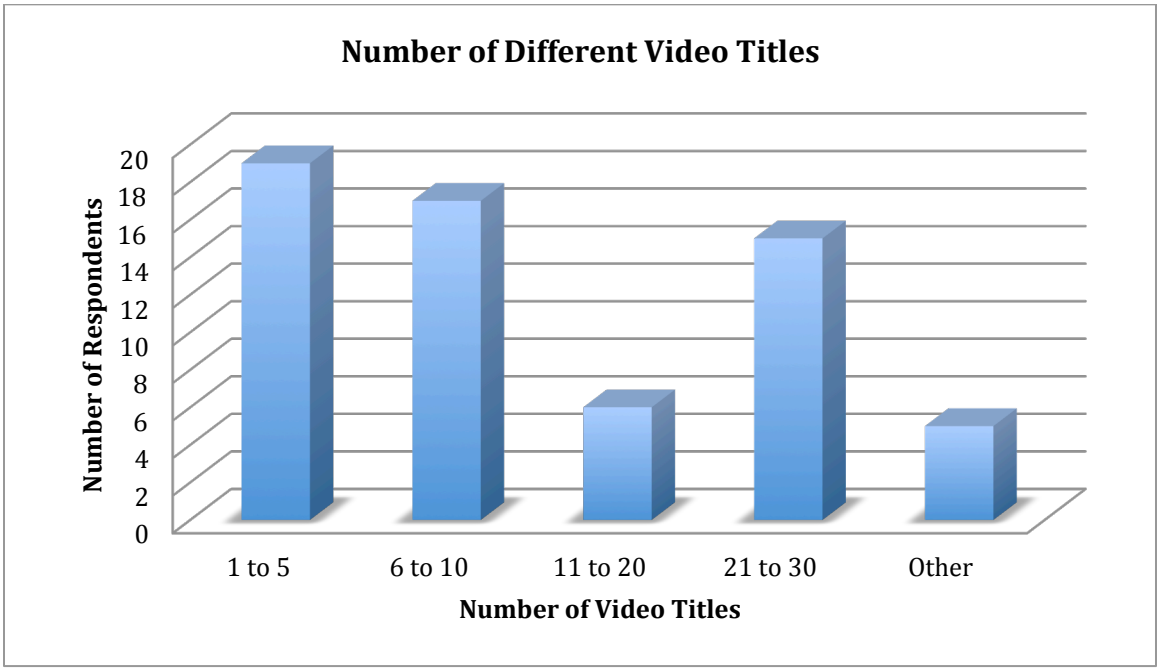

Figure 10. Number of different video titles. Responses to survey question 4, n = 62: *Approximately how many different video titles do you use in one academic year*?

Nineteen respondents or 31 % had 1 to 5 video titles, 17 or 27 % collected 6 to 10 video titles, 6 or 10 % had 11 to 20 different videos, 15 or 24 % collected 21 to 30 video titles, and 5 or 8 % reported in the *other* category. Write-in responses for the *other*

category included 50 clips, more than 30, and 200. These results showed a noteworthy collection of instructional videos by educators that could indicate a time commitment toward finding and selecting appropriate instructional videos on the behalf of the instructors.

A relationship existed between how frequently teachers used instructional videos and the approximate number of different video titles that were used. The cross tabulation statistical test was used in the Qualtrics Online Survey Software to identify the relationship (© Qualtrics Labs, Inc. 2015). The software was used to analyze the relationships between two different variables on the survey.

The analysis of the data included the chi-square test to determine the statistical significance of the cross tabulations done on the data. A *p*-value was calculated for each cross tabulation and *p*-values of less than 0.05 were considered to be significant. If the *p*-value was greater than 0.05, the relationship was considered to be not significant. This cross tabulation statistical test indicated that a significant relationship, $p < 0.01$, existed between the frequency with which teachers used instructional videos and the number of different video titles that were used. Table 1 below shows a cross tabulation of these results.

Table 1

Cross Tabulation of the Relationship Between How Frequently Teachers Used Instructional Videos and the Approximate Number of Different Video Titles That Were Used in One Academic Year

		How frequently do you use instructional videos?						
		Daily	Once a week	Once a month	Once a quarter	Once a semester	Once a year	Other
Approximately How many different video titles do you use in one academic year?	1 to 5	0	1	1	9	7	0	1
	6 to 10	0	1	13	1	0	0	2
	11 to 20	0	3	3	0	0	0	0
	21 to 31	2	10	1	0	0	0	2
	Other	1	3	0	0	0	0	1

Note. $n = 62$
p-value significant at $p < 0.01$ level
Chi-Square 79.613, degrees of freedom 24

Based on these results, teachers who showed videos frequently also had a larger collection of different video titles than teachers who did not show videos as frequently. This indicated that those teachers who used videos frequently were using the practice with a variety of videos.

Research Question 3

The third research question investigated was the following: *In what ways are instructional videos being used in K – 12 classrooms?* This question was posed to provide educators with uses of instructional videos beyond those described in the research on flipped classrooms and online learning instructional practices. When asked which of the following describes the videos that you use and select all that apply, *worked example* was reported 25 times, *screen capture* was reported 12 times, *lecture* was reported 15 times, *demonstration* was reported 42 times, and the *other* category was

selected 19 times. Figure 11 below shows the results for the question pertaining to the type of videos used.

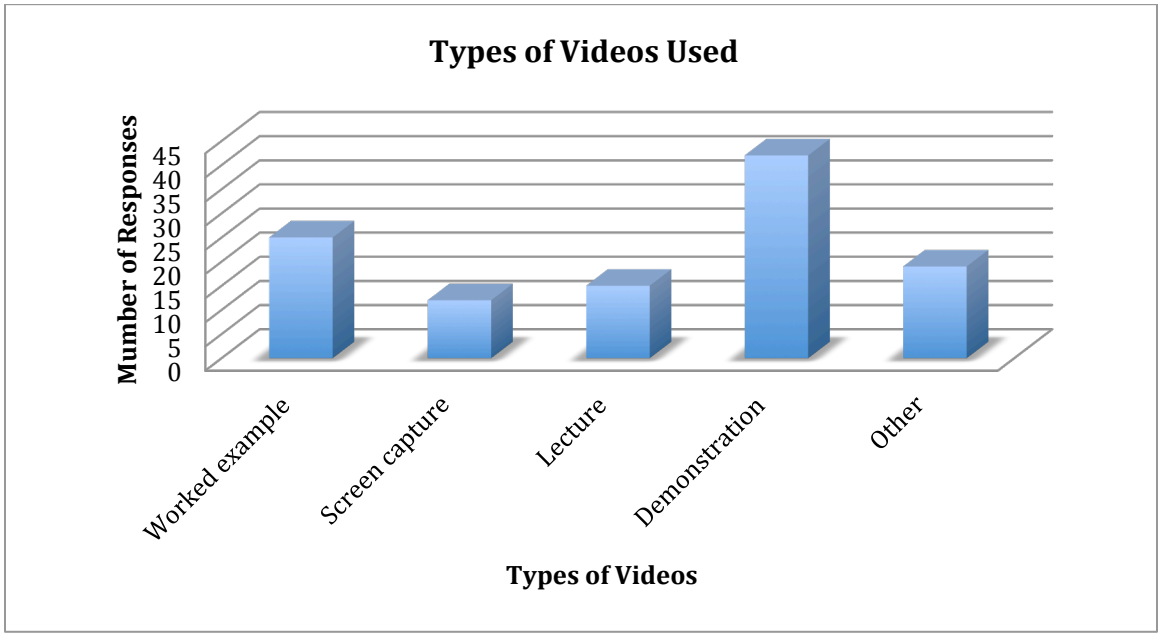

Figure 11. Types of videos used. Responses to survey question 5: *Which of the following describe the videos that you use? Select all that apply.*

Participants were able to select more than one option. The items written in for the *other* category included the following: videos that demonstrate a concept, informative background information on articles we read, documentaries, video recordings, language instruction and practice, animated stories, read aloud books, historical stories, newsreel, student generated videos, TV movies, feature films, YouTube clips, Brainpop, videos found online and imbedded into PowerPoint, real life examples, animation, literature videos, Reading Rainbow, videos with songs about a subject, and historical videos.

Also contributing to answering research question 3, *in what ways instructional videos are used in K – 12 classrooms*, was the survey item pertaining to instructional practices. This survey item stated: *The whole class views the videos at the same time*.

The researcher posed this question to determine whether or not students were viewing instructional videos individually or as an entire class simultaneously. The respondents were offered a 4-point scale to rate the statement to include *never*, *rarely*, *often*, and *always*. Thirty teachers responded that the whole class views the videos at the same time as *always*, and 30 teachers selected *often*. This left only 2 responses in the *rarely* category and none in the *never* category. Likewise, another survey item stated: *Students view the videos individually*. Twenty teachers responded with *never* and 31 indicated *rarely*. Nine selected *often*, and only 1 chose *always*. The responses for these two survey items are depicted in table 2 below.

Table 2

Responses to Survey Question 2, Sub Questions 1 and 2: Responses Pertaining to Students Viewing Videos Individually and as a Whole Class

Question	Never	Rarely	Often	Always	Total Responses (n)	Mean
The whole class views the videos at the same time.	0	2	30	30	62	3.45
Students view the videos individually.	20	31	9	1	61	1.85

Note. The number of respondents to the survey, $n = 62$, varies slightly in specific responses due to participants infrequently leaving selections blank.

These results showed that an overwhelming number of teachers presented instructional videos to the entire class simultaneously as opposed to using instructional videos for individual student use. The mean of 3.45 for the responses to the *views the videos at the same time* was calculated by assigning values to each possible option. The response *never* was assigned a value of 1, *rarely* was assigned a value of 2, *often* was

assigned a value of 3, and *always* was assigned a value of 4. The mean was calculated based on the responses in each category. A mean of 3.45 indicated that the average response was on the positive end being *often* or *always* as opposed to the mean of 1.85 for *students view the videos individually*, which was on the low end receiving more responses on the negative end of *never* or *rarely*.

Whether or not the students have prior knowledge in the subject area presented in the video also gives some insight into answering research question 3: *In what ways are instructional videos used in K – 12 classrooms?* Respondents were offered a 4-point scale for the statement: *The videos are used with students who have prior knowledge in the subject area*. Six teachers responded with *always*, 41 selected *often*. Fourteen participants chose *rarely*, and no one selected *never*. Responses were also collected for the survey item: *The videos are used with novice learners in the subject area*. Three educators reported *always*, 32 selected *often*, 24 chose *rarely*, and 2 indicated *never*. These results showed mixed uses of instructional videos with students who were novice learners and students who were experienced in the content areas. The mean score for each response indicated very little difference in the responses with 2.87 as the mean for the survey item *The videos are used with students who have prior knowledge in the subject area* and 2.59 as the mean score for *The videos are used with novice learners in the subject area*. Table 3 shown below summarizes these results.

Table 3

Responses to Survey Question 2, Sub Questions 17 and 18: Responses Pertaining to the Use of Instructional Videos With Students Who Have Prior Knowledge in the Subject Area and Students Who Are Novice Learners

Question	Never	Rarely	Often	Always	Total Responses (n)	Mean
The videos are used with students who have prior knowledge in the subject area.	0	14	41	6	61	2.87
The videos are used with novice learners in the subject area.	2	24	32	3	61	2.59

The survey item: *The videos are created by the teacher* was included on the survey to determine how often teachers created their own instructional videos as opposed to using instructional videos that were already created. Forty-seven percent or 28 teachers reported *never* creating their own instructional videos. Thirty-eight percent or 23 respondents indicated *rarely* creating their own videos. Twelve percent or 7 teachers *often* create their own videos while 3 % or 2 teachers *always* create their own videos. Based on these results, instructional videos that were already created were used much more often than videos that were created by the teacher.

Teachers were also asked the following question: *Have you ever received training related to the use of instructional videos?* Thirteen teachers or 21 % of the respondents selected *yes*. Forty-nine participants or 79 % of the respondents selected *no.* Since 85 % of the respondents reported using instructional videos, this low percentage of teachers who have actually received training on the practice was unexpected.

Various data were collected to answer the research question: *In what ways are instructional videos being used in K – 12 classrooms?* Demonstration type videos were reported as being used more than any other type of instructional video. Educators from this study reported showing the videos to the entire class simultaneously as opposed to having students view the videos individually. The use of videos with students who were novice learners as opposed to students having background knowledge in the content area were somewhat split in the responses. Videos appeared to be used with both groups of students. In addition to investigating the basic uses of instructional videos in the classroom, this study also delved into two specific uses of instructional videos that were reported extensively in the research provided in the literature review of this study. Those two practices were flipped classroom environments and online learning environments.

Research question 3 consisted of the overarching question: *In what ways are instructional videos being used in K – 12 classrooms?* Two subordinate questions were also asked. One of the subordinate questions was: *Are you using instructional videos in a flipped classroom environment? (A flipped classroom is one in which students watch videos for homework and engage in learning activities while in the classroom).* Because the research on instructional videos showed an extensive use of this technology in a flipped classroom setting, the researcher included a subordinate question on flipped classrooms. If respondents answered *yes* to the question indicating that instructional videos were used for flipping the classroom, then an additional request was presented asking the respondent to: *Please explain how you use the instructional videos in a flipped classroom environment*. Skip logic was used in Qualtrics to display the additional request based on the *yes* response to the original question (© Qualtrics Labs, Inc. 2015).

Respondents who selected *no* for the flipped classroom questions were not given the request to explain how the flipped classroom was used.

Eight percent of the teachers who were using instructional videos reported using the videos in a flipped classroom setting. Ninety-two percent of the teachers reported not using videos for a flipped classroom. This was an unexpected result considering the research that supports the flipped classroom instructional method. The 8 % of those who did use flipped classroom included 5 teachers. Four of the 5 participants expanded upon their use of flipped classrooms by reporting the following on how the videos were used in a flipped classroom:

- *I teach a lesson to my kids using the Promethean board, tape it and put it out on YouTube. The kids watch it at home and when they come into class the next day, they work in groups to complete activities that relate to the topic taught the night before.*
- *Students watch the lecture at home and then come in to complete activities and practice problems.*
- *I give the links out to the students so they can watch at home. This way when we have pull-out time for enrichment....the student can have support on their specific project. The videos provide the skill training for different computer software.*
- *All lessons were video recorded - demos, lecture, activities. Moodle is used to provide an easy platform to store all videos. Additional videos (not teacher made) are used to supplement teacher created videos.*

Online learning is another use of instructional videos reported in the research; therefore, respondents were asked a second subordinate question to research question 3:

Are instructional videos being used in an online learning environment? Similar to the first subordinate question, a skip logic parameter was placed on this question. If the response was *yes* then respondents were requested to: *Please explain how you use the instructional videos in an online environment.* If the response was *no* then the respondents were not given the request for more information on how instructional videos were used in online environments.

When asked if instructional videos were used for online learning, 77 % of the respondents selected *no*. Of the 13 educators who reported using instructional videos in an online platform, 7 included details on how the videos are used. Those responses are listed below:

- *We have embedded several short videos into our Moodle course. Some are to convey concepts, and some are to draw interest at the beginning of a unit.*
- *Short videos demonstrating a specific task or recipe.*
- *I purchase online learning for gifted support students and these online courses frequently include videos. We purchase courses for foreign languages not taught here as well as computer programming and AP courses.*
- *Video tutorials are used to teach concepts.*
- *Moodle - Same as regular classroom. I treat my face-to-face class as a hybrid (online-F2F combo) class.*
- *For my online classes for the county and my face-to-face courses at school, I have posted many instructional videos that help deepen the understanding of literature. Some videos explain the text.*
- *Links to videos are provided to the student.*

Two of the respondents referred to using videos for both online and face-to-face courses. These results reinforce the research that indicates that all students can benefit from using instructional videos (Tucker, 2012).

The two sub questions pertaining to flipped classrooms and online learning provided insight into the use of instructional videos in K – 12 classrooms and supported the existing research on these practices. However, the 8 % of teachers using flipped classrooms and the 23 % of teachers using online learning in this study were surprisingly low percentages considering the extensive research supporting both of these practices. These results provided a partial contribution toward answering research question number 3: *In what ways are instructional videos being used in K – 12 classrooms*?

The survey request: *Please explain any additional ways that instructional videos are used in your classroom* was posed to the participants with the intent to uncover additional uses for instructional videos in K – 12 classrooms. The responses to this statement provided extensive information, which went beyond the flipped classroom and online learning scenarios.

Inductive qualitative analysis was used to analyze the results of this open-ended request (Hatch, 2002). After reading the data multiple times, specific domains were identified. Within the domains, categories were established. Ultimately, 5 themes emerged from the categories. Initially, 22 domains were identified through careful and thorough reading and re-reading of the data. The 22 domains were then categorized into clusters of uses for instructional videos, which were identified as *after instruction, before instruction, individual needs, explore,* and *present.* Through additional analysis of the data with the identified categories, the 5 themes encapsulated the responses and

contributed to answering research question 3: *In what ways are instructional videos being used in K – 12 classrooms?* Those 5 themes were to *reinforce, motivate, meet student needs, use authentic content,* and *demonstrate.* The flowchart displayed in Figure 12 below details the domains, categories, and themes that evolved through the data.

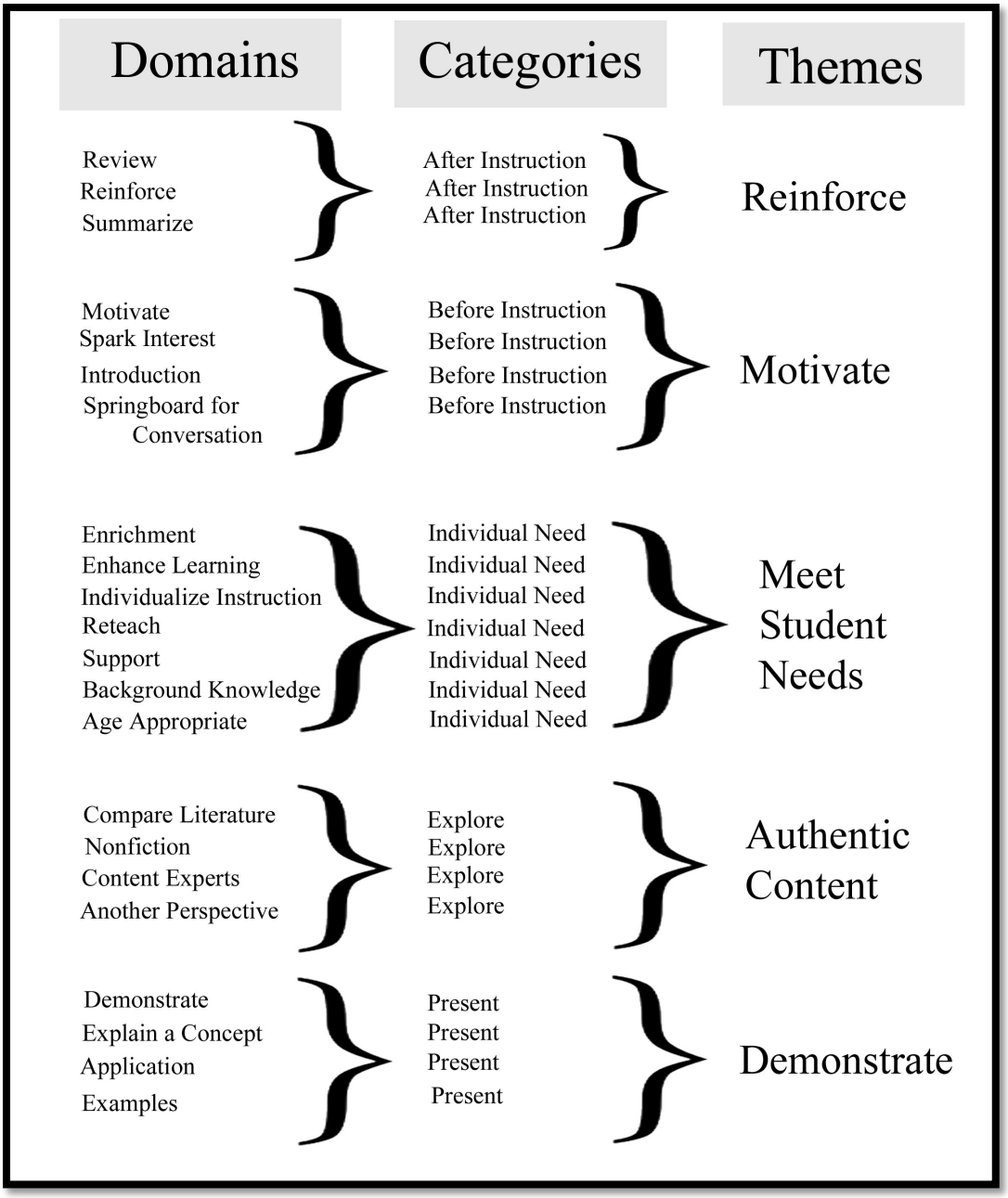

Figure 12. Qualitative analysis of the data from survey request 14: *Please explain any additional ways that instructional videos are used in your classroom.*

The theme *reinforce* was represented in the data by teachers making statements such as, "I use them as reinforcement for concepts I teach," "To review a skill," "For review before tests," "Reinforce complex scientific concepts," and "To sum up material."

The theme *motivate* emerged from the data through comments from teachers such as, "Videos are used to provide examples, create interest, and motivate the students," "I use them to spark an interest in a topic," "To help the class better remember a skill," and "I sometimes use whole or pieces of regular entertainment videos for instruction…springboards for conversation."

The theme *meet student needs* was evident through a variety of statements made by teachers. Remarks that supported this theme included the following: "The videos are used to support instruction for academic as well as social skills," "Support concepts with which some students struggle," "To provide alternate instruction," "Provide background knowledge before reading about an unfamiliar topic," "Students use the instructional videos for enrichment as well," and "…geared toward the middle school age group." The use of instructional videos to meet the needs of students was clearly evident through one participant's comment:

> Due to our schedule, students often miss class for other classes such as band section or the gifted program. The videos allow the students who have missed to gain the exact instruction as their peers by individually watching the same video. It also allows the students to be able to work at their own pace and still have instructional information available to them as they are ready for it.

These comments supported the use of instructional videos to meet the needs of students through individualized instruction and reteaching.

The theme *authentic content* became apparent through the inductive qualitative analysis of the data. Participants made comments such as, "Videos of college professors and content experts are used to enhance the learning experience," "I use videos that match a concept we are using. Many of them are cartoons with a nonfiction basis like Magic School Bus," "Show another perspective," "I use it to compare literary text to on-stage or on-screen interpretation. I use it to provide historical background to literature," "Sometimes we will use videos that are an extension of learning beyond an article that we are reading," "Most videos used are from an online database, 'Discovery Education United Streaming.' Some videos are standard DVD," and "We use the instructional videos available for Arts & Bots on the Birdbrain Technologies website." These comments provided support for the use of instructional videos to provide students with authentic, real-world concepts.

The theme *demonstrate* developed through various disciplines reporting the use of instructional videos for demonstration purposes. Comments made by participants included, "I only use instructional videos for demonstrating a certain art technique or process," "In order to demonstrate vocabulary," "Watch multicultural music and dances," "I sometimes use whole or pieces of regular entertainment videos for instruction, focusing on clips that demonstrate something related to the lesson or unit plan," "Videos are used to provide examples," "Application of course material," and "Mainly used for demonstration purposes of cooking and preparation techniques." One participant provided the following explanation of the use of instructional videos for demonstration purposes:

By showing a video on skill development (for swimming) it gives all students the same vantage point and allows the instructor to stop the video to explain key points of the swimming skills being developed.

Through inductive qualitative analysis, the researcher identified patterns in the data. Domains, categories, and themes captured the essence of how teachers used instructional videos in K – 12 classrooms. These overall themes showed that teachers used instructional videos to *reinforce, motivate, meet student needs, use authentic content,* and *demonstrate.*

Research Question 4

The fourth research question investigated was the following: *What are teachers' perceptions of the advantages and disadvantages of using instructional videos in the classroom?* The advantages were addressed first in the analysis of the data, and then the disadvantages were identified. The survey question: *What do you perceive as advantages to using instructional videos?* was posed to the participants with the intent to uncover the benefits that teachers perceived from the use of instructional videos.

The responses to this question provided extensive information that went beyond the current research on instructional videos. Inductive qualitative analysis was used to analyze the results of this open-ended question (Hatch, 2002). After reading the data multiple times, specific domains were identified. Within the domains, categories were established based on patterns that evolved from the data. Eventually, 6 themes emerged from the categories. The flowchart displayed in Figure 13 details the domains, categories, and themes that evolved through the data.

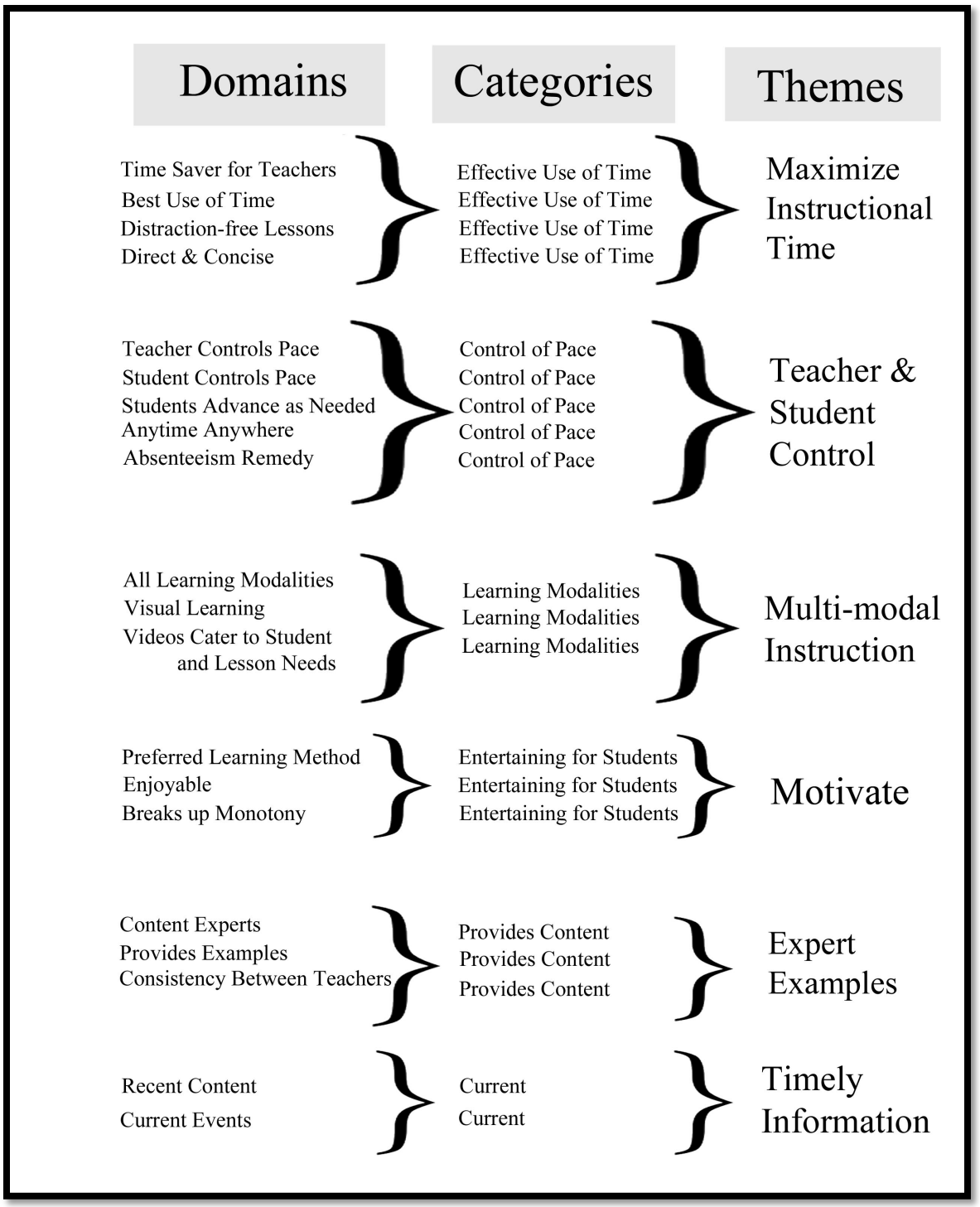

Figure 13. Qualitative analysis of the data from survey question 15: *What do you perceive as advantages to using instructional videos?*

First, 20 domains were identified through careful and thorough reading and re-reading of the data. The 20 domains were then categorized into clusters of perceived advantages to using instructional videos, which were identified as *effective use of time, control of pace, learning modalities, entertaining for students, provides content,* and *current information.* Through additional analysis of the data with the identified categories, the 6 themes captured the essence of the responses and contributed to answering research question 4: *What are teachers' perceptions of the advantages and disadvantages of using instructional videos in the classroom?* The 6 themes were *maximize instructional time, teacher and student control, multi-modal instruction, motivate, expert examples,* and *timely information.*

The theme *maximize instructional time* became apparent through comments from the teachers that were documented in the qualitative data. Teachers made statements referring to the efficient presentation of information through videos with comments such as, "They are a quick and easy way to demonstrate a skill for students" and "They are a direct, concise tool for explaining a procedure quickly and clearly." References were also made concerning the use of instructional time that connected to student and teacher interactions such as, "Better use of student contact time," and "It also allows for my time to be best used with aiding the students as they work, while the students who need the information presented gain that information from the video." One participant alluded to the time factor in that instructional videos "provide ways to demonstrate things in an easier way than having to collect or create materials myself."

The theme *teacher and student control* emerged from multiple comments by participants which indicated that controlling the pace of the videos, selecting excerpts,

and viewing videos anywhere and anytime were a significant advantage to using instructional video technology. Remarks referring to the benefits of students having control were made such as, "They can stop the video and replay certain steps," "Students can pause, rewind, and review the lecture as needed," "For students who grasp new skills quickly, they are able to move into their own project quickly," and "Kids can work at their own pace." The ability of students to view the videos anywhere and anytime became apparent as an advantage through comments such as "Students are able to review concepts if they were absent from class," "Students can watch them at home if they are absent or if they missed a concept," "That it creates a way for students to view and review the demonstrated information at their own pace and around their own schedule," and "If a student needs extra help, the videos are directed to provide that instruction." Teacher control also emerged as an advantage to using video as one participant indicated, "The videos from United Streaming allow me to show all or only a few clips, which is an advantage in the classroom and can be targeted to a specific skill." The participants saw various forms of student and teacher control as advantages of using instructional videos.

Multi-modal instruction emerged as a theme through the qualitative analysis process. Statements made by the participants included, "Using an instructional video allows you to hit all modalities for the students," "Great for both the visual and auditory learner," "I think it gives the students another way of receiving the information. They can see what I was talking about," "It gives the students another way to learn rather than direct instruction," and "Helps with the different modalities of learning." Comments were made concerning the advantage of students gaining a better understanding of the content because of the medium used. Participants stated, "Students can better visualize

concepts and see how they apply," "Another instructional tool with many visuals," "Things I can't do or show in class are available," "Students can better visualize concepts and see how they apply," and "…I can tailor them to the students' and lesson's needs."

Motivate was another theme that surfaced as an advantage to using instructional videos. Teachers referred to the instructional videos as, "More interesting than me," "When they are done well, video can really spark student interest," "Motivation, grasps attention," "The kids like using technology in class," and "Can be very entertaining and enjoyable to students."

A pattern also emerged within the *motivate* theme. Multiple comments were made alluding to technology being a preferred method of learning for students. One teacher wrote the following:

> A change in pace, the students don't often think of a lesson presented with a video as "work" so they are more attentive. Also, many students are very conditioned to watching a screen so they are more attentive.

Another participant experienced a similar response from students. This teacher indicated the following:

> The students are interested in videos. They would rather learn about a topic from a video than a teacher talking about it. The video incorporates music, visual images, and expertise that a teacher alone isn't able to provide.

Additionally, another participant expressed a similar response by stating, "Most of our students like watching TV or going to the movies or playing video games so this is a 'way in' to their usual way of experiencing information." Yet another teacher offered, "Students like videos, especially from TV shows and things they know."

Another pattern that evolved from the data in the *motivate* theme was that students are more likely to be on task when instructional videos are being used. Teachers made comments such as, "It gives the students a break from listening to their peers and teachers talk—they 'tune in' when it's time to watch a video and almost all students are on-task during that time," "Video engages the learner," "It allows for a distraction-free lesson or mini-lesson," and "Kids are so used to technology it keeps them interested."

The theme *expert examples* become apparent through the qualitative analysis of the data. Teachers offered advantages to using instructional videos in the classroom which included the use of videos featuring experts in the field of study as well as providing extensive examples beyond the confines of the classroom. For example, comments from participants supported this theme with remarks such as, "Students can be transported to other locations – like museums," "Videos bring experts into the classroom," "Content experts provide content that I cannot," "Utilizing real-life examples," "Another point of view and view for students to process understanding," "Additional examples are always helpful in instruction, and choosing a video to exemplify a skill can help all learners," and "Gives students another perspective on a skill/concept."

The final theme identified in the data concerning the teachers' perceptions of advantages to using instructional videos was *timely information*. Teachers identified the use of videos for current events and recent information to be advantageous. Statements that support this theme included, "Current information can be provided to students," "Integrating current events," and "Such videos provide an opportunity to expose the students to information that is critical to an upcoming investigation, etc."

Research question 4 was partially answered through the open-ended responses to the question: *What do you perceive as advantages to using instructional videos*? The themes that emerged through a thorough analysis of the data encapsulated the perception of the teachers in this study concerning the advantages toward using instructional videos. Research question 4 also included the need to identify any disadvantages that exist through the use of instructional videos. In order to uncover the disadvantages to using instructional videos, the participants were asked: *What do you perceive as disadvantages to using instruction videos?* The data reported for this question underwent inductive qualitative analysis (Hatch, 2002). The analysis resulted in 4 dominant themes related to disadvantages in using instructional videos to include *lack of access, full group viewing, lack of interaction,* and *learning barriers.* The domains, categories, and themes are displayed in Figure 14.

The theme *lack of access* was present throughout the data when respondents made statements related to the difficulties that occur from using or preparing to use instructional videos. Teachers reported the lack of access to equipment as a disadvantage through statements such as, "Lack of technology in the classroom so students have to watch while grouped," and "Some students do not have access to the Internet at home." Teachers also reported the lack of access to appropriate videos with comments such as, "Difficulty in finding modern, relevant samples to use, vehicle availability," "There are also not a selection of good puberty videos – they are pretty dated," and "Sometimes material becomes dated, and I am hesitant to use it – even if it is good information." Teachers reported the lack of access to the equipment for viewing the videos as well as the lack of access to appropriate videos.

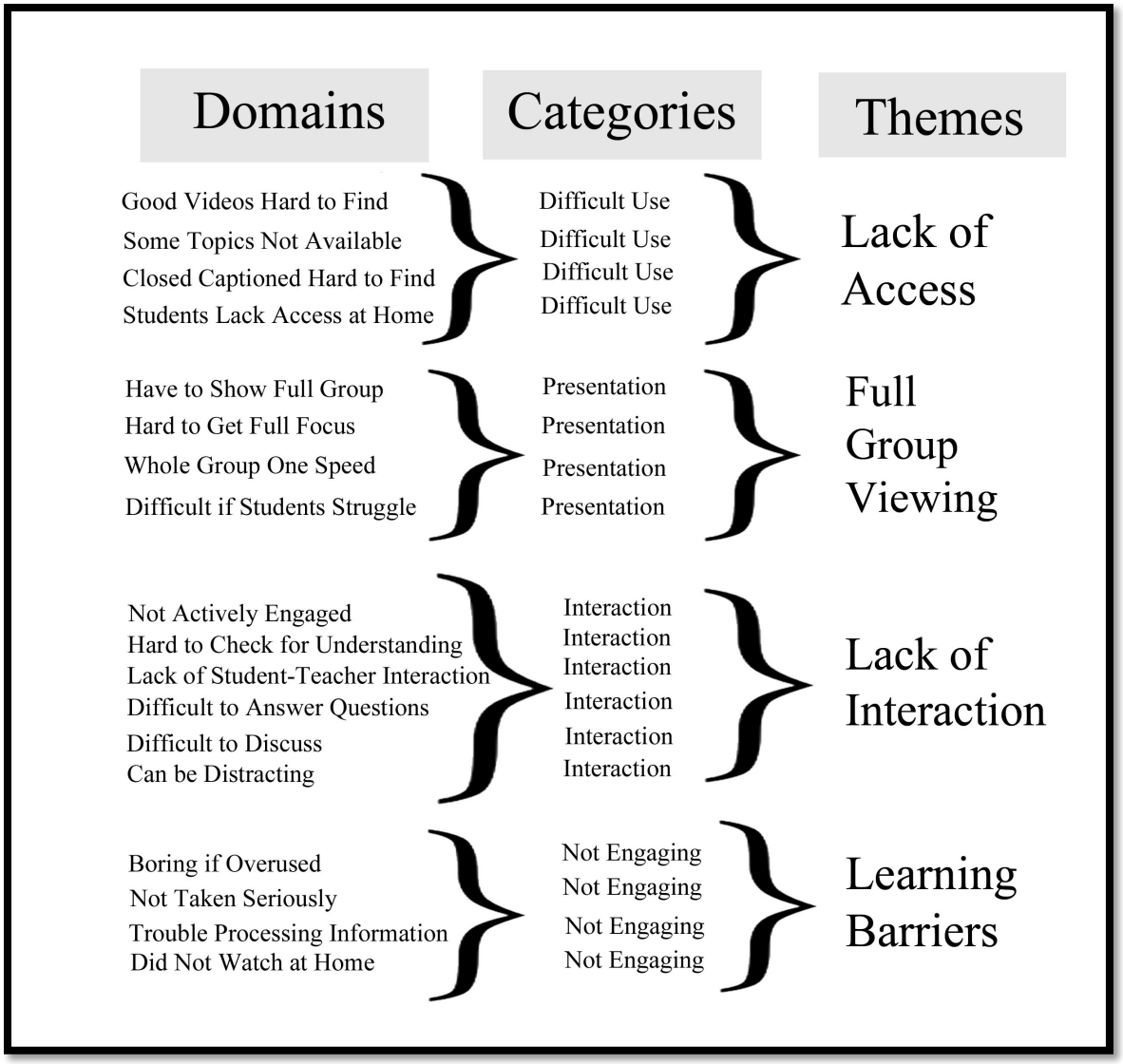

Figure 14. Qualitative analysis of the data from survey question 16: *What do you perceive as disadvantages to using instructional videos?*

The theme *full group viewing* emerged as a disadvantage to using instructional videos in K – 12 classrooms. Comments related to full group viewing as a disadvantage included the following: "Like any full group instruction method, it is hard to guarantee 100% focus of all students," "Students seem to struggle more with video instruction as a whole class," and "Disadvantages would probably be the fact that students need to watch the video at the same speed since it is a whole class viewing,"

The theme *lack of interaction* became prevalent in the data on disadvantages to using instructional videos. Disadvantages related to the lack of student interaction and student engagement were included in the data with statements such as, "Kids are not actively engaged," "It is difficult to make sure that all students are actively engaged," and "Lack of interaction to practice the language." Interactions between the students and teacher were reported as disadvantages when instructional videos were used with statements such as, "Sometimes it does not provide the student teacher interactions I like for my class dynamics," "They cannot respond to students' questions; an instructional video cannot be used alone," "Cannot discuss questions/concerns with students as they arise during the video," "Students are unable to ask questions if they are in an environment without the teacher," and "It is difficult to gauge if the student actually understood the information since direct teaching isn't happening." The following remark was made regarding the teacher and disadvantages to using instructional videos:

> I think it is a great way to demonstrate a task without actually having to demonstrate it yourself; however the disadvantage would be that students might relate to seeing their actual teacher doing the task more than a stranger.

Teachers also reported that parts of the video could actually lead to distractions to the learning process. Teachers stated, "Sometimes things in the video can distract from the learning that you want to take place," and "If not previewed before hand, they can create problems that are distracting to the learning process," and "Kids can goof around and not take them seriously."

The theme *learning barriers* became apparent in the data when teachers made statements regarding instructional videos as a hindrance to the learning process.

Teachers made specific reference to this form of learning as not appropriate for specific student needs with statements such as, "Some students can't process the information quickly enough when watching an instructional video," "Some are not close captioned for the hearing impaired," and "I have noticed that some of the struggling students seem to have trouble grasping materials from a video. These students seem to need one-to-one instruction from a teacher with them." Other learning barriers included how engaging the selections of videos were. Teachers responded with comments such as, "Boring, not all students learn from this medium," and "I think overuse of them can get boring for students." Another learning barrier included the need for students to watch the videos outside of class. Teachers expressed concerns by stating, "Some students who don't watch the video the night before do not have the information to do what they need to in class" and "If you don't show it in class, they may not watch it."

Research question 4: *What are teachers' perceptions of the advantages and disadvantages of using instructional videos in the classroom?* was partially answered through the survey question: *What do you perceive as disadvantages to using instructional videos*? The overarching themes that emerged revealed that teachers perceive *lack of access, full group viewing, lack of interaction,* and *learning barriers* to be disadvantages to using instructional videos in K – 12 classrooms.

Research Question 5

The fifth research question investigated was the following: *Do the instructional videos used in K - 12 classrooms meet the design recommendations set forth by the cognitive theory of multimedia learning?* This question was investigated to identify the

frequency with which instructional videos used in K – 12 classrooms met the expectations of the cognitive theory of multimedia learning.

Sixty-two respondents reported the use of instructional videos and completed the additional questions on the survey. However, a few individual respondents sporadically skipped one or two of the survey items concerning the specific design features of the instructional videos. Each survey item provided data that was independent of the other survey items. Because the statements were independent, the response to one statement did not impact the remaining survey items. Therefore, all of the data were included for analysis. As indicated in the forthcoming analysis, the number of participants was slightly less than 62 for some of the survey items.

Nineteen Likert style statements were included on the survey. Sixteen of these statements on the survey referred to the design characteristics of the instructional videos. Each statement was posed with the intent to uncover the use of specific design principles recommended by the cognitive theory of multimedia learning. Those principles included segmentation, pre-training, coherence, signaling, temporal contiguity, spatial contiguity, personalization, voice, politeness, and redundancy. Each of the 10 principles will be examined in turn, beginning with segmentation.

The segmentation principle of the cognitive theory of multimedia learning supports that people learn better when they have control over the pace of an instructional video (Mayer, 2009). The survey statement: *Students are able to control the pace of the videos with pause/play buttons,* was presented to the respondents. Fifty-one of the 61 respondents reported that students *never* or *rarely* have control over the pace of the instructional videos. Twenty-nine participants or 48 % responded with *never*, 22

teachers or 36 % selected *rarely,* 8 respondents or 13 % reported *often,* and 2 participants or 3 % selected *always.* These results showed that 84 % of the teachers who used instructional videos in the classroom did not or rarely offered the students the opportunity to control the pace of the videos. Figure 15 below displays the responses in all 4 areas of the Likert style responses.

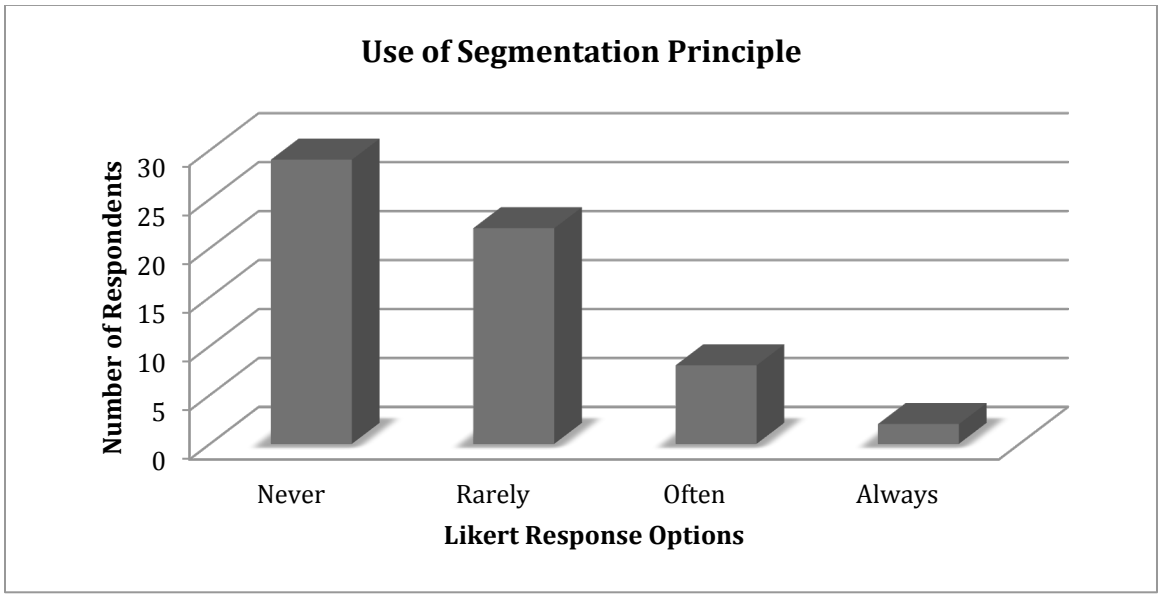

Figure 15. Use of segmentation principle. Responses to survey question 2, sub question 3, *n* = 61: *Students are able to control the pace of the videos with pause/play buttons.*

The mean and mode for each statement was analyzed to show measures of central tendency. Although the mean gave insight into the results, the mode indicated the response that received the most selections. The mode provided another method for statistical analysis of the results, which was valuable for analyzing the data.

A mean score of 1.72 for this survey item indicated that responses were on the negative end with many responses in the *never* and *rarely* category. The mode was 29 responses in the *never* category. Although research supports the use of segmentation for better learning through multimedia messages, an overwhelming number of participants in

this study did not provide the opportunity for students to control the pace of the instructional videos. Participants in this study were not following the cognitive theory of multimedia learning recommendation to allow students to control the pace of multimedia messages.

The pre-training principle includes the idea that multimedia messages will be more effective if the learner has knowledge of the major concepts and terminology prior to watching the video (Mayer, 2010). The pre-training principle refers to the process of providing students background knowledge on a topic prior to viewing an instructional video (Mayer, 2010). When teachers were given the statement: *General concepts and/or key vocabulary are taught prior to students viewing the videos,* 40 participants or 65 % of the 62 teachers responded with *often*. Fifteen respondents or 24 % responded with *always,* and 7 teachers or 11 % responded with *rarely.* None of the respondents chose *never.* Figure 16 below shows the responses from all participants for the question pertaining to the pre-training principle.

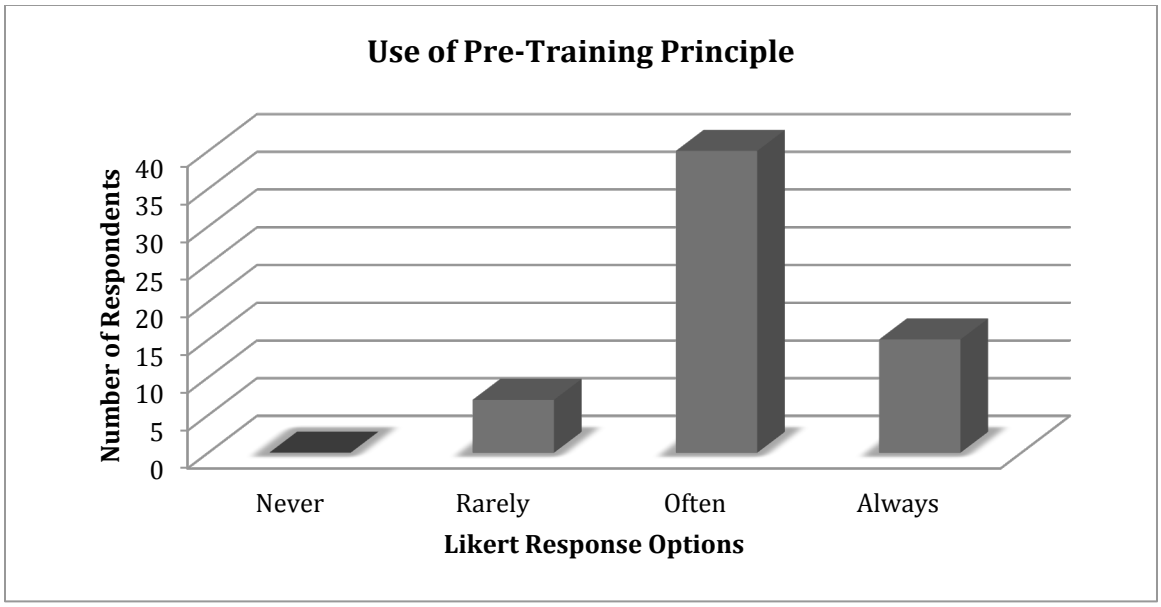

Figure 16. Use of pre-training principle. Responses to survey question 2, sub question 4, *n* = 62: *General concepts and/or key vocabulary are taught prior to students viewing the videos.*

The mean score of 3.13 showed responses on the positive end pertaining to the pre-training principle with teachers selecting *often* and *always.* The mode was 40 selections in the *often* category. These results showed that the teachers were practicing the pre-training principle as recommended by the cognitive theory of multimedia learning.

Participants were also presented with the statement: *The videos are used with students who have prior knowledge in the subject area.* Of the 61 respondents to this statement, 0 reported *never,* 14 respondents or 23 % indicted *rarely*, 41 teachers or 67 % stated *often*, and 6 respondents or 10 % indicated *always.* Figure 17 below summaries the results showing how frequently the students have prior knowledge in the content area.

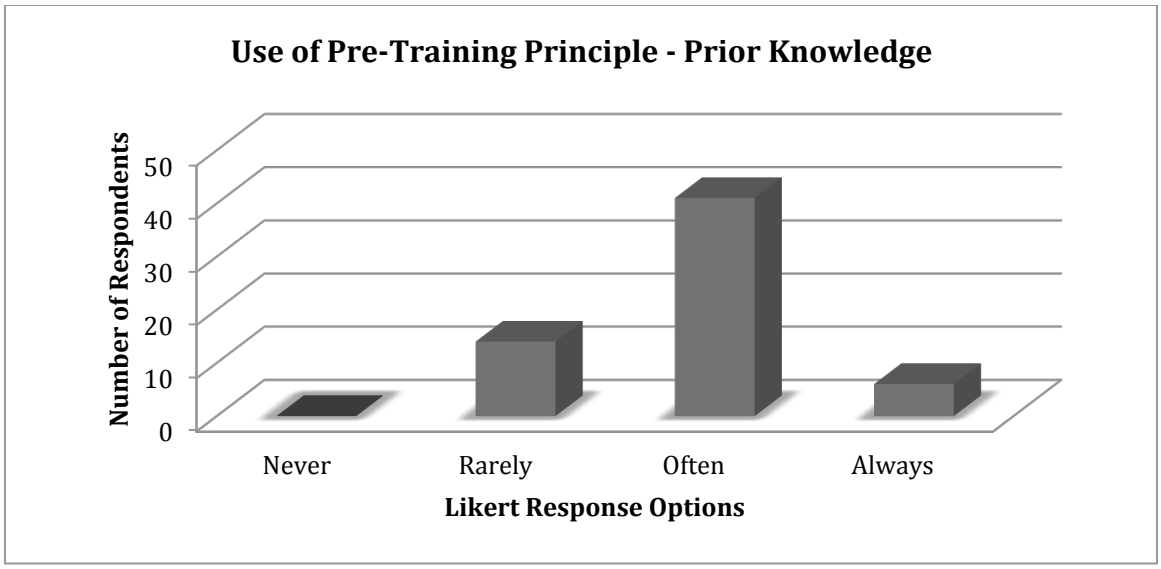

Figure 17. Use of pre-training principle – prior knowledge. Responses to survey question 2, sub question 17, n = 61: *The videos are used with students who have prior knowledge in the subject area.*

Participants were also given the survey item: *The videos are used with novice learners in the subject area*. The results showed that, of the 61 respondents, 2 participants or 3 % stated *never*, 24 teachers or 39 % indicated *rarely,* 32 participants or 53 % said *often*, and 3 teachers or 5 % responded *always*. Figure 18 below displays the data concerning the pre-training principle.

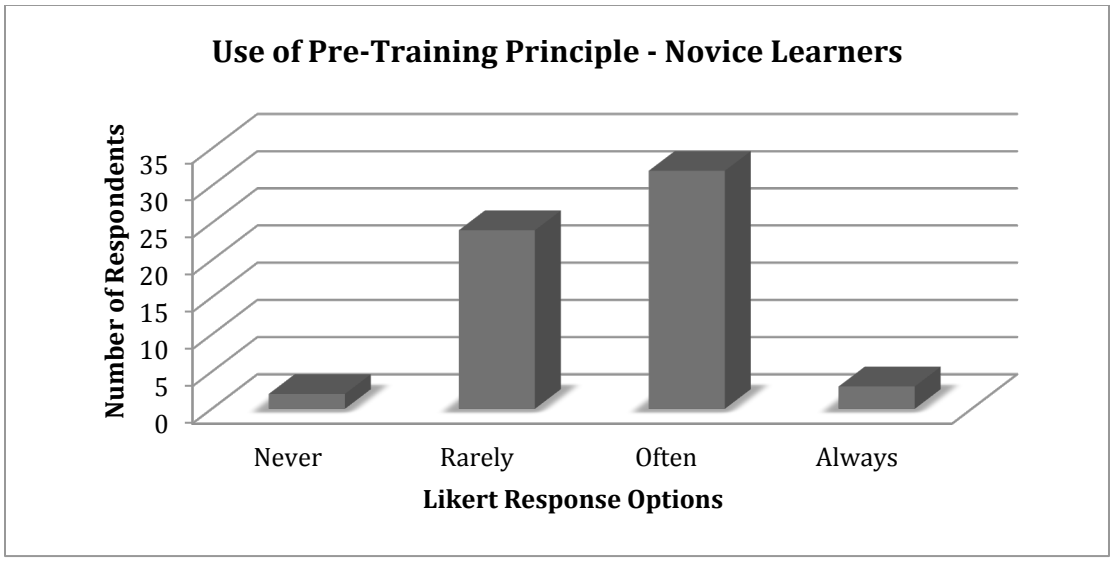

Figure 18. Use of pre-training principle – novice learners. Responses to survey question 2, sub question 18, $n = 61$: *The videos are used with novice learners in the subject area.*

The pre-training principle was investigated further with additional survey items concerning the use of instructional videos with students with prior knowledge in the content area and with novice learners in the content area. The means of 2.87 and 2.59 respectively indicated middle range responses in the *rarely* and *often* sections for both survey items. The mode, or most frequently selected option, for the statement concerning students having prior knowledge in the content area was 41 for *often*, and the mode for students being novice learners was 32 in the *often* category. However, the use of instructional videos with students with prior knowledge received positive responses more frequently than the use of instructional videos with novice learners. These responses indicated the need for additional support for the inclusion of the pre-training principle as recommended by the cognitive theory of multimedia learning.

The coherence principle refers to the inclusion of only relevant information and the exclusion of extraneous media in an instructional video as being beneficial for learning (Moreno & Mayer, 2000). The research supports that the extraneous media

actually hinders the learning process. To determine the frequency with which teachers use extraneous media in their instructional videos, the survey item: *Information that is NOT essential to the learning is included in the videos to add interest,* was included on the survey. Thirty-seven participants or 60 % of the 62 respondents reported *often*, 7 teachers or 11 % responded with *always*, 15 teachers or 24 % responded with *rarely*, and 3 participants or 5 % reported *never*. Figure 19 below depicts the responses from the participants to the survey item pertaining to the coherence principle.

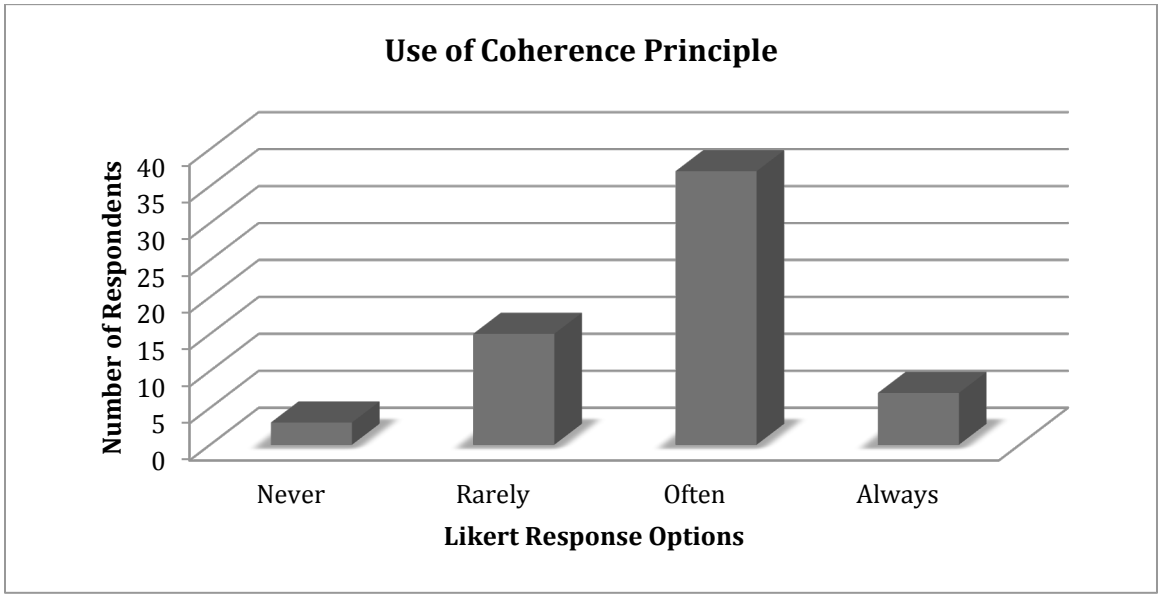

Figure 19. Use of coherence principle. Responses to survey question 2, sub question 5, *n* = 62: *Information that is not essential to the learning is included in the videos to add interest.*

When teachers include non-essential information in instructional videos to add interest or select videos with non-essential information, the videos actually hinder the learning process according to the coherence principle. The mean was 2.77 and the mode was 37 in the *often* category.

The results of this study indicated that 71 % of the respondent *often* or *always* included non-essential information in the videos to add interest, which indicated that the cognitive theory of multimedia learning's coherence principle was not being followed.

The signaling principle refers to the process of providing cues or highlighting information to make the information stand out as significant in a multimedia message (Mayer, 2010). The cognitive theory of multimedia learning supports the use of signaling to improve learning. The statement: *Cues such as changes in voice, highlighting, arrows, etc. are included in the videos to draw attention to important information* was presented to determine how frequently the signaling principle was used in instructional videos. Thirty-two respondents or 52 % reported *often,* 9 teachers or 14 % reported *always*, 16 teachers or 26 % stated *rarely,* and 5 respondents or 8 % reported *never*. Figure 20 below displays the responses from educators concerning the inclusion of the signaling principle in the design of instructional videos used in the classroom.

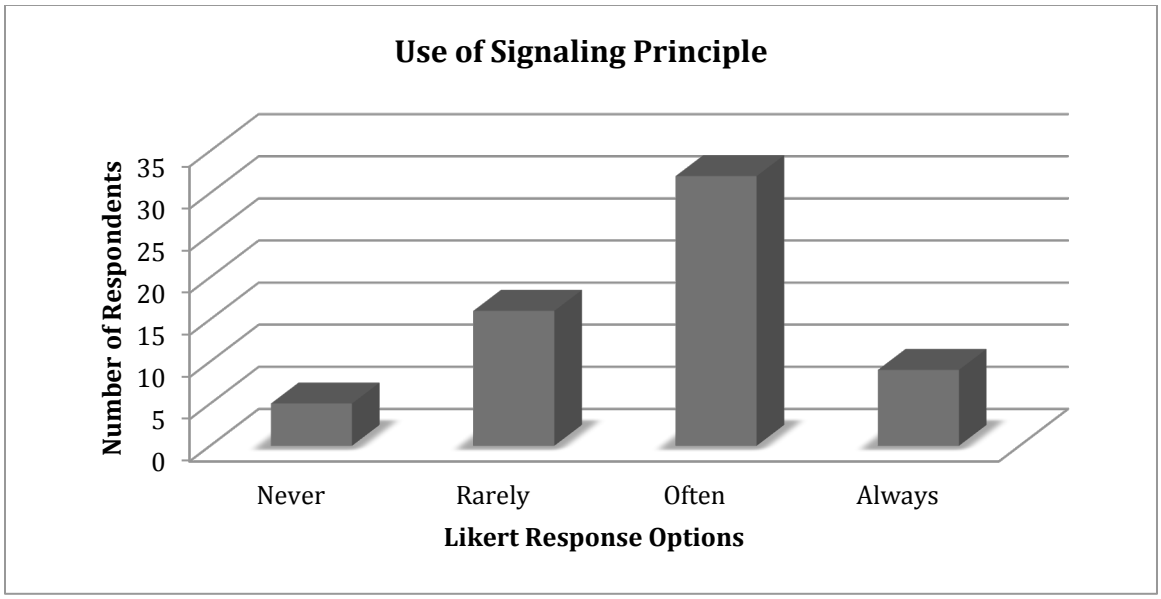

Figure 20. Use of signaling principle. Responses to survey question 2, sub question 6, *n* = 62: *Cues such as changes in voice, highlighting, arrows, etc. are included in the videos to draw attention to important information.*

The mean of 2.73 indicated that the responses to the survey item on signaling were toward the positive end with 66 % of the respondents reporting *always* or *often.* The mode was 32 responses in the *often* category. These results showed support for the signaling principle of the cognitive theory of multimedia learning since 66 % of the respondents in this study were adhering to the signaling principle of the cognitive theory of multimedia learning.

The temporal contiguity principle is an instructional video design principle that supports the idea that the presentation of visual elements and the spoken word should be done synchronously (Moreno & Mayer, 1999). The visual word should be presented as on-screen text simultaneously with the spoken word as narration (Mayer & Anderson, 1991). The survey item: *Text is included on the screen at the same time that a narrator is speaking* was included on the survey to determine how frequently the temporal contiguity

principle was present in the instructional videos that were used. None of the 62 respondents stated *always,* 23 teachers or 37 % stated *often*, 30 teachers or 48 % responded with *rarely*, and 9 participants or 15 % stated *never.* Figure 21 visually displays the results of the survey item designed to determine the use of temporal contiguity in instructional videos.

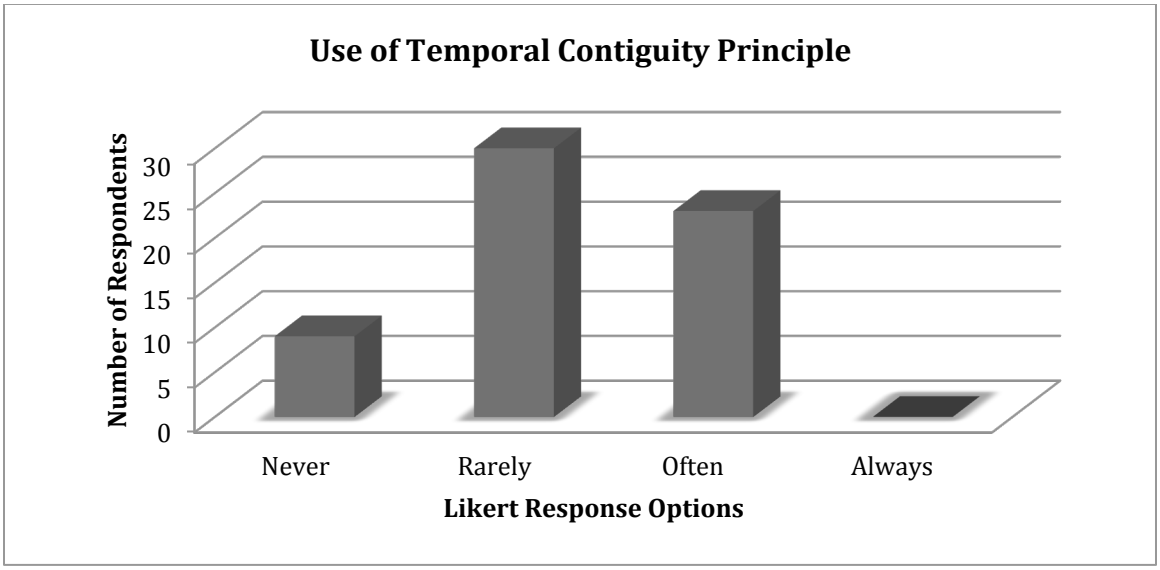

Figure 21. Use of temporal contiguity principle. The responses to survey question 2, sub question 7, $n = 62$: *Text is included on the screen at the same time that a narrator is speaking.*

The mean score of 2.23 indicated a slightly negative response to the survey item pertaining to the temporal contiguity principle. The mode was 30 responses in the *rarely* category. With 63 % of the respondents reported *never* or *rarely* to the simultaneous use of on-screen text and narration, the temporal contiguity principle was not well supported by the teachers participating in this study.

The spatial contiguity principle is an instructional video design principle that supports the idea that the presentation of text and graphics should be displayed in close proximity (Moreno & Mayer, 1999). In order to determine the frequency with which the

spatial contiguity principle was present in instructional videos used in K – 12 classrooms, the following survey statement was presented: *Text is included on the same screen as the picture or footage for which it applies.* Twenty-four of the 59 respondents or 40 % indicated *often*, 1 teacher or 2 % responded with *always*, 26 teachers or 44 % selected *rarely,* and 8 participants or 14 % chose *never.* Figure 22 shows the visual display of the responses pertaining to the spatial contiguity principle.

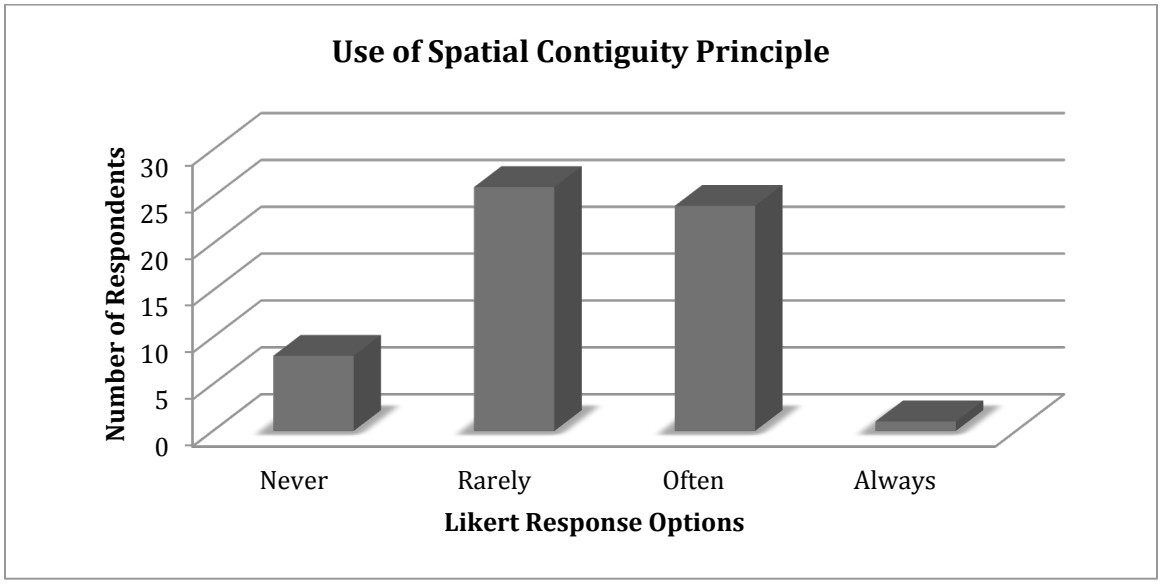

Figure 22. Use of spatial contiguity principle. Responses to survey question 2, sub question 8, *n* = 59: *Text is included on the same screen as the picture or footage for which it applies.*

The spatial contiguity survey item resulted in a mean score of 2.31, which showed no dramatic data one way or the other. The mode was 26 in the *rarely* category. Forty-two percent reported on the positive end with either *often* or *always* while 58 % reported either *never* or *rarely.* Teachers participating in this study used instructional videos that did not include the spatial contiguity principle more often than they did use this design recommendation. The spatial contiguity principle of the cognitive theory of multimedia learning was not strongly supported by these results.

The personalization principle is an instructional video design principle that supports the idea that when the narrator of an instructional video uses conversational style rather than formal style speech, students learn better (Mayer, 2009). To determine the frequency of the use of the personalization principle in instructional videos, the following survey item was included on the survey: *The voice of the narrator is personalized, such as using terms like "you" and "I" as opposed to third-person narration.* Of the 62 responses, 36 participants or 58 % stated *often*, 5 teachers or 8 % stated *always,* 20 respondents or 32 % said *rarely*, and 1 participant or 2 % indicated *never*.

The mean score of 2.73 showed responses on the positive end of the rating scale. The mode was 36 in the *often* category. Teachers reported using the personalization principle with responses of *always* and *often* 66 % of the time, thus using personalized instructional videos and supporting the cognitive theory of multimedia learning. Figure 23 shows the responses to the survey item referring to the personalization principle.

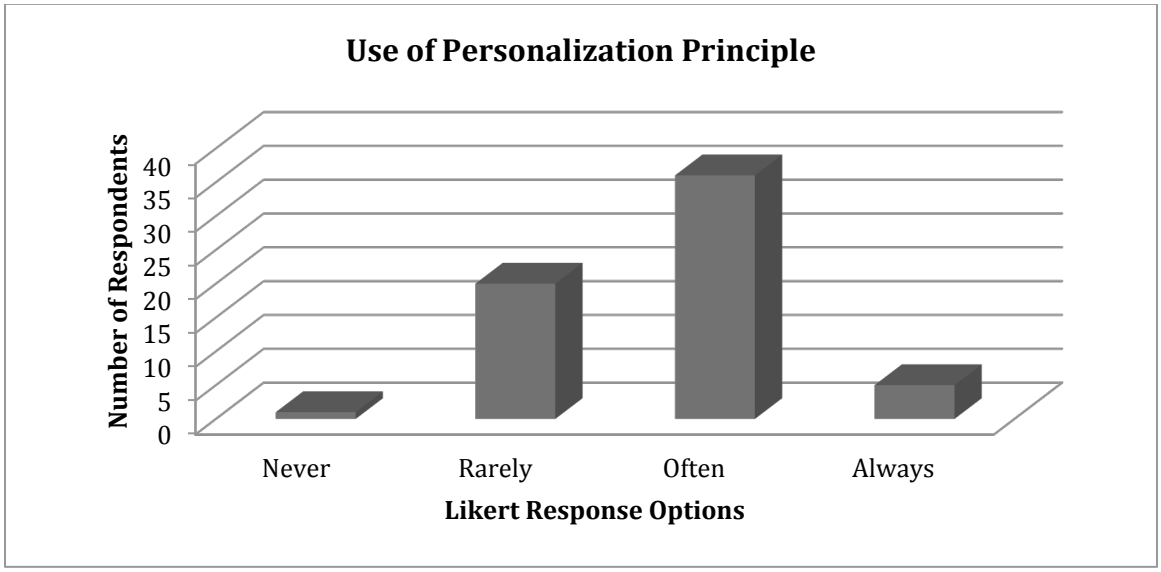

Figure 23. Use of personalization principle. Responses to survey question 2, sub

question 9, $n = 62$: *The voice of the narrator is personalized, such as using terms like "You" & "I" as opposed to third-person narration.*

The voice principle is an instructional video design principle that supports the idea that people learn better when the narration is done in a human voice rather than a computer-generated voice (Mayer, 2009). Two of the statements on the survey contributed to determining the frequency with which the voice principle was in effect in instructional videos. The statement: *The voice of the narrator is a computer-generated voice* was posed to determine how frequently the voice of the narrator did not meet the voice design principle. The statement: *The voice of the narrator is a human voice* was also addressed on the survey. Of the 62 respondents to the statement concerning the voice being a computer-generated voice, 0 said *always*, 1 teacher or 2 % said *often*, 20 participants or 32 % stated *rarely*, and 41 respondents or 66 % reported *never*. For the statement concerning the voice being human, 61 participants responded, and 40 teachers or 66 % stated *always*, 20 respondents or 33 % stated *often*, 0 stated *rarely,* and 1 participant or 1 % reported *never*. Figure 24 and Figure 25 below display the results of the survey item pertaining to the voice principle. The data for these two questions resulted in near mirror images, which showed reliable results from the participants.

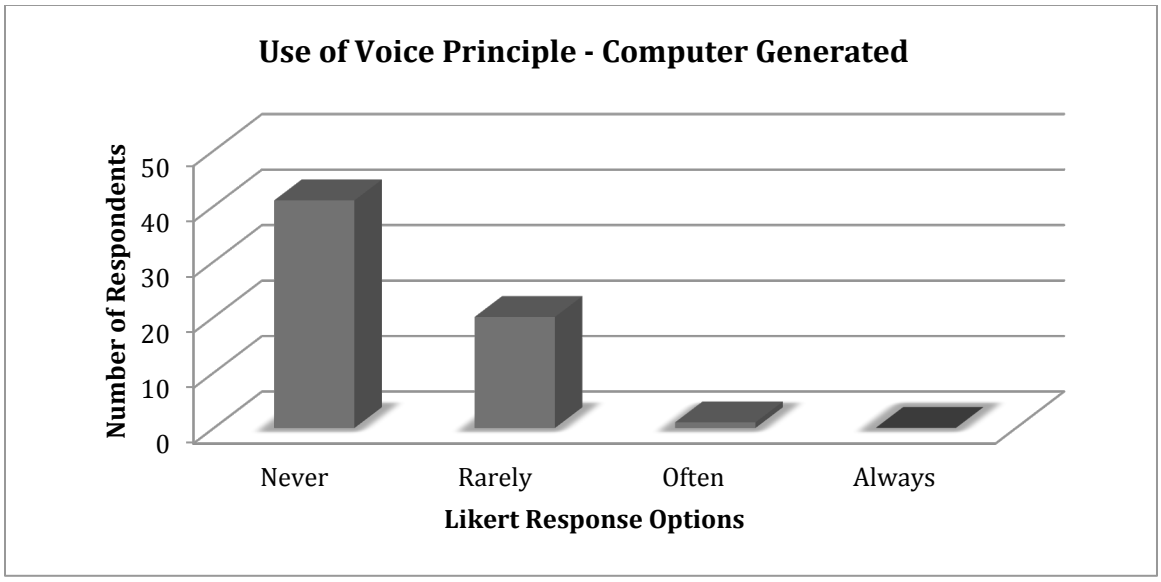

Figure 24. Use of voice principle – computer generated. Responses from survey question 2, sub question 10, *n* = 62: *The voice of the narrator is a computer-generated voice.*

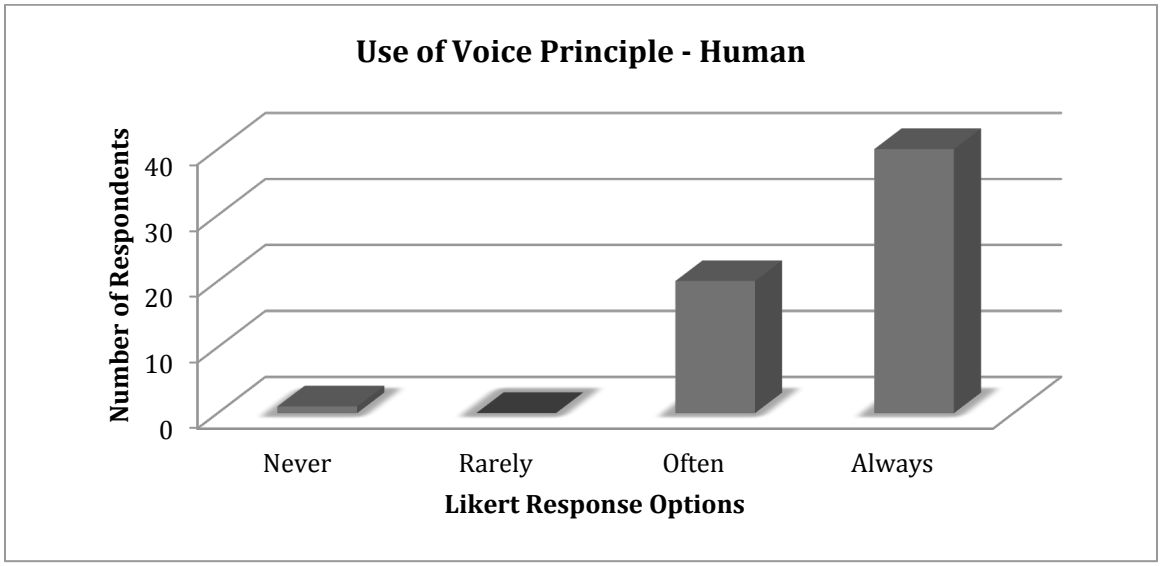

Figure 25. Use of voice principle – human. Responses to survey question 2, sub question 11, *n* = 61: *The voice of the narrator is a human voice.*

A mean score of 3.62 for the voice being that of a human and a mean score of 1.35 for the voice being computer generated showed a positive response for the use of a human voice and a negative response for the voice being computer generated. A mode of

40 in the *always* category for the voice being that of a human and a mode of 38 for the voice being computer generated in the *never* category also showed a positive response for the use of a human voice and a negative response for the voice being computer generated. An overwhelming 99 % reported the use of a human voice *often* or *always*. Respondents to this survey were clearly using instructional videos that adhere to the voice principle of the cognitive theory of multimedia learning concerning human voice versus computer-generated narration.

A relationship existed between the personalization principle and the voice principle concerning the use of a human voice over a computer-generated narration. A cross tabulation statistical test was used in the Qualtrics Online Survey Software to identify the relationship (© Qualtrics Labs, Inc. 2015).

A chi-square test of significance was used to determine the statistical significance of the cross tabulations. A *p*-value was calculated for each cross tabulation and *p*-values of less than 0.05 were considered to be significant. If the *p*-value was greater than 0.05, then the relationship was not considered significant. This cross tabulation statistical test indicated that a significant relationship, $p < 0.01$, existed between the personalization principle and the voice principle with the narrator being a human voice. The more often the narrator used personalized terminology the more frequently the voice was a human. Table 4 below shows a cross tabulation of these results.

Table 4

Cross Tabulation of the Relationship Between the Personalization Principle and the Voice Principle (human voice)

		The voice of the narrator is personalized, such as using terms like "you" and "I".			
		Never	Rarely	Often	Always
The voice of the narrator is a human voice.	Never	1	0	0	0
	Rarely	0	0	0	0
	Often	0	7	13	0
	Always	0	13	22	5

Note. For the human voice question, $n = 61$; for the personalization statement, $n = 62$.
p-value significant at $p < 0.01$ level
Chi-Square 63.80, degrees of freedom 9

Two additional survey items were posed that contributed to the voice principle. The cognitive theory of multimedia learning also supports that students learn better if the voice of the narrator is that of a familiar accent as opposed to a foreign accent (Mayer, 2010). The respondents were asked to respond to the survey item: *The voice of the narrator is that of a foreign accent or is unfamiliar to the students*. Respondents were also asked to respond to the statement: *The voice of the narrator is that of a standard accent or is familiar to the students.* For the statement concerning the narrator being foreign or unfamiliar, 38 respondents or 61 % chose *never*, 21 teachers or 34 % said *rarely*, 2 respondents or 3 % reported *often*, and 1 teacher or 2 % reported *always*. For the statement concerning the narrator speaking in a standard or familiar accent, 24 respondents or 39 % chose *always*, 32 teachers or 53 % selected *often*, 3 participants or 5 % said *rarely*, and 2 teachers or 3 % stated *never*. Figure 26 and Figure 27 displays the data regarding the voice principle design feature of a foreign accent versus a standard accent of the narrator.

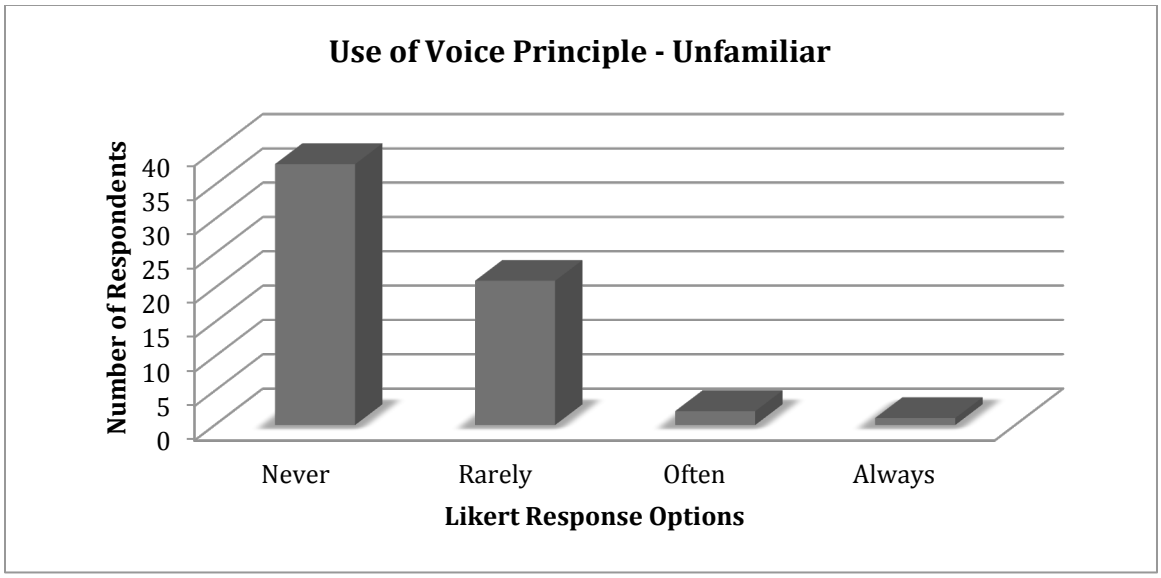

Figure 26. Use of voice principle – unfamiliar. Responses to survey question 2, sub question 12, *n* = 62: *The voice of the narrator is that of a foreign accent or is unfamiliar to the students.*

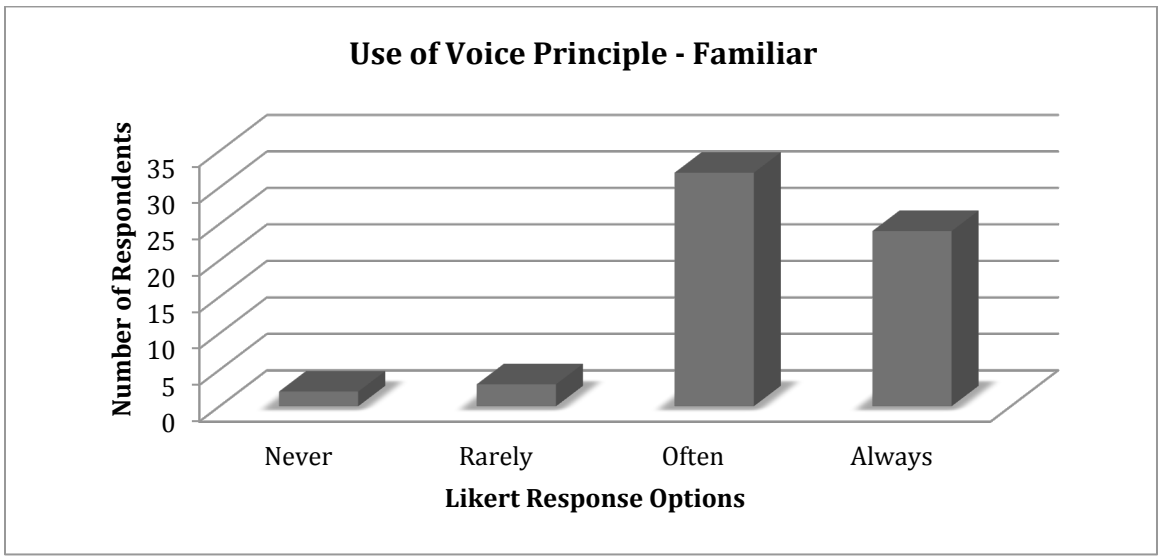

Figure 27. Use of voice principle – familiar. Responses to survey question 2, sub question 13, *n* = 61: *The voice of the narrator is that of a standard accent or is familiar to the students.*

The results of these two questions resulted in near mirror images, which showed reliable results from the participants. A mean score of 3.28 for the voice being standard

or familiar to the students and a mean score of 1.45 for the voice being foreign or unfamiliar to the students showed a positive response for the use of a standard or familiar narrator and a negative response for the voice being foreign or unfamiliar to the students. The mode for familiar voice was 32 in the *often* category and was 38 in the *never* category for unfamiliar voice. An overwhelming 92 % reported the use of a standard or familiar accent *often* or *always*. Respondents to this survey were clearly using instructional videos that adhere to the voice principle of the cognitive theory of multimedia learning concerning familiar accent narration versus unfamiliar accent narration.

A relationship existed between the personalization principle and the voice principle concerning the use of a familiar accent over an unfamiliar accent. The cross tabulation statistical test was used in the Qualtrics Online Survey Software to identify the relationship (© Qualtrics Labs, Inc. 2015).

The analysis of the data included the chi-square test to determine the statistical significance of the cross tabulations done on the data. A *p*-value was calculated for each cross tabulation and *p*-values of less than 0.05 were considered to be significant. If the *p*-value was greater than 0.05, the relationship was considered to be not significant. This cross tabulation statistical test indicated that a significant relationship, $p < 0.01$, existed between the personalization principle and the voice being a familiar voice to the students. The more often the narrator used personalized terminology the more frequently the voice was familiar to the students. Table 5 below displays a cross tabulation table of these results.

Table 5

Cross Tabulation of the Relationship Between the Personalization Principle and the Voice Principle (familiar accent)

		The voice of the narrator is personalized, such as using terms like "you" and "I".			
		Never	Rarely	Often	Always
The voice of the narrator is that of a standard accent or is familiar to the students.	Never	1	1	0	0
	Rarely	0	1	1	1
	Often	0	12	20	0
	Always	0	6	14	4

Note. For the standard accent statement, $n = 61$; for the personalization principle, $n = 62$.
p-value significant at $p < 0.01$ level
Chi-Square 39.14, degrees of freedom 9

The politeness principle is an instructional video design principle that supports the idea that when the narrator speaks politely, the learner feels more connected to the narrator and the learner feels more appreciated (Mayer, 2009). Two statements were presented on the survey that connected to the politeness principle. Respondents were asked to respond to the survey item: *The narrator speaks politely such as "let's complete a problem"*. Respondents were also asked to respond to the statement: *The narrator speaks directly or firmly such as "complete a problem"*. The responses to the statement regarding polite narration included the following: 20 participants or 32 % said *always,* 37 teachers or 60 % said *often,* 3 respondents or 5 % said *rarely,* and 2 teachers or 3 % replied *never.* The responses to the statement regarding direct narration included the following: 19 teachers or 31 % chose *never,* 34 respondents or 56 % chose *rarely,* 7 participants or 11 % said *often,* 1 teacher or 2 % replied *always.*

Figure 28 and Figure 29 show the results of the survey item concerning the politeness principle. The results of these two questions resulted in near mirror images, which showed reliable results from the participants.

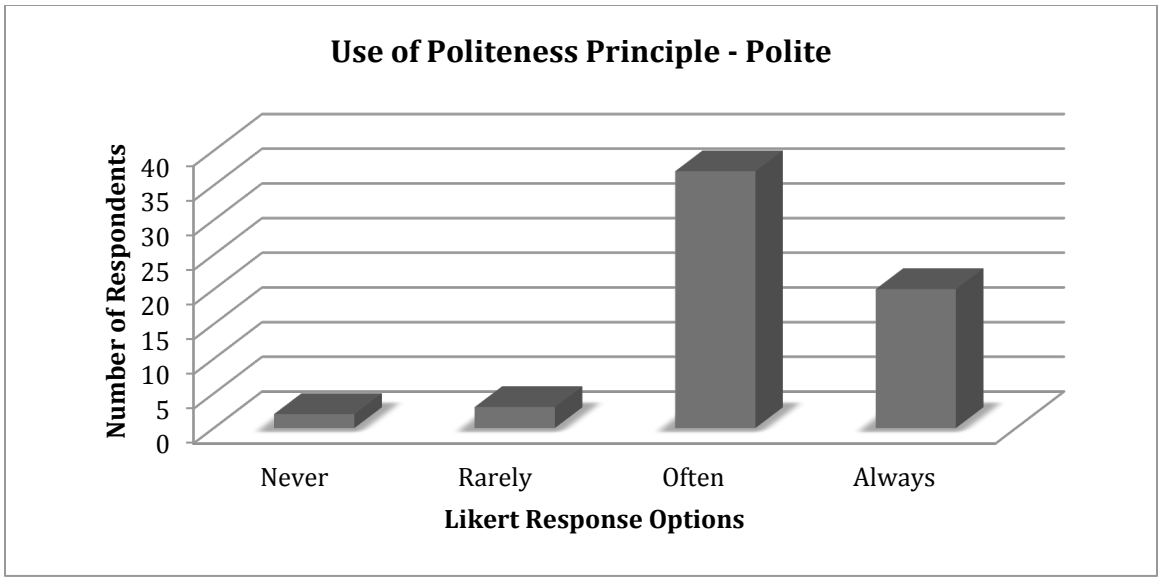

Figure 28. Use of politeness principle – polite. Responses to survey question 2, sub question 14, *n* = 62: *The narrator speaks politely such as "Let's complete a problem".*

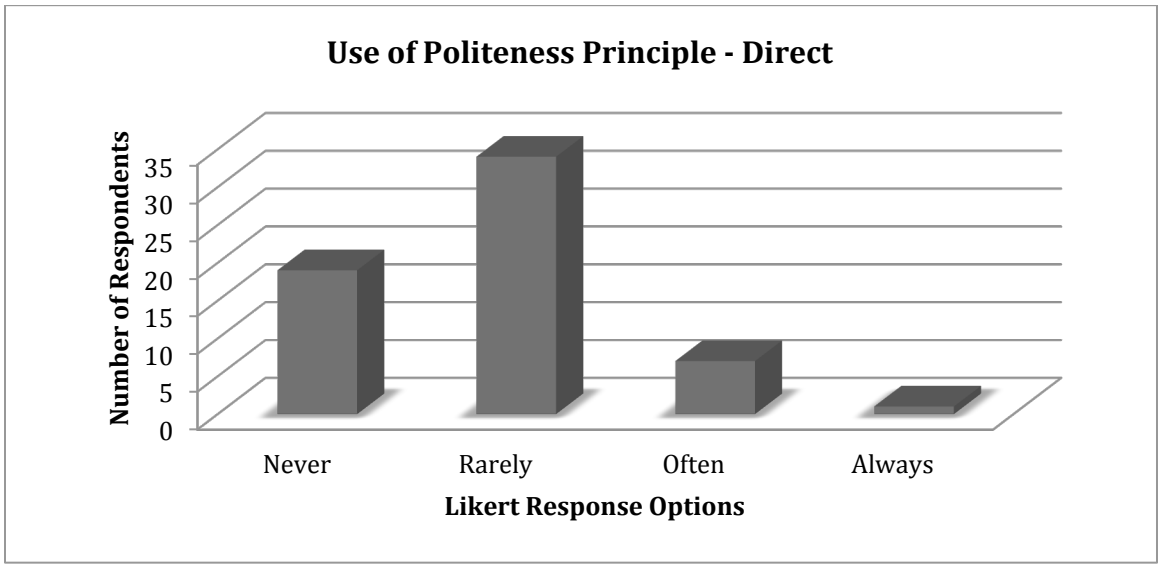

Figure 29. Use of politeness principle – direct. Responses to survey question 2, sub question 15, *n* = 61: *The narrator speaks directly or firmly such as "complete a problem".*

A mean score of 3.21 for the narrator speaking politely and a mean score of 1.84 for the narrator speaking directly showed a positive response for the use of polite narration and a negative response for the use of direct narration. The mode for speaking

politely was 37 in the *often* category and was 34 in the *rarely* category for speaking directly. An overwhelming 92 % reported the use of polite narration *often* or *always*. Respondents to this survey were clearly using instructional videos that adhere to the politeness principle of the cognitive theory of multimedia learning concerning polite narration versus direct narration.

A relationship existed between the personalization principle and the politeness principle concerning the use of personalized language and polite terminology. The cross tabulation statistical test was used in the Qualtrics Online Survey Software to identify the relationship as well as the significance level (© Qualtrics Labs, Inc. 2015).

The analysis of the data included the chi-square test to determine the statistical significance of the cross tabulations. A *p*-value was calculated for each cross tabulation and *p*-values of less than .05 were considered to be significant. If the *p*-value was greater than 0.05, the relationship was considered to be not significant. This cross tabulation statistical test indicated that a significant relationship, $p < 0.01$, existed between the voice of the narrator being personalized and the voice of the narrator being polite. The more often the narrator used personalized terminology the more frequently the voice was polite. Table 6 below shows a cross tabulation of these results.

Table 6

Cross Tabulation of the Relationship Between Personalization and Politeness Principles

		The voice of the narrator is personalized, such as using terms like "you" and "I".			
		Never	Rarely	Often	Always
The narrator speaks politely such as "let's complete a problem".	Never	1	1	0	0
	Rarely	0	2	1	0
	Often	0	12	25	0
	Always	0	5	10	5

Note. $n = 62$
p-value significant at $p < 0.01$ level
Chi-square 44.40, degrees of freedom 9

A significant relationship also existed between the politeness principle and the voice principle concerning the use of voice as a human voice and the voice being of a familiar accent. The cross tabulation statistical test was used in the Qualtrics Online Survey Software to identify the relationship and the significance level (© Qualtrics Labs, Inc. 2015).

The chi-square test of significance was used to determine the statistical significance of the cross tabulation. A p-value of less than .05 was considered to be significant. If the p-value was greater than 0.05, the relationship was considered to be not significant. This cross tabulation statistical test indicated that a significant relationship, $p < 0.01$, existed between the narrator speaking politely and in a human voice familiar to the students. The more often the narrator spoke politely the more frequently the voice was human and familiar to the students. Table 7 and table 8 below show cross tabulations of these results.

Table 7

Cross Tabulation of the Relationship Between the Politeness Principle and the Voice Principle (human)

		The voice of the narrator is a human voice.			
		Never	Rarely	Often	Always
The narrator speaks politely such as "let's complete a problem".	Never	1	0	0	1
	Rarely	0	0	2	1
	Often	0	0	16	20
	Always	0	0	2	18

Note. $n = 61$
p-value significant at $p < 0.01$ level
Chi-square 38.79, degrees of freedom 9

Table 8

Cross Tabulation of the Relationship Between the Politeness Principle and the Voice Principle (familiar)

		The voice of the narrator is that of a standard accent or is familiar to the students.			
		Never	Rarely	Often	Always
The narrator speaks politely such as "let's complete a problem".	Never	1	0	1	0
	Rarely	1	0	1	1
	Often	0	2	23	11
	Always	0	1	7	12

Note. $n = 61$
p-value significant at $p < 0.01$ level
Chi-square 29.65, degrees of freedom 9

The redundancy principle refers to cognitive overload that occurs when information is presented through narration, animation, and on-screen text (Moreno & Mayer, 2002). To determine the frequency of the redundancy principle in instructional videos in K – 12 classrooms, the survey item: *The video contains pictures/video footage AND on-screen text AND narration all simultaneously* was included in the survey. The results showed that, of the 61 teachers who responded to this statement, 9 respondents or 15 % reported *never*, 23 teachers or 37 % stated *rarely*, 25 teachers or 41 % said *often*,

and 4 respondents or 7 % reported *always.* Figure 30 shows a visual display of the data regarding the redundancy principle.

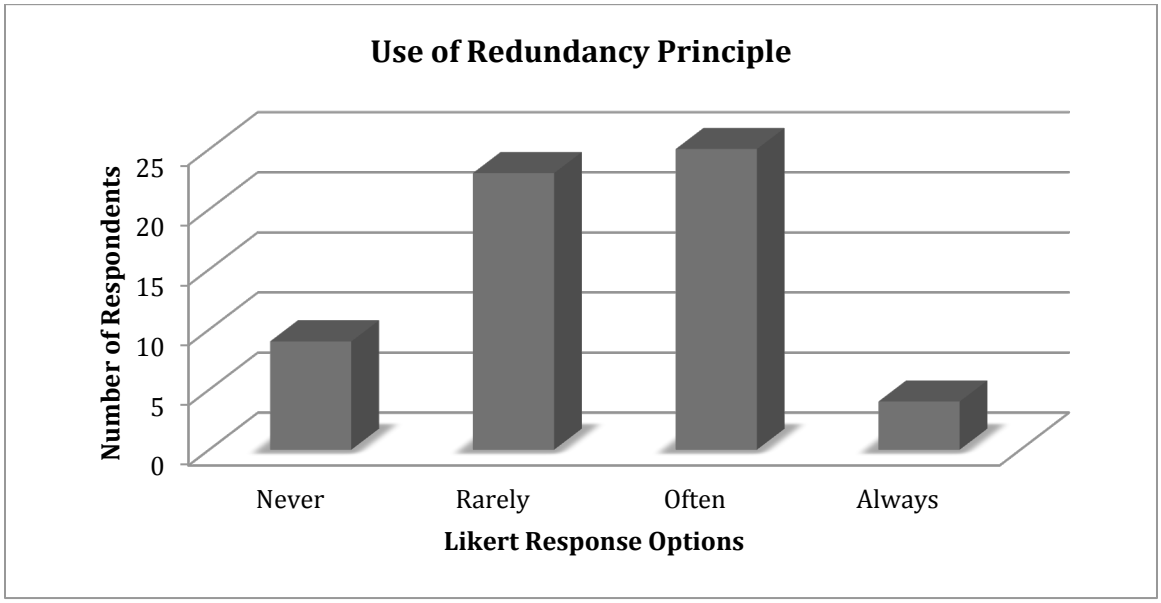

Figure 30. Use of redundancy principle. Responses to survey question 2, sub question 16, *n* = 61: *The video contains pictures/video footage AND on-screen text AND narration all simultaneously.*

A mean score of 2.39 showed a neutral response to the question pertaining to the redundancy principle. The mode was 25 in the *often* category. Respondents reported the use of the design characteristics that result in cognitive overload *never* or *rarely* 52 % of the time. Teachers also reported the use of the design characteristics that result in cognitive overload *often* or *always* 48 % of the time. Because more than 50 % of the responding teachers reported using various multimedia techniques simultaneously, they may believe that the use of these design features has a positive effect on learning. However, the research surrounding the cognitive theory of multimedia learning suggests that the simultaneous use of pictures/video footage, on-screen text, and narration results in cognitive overload. This overload leads to instruction that is less effective than when

the tools are not used simultaneously. These results showed that teachers did not adhere to the redundancy principle of the cognitive theory of multimedia learning.

A significant relationship existed between the redundancy principle and the grade level taught. Qualtrics Online Survey Software was used to identify the relationship as well as the significance level (© Qualtrics Labs, Inc. 2015).

The analysis of the data included the chi-square test to determine the statistical significance of the cross tabulations done on the data. A *p*-value of less than 0.05 was considered to be significant. If the *p*-value was greater than 0.05, the relationship was considered to be not significant. This cross tabulation statistical test indicated that a significant relationship, $p < 0.05$, existed between the grade level taught and the redundancy principle. Secondary teachers of grades 6 through 8 and 9 through 12 overloaded students with redundant information in the videos more frequently than elementary teachers of grades K - 5. Table 9 below shows a cross tabulation of these results.

Table 9

Cross Tabulation of the Relationship Between the Grade Level Taught and the Simultaneous Use of On-Screen Text, Pictures/Video Footage, and Narration

		What grade level do you teach?			
		Grades K–5	Grades 6 - 8	Grades 9-12	Other
The video contains pictures/video, text, & narration simultaneously	Never	2	2	4	1
	Rarely	14	10	2	0
	Often	4	10	13	0
	Always	1	2	1	0

Note. $n = 61$
p-value 0.01, significant at $p < 0.05$ level of significance
Chi-square 21.63, degrees of freedom 9

The design characteristics set forth by the cognitive theory of multimedia learning provide educators with empirically supported design recommendations for creating effective instructional videos (Mayer, 2009). Five of the 10 design recommendations analyzed in this study showed that educators used the recommendations more than 50 % of the time in the instructional videos either *often* or *always*. The other five were used less than 50 % of the time. Table 10 below summarizes the results of how frequently these design characteristics were implemented by educators in K – 12 classrooms. Table 10 includes the five design features that supported the cognitive theory of multimedia learning recommendations more than 50 % of the time.

Table 10

The Five Design Principles Set Forth by the Cognitive Theory of Multimedia Learning That Were Included in the Videos the Majority of the Time in Order of Most Frequently Used

Adherence to the Cognitive Theory of Multimedia Learning Design Principles		
Principle	Percent Responding with *Often* or *Always* (supporting the cognitive theory of multimedia learning)	Percent Responding with *Never* or *Rarely* (not supporting the cognitive theory of multimedia learning)
Voice	99 %	1 %
Politeness	92 %	8 %
Pre-training	89 %	11 %
Personalization	66 %	34 %
Signaling	66 %	34 %

Table 10 indicates that the cognitive theory of multimedia learning design recommendations were used the majority of the time with 5 of the 10 design features investigated. The other half of the design features were not used the majority of the time. The design features that were not used the majority of the time are included in Table 11 below.

Table 11

The Five Design Principles Set Forth by the Cognitive Theory of Multimedia Learning That Were Not Included in the Videos the Majority of the Time in Order of Most Frequently Used

Adherence to the Cognitive Theory of Multimedia Learning Design Principles		
Principle	Percent Responding with *Often* or *Always* (supporting the cognitive theory of multimedia learning)	Percent Responding with *Never* or *Rarely* (not supporting the cognitive theory of multimedia learning)
Redundancy	48 %	52 %
Spatial Contiguity	42 %	58 %
Temporal Contiguity	37 %	63 %
Coherence	29 % (never or rarely)	71 % (often or always)
Segmentation	16 %	84 %

The coherence principle survey item on the survey was worded so that the responses in the *often* and *always* categories indicated that the coherence principle was not being used. Likewise, the responses in the *never and rarely* categories showed support for the coherence principle. This was why the statistical analysis for the coherence principle was labeled differently from the other design principles in Table 11. When participants responded with *never* or *rarely* to the survey item, *Information that is NOT essential to the learning is included in the videos to add interest*, the coherence principle was being supported.

Summary

Chapter 4 presented the results of the study with a focus on answering the research questions of interest for this study. The results were included for both qualitative and quantitative data. Inductive qualitative analysis was used to analyze the qualitative data while descriptive statistics were used to analyze the quantitative data.

Chapter 5 includes a discussion of the results, conclusions, and recommendations for extending the research.

CHAPTER 5

KEY FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The objectives for this mixed-method study were to explore the uses of instructional videos in K – 12 classrooms, determine how often instructional videos were used in K – 12 classrooms, identify the percentage of teachers who used the tool, uncover teachers' perceptions of advantages and disadvantages to using instructional videos, and determine the effectiveness of the design of the instructional videos used in public schools. The literature review included in this study documented the use of instructional videos for online classrooms, for flipping the classroom, and for unique educational purposes revolving around the needs of individual students and programs (Beckwith & Cunniff, 2009; Brunsell & Horejsi, 2013; Hartland, Biddle, & Fallacaro, 2008; Herreid & Schiller, 2013; Pierce & Fox, 2012). Additionally, Dr. Richard Mayer's work surrounding the cognitive theory of multimedia learning provided empirical research to support the effective use of instructional videos in the classroom (Mayer, 2009). However, the actual use of these effective design features in K – 12 classrooms was unknown. The researcher was particularly interested in the effectiveness of the videos being used in classrooms now that Web 2.0 technology has made instructional videos more common for various learning environments (Sherer & Shea, 2011). This study is valuable because the educational landscape continuously evolves with advancements in technology.

The sample for this study consisted of teachers from grades K – 12 in two public school districts in southwestern Pennsylvania. An expert panel reviewed the researcher-created instrument and a pilot test was conducted, then the educators were invited to

complete an online survey. The response rate for the study was 23 % with 73 actual participants. The survey was designed to collect data that answered specific research questions. This chapter provides the findings from the study including the interpretation of the data for the purpose of answering the research questions.

Key Findings

Finding 1: Substantial Use of Instructional Videos

The first research question investigated the percentage of teachers who used instructional videos in grades K – 12. This question was important because the literature review conducted for this study revealed numerous uses of instructional videos in the classroom, but the available literature lacked any indication of just how many teachers in K – 12 educational environments actually use instructional video technology. The number of respondents who reported using instructional videos was noteworthy with 62 out of 73 participants, or 85 %, having used instructional videos. Only 11 or 15 % of the respondents indicated that they have not used an instructional video for educational purposes. This sizable response indicated substantial use of instructional videos by K – 12 teachers. These data helped to fill the gap in the research on use of instructional videos and revealed a snapshot of the percentage of teachers who used this instructional practice.

Finding 2: Frequent Use of Instructional Videos

The second research question investigated was designed to determine how frequently teachers use instructional videos. This question was of interest since the existing research did not indicate the frequency of use of instructional videos by teachers in K – 12 classrooms. Teachers who reported using instructional videos at least once a week comprised 33 % of the respondents. Thirty percent of the respondents reported

using instructional videos at least once a month. Sixteen percent reported the use of instructional videos every quarter while the remaining 21 % reported a variety of times for the use of instructional videos. These results indicated that educators who used instructional videos were using the videos often.

Along with frequency of use, also helpful for answering research question 2 was the investigation into how many video titles were used. The number of videos titles used varied from a range of one through five to 200. These results showed an extensive variety of instructional videos by educators. Noteworthy was the significant relationship that existed between the frequency of use and the number of video titles used at the $p < 0.05$ level. These results showed that teachers not only used instructional videos frequently, but also used a variety of different video titles. Interestingly, the participants in this study, although compiling an impressive collection of instructional videos, also reported that good videos were hard to find as a disadvantage to using videos under the theme of *lack of access*.

Finding 3: Uses of Instructional Videos

Extensive data were collected concerning practical uses of instructional videos in K – 12 classrooms. While some of the results mirrored the results of other researchers, additional findings also existed in the data. One of the uses of instructional videos that was apparent in the themes that emerged from the data was the use of instructional videos to *meet student needs*. Providing the high-achieving students with the opportunity to excel was an identified student need as well as a use for instructional videos. A specific need reported from one respondent was that instructional videos were advantageous, "for students who grasp new skills quickly, they are able to move into their own project

quickly." Tucker (2012) reported similar information in that instructional videos allow accelerated students to continue learning and growing specifically in a flipped classroom environment. Lewis (2007) suggested that high-achieving students were regressing toward the mean instead of accelerating because of the emphasis on standardized tests and the need to improve test scores for low-achieving students. Payne-Tsoupros (2010) offered caution to the educational community in that the closing of the achievement gap may actually be that the high-achieving students were regressing toward the mean instead of the low-achieving students improving. This study along with other literature suggested that instructional videos may assist accelerated students. The responses in this study supported the current research in that the use of instructional videos may help to meet the needs of high-achieving students.

Both this study and the existing research supported the use of instructional videos for students who struggle in the classroom (Brunsell & Horejsi, 2013; Tucker, 2012). The responses from this study under the *meet student needs* theme identified the use of instructional videos to support students who were struggling. Remediation and reteaching for students who struggle was well documented in the research as a use of instructional videos (Flumerfelt & Green, 2013; Giannakos, Chorianopoulos, Ronchetti, Szegedi, & Teasley, 2014; Herreid & Schiller, 2013; Tucker, 2012). Khan (2013) found that students were comfortable using videos because they were able to watch again and again the sections that were difficult for them without any embarrassment. This research, along with other literature, documents the use of instructional videos to support students who struggle in the classroom.

Additional research supports the theme of *meet student needs*, which emerged through the research question concerning uses of instructional videos. Comments made in the qualitative data for this study suggested that instructional videos offered students the opportunity for reteaching when students miss class for out-of-school absences as well as in-school absences. The existing research supported this use of instructional videos. Tucker (2012) discussed that the flipped classroom model was developed as a tool to assist student who were chronically absent but then it became an instructional method preferred by many students, not just students with attendance issues. Providing students with individualized instructional opportunities through the use of instructional video was supported in this study as well as in the research.

The current study contributed some additional ways to *meet student needs* that included the use of instructional videos to provide students with needed *background knowledge* and generally provided *support* for students who needed it. Although instructional videos received tremendous support from teachers in this study for helping students who struggle, some information was reported that opposes this thought. Teachers also reported in this study that using instructional videos with students who struggle was actually a disadvantage. Participants in this study reported that students who struggle often have difficulty with instructional videos citing that students may lack focus and often need to ask questions as the major downfalls.

The uses of instructional videos in a flipped classroom environment found in this study supported those uses reported in the research. Herreid and Schiller (2013) indicated that students were able to engage in classroom activities with the teacher after watching the instructional videos at home. Two of the respondents from this study made

reference to students being able to "complete activities", which was also found by other researchers (McCammon, 2011; Tucker, 2012). Tucker (2012) included that the flipped classroom model allows the teacher to work individually with students. This research also highlighted the ability for the teacher to support the students during the class period, which was reported in the research as well (Brunsell & Horejsi, 2013; Herreid & Schiller, 2013; Pierce & Fox, 2012; Tucker, 2012). One teacher reported in the qualitative data for this study the following explanation for the use of instructional videos:

> Due to our schedule, students often miss class for other classes such as band section or the gifted program. The videos allow the students who have missed to gain the exact instruction as their peers by individually watching the same video. It also allows the students to be able to work at their own pace and still have instructional information available to them as they are ready for it.

The qualitative data from this study as well as the research from the literature review for this study suggested that the use of instructional videos engages students, allows students to work with the teacher individually, and provides new learning for students when needed. The use of flipped classrooms was a dominant use of instructional videos in the research. However, this study revealed that although the practice is being used, only 8 % of the respondents reported using instructional videos for a flipped classroom environment. With an overwhelming 92 % of the respondents indicating that instructional videos were not used for a flipped classroom environment, the practice appears to be less common than would be expected since the practice is so well documented in the research. Although only a few teachers used instructional videos for

flipping the classroom in this study, those who did reported similar uses as those found in the research.

Motivate was another theme that emerged from the uses of instructional videos qualitative question in this study. Ellis (2011) reported that the multimedia effects included in instructional videos attract the attention of students even if the students were not interested in the content. Sever, Oguz-Unver, and Yurumezoglu (2013) reported that science students were drawn to the video stimulation, and the researcher observed highly motivated students when using instructional videos. Teachers in this study also revealed that instructional videos were used to motivate students as identified in the themes for uses of videos.

Online learning was reported in the research as an expanding and evolving instructional practice. Research indicated that online learning was a growing field (Giannakos, Chorianopoulos, Ronchetti, Szegedi, & Teasley, 2014; Ruth, 2012). Beckwith and Cunniff (2009) report that instructional videos were an instrumental part of an online learning environment. Researchers reported the increased implementation of online learning programs for reasons from convenience to credit recovery to social stigmas (Repetto, Cavanaugh, Wayer, & Liu, 2010; Roblyer, 2006; Smith & Smith, 2012). However, this research showed that only 23 % of the respondents used instructional videos for online learning purposes. Seventy-seven percent of the respondents reported that they do not use instructional videos for online learning environments. Given the research from the literature review for this study documenting increases in online courses, the low number of teachers using instructional videos for online purposes from the current study was unexpected.

This study revealed additional uses of instructional videos that were not documented in the literature and add to this field of study. The theme of *reinforce* was ever-present in the results of this research. Teachers reported that instructional videos were used frequently for review, reinforcement, and summarization after instruction. Another theme that emerged beyond the current literature was the use of instructional videos to *demonstrate*. Many of the websites that included instructional videos provided worked example videos, which demonstrate a specific skill. Demonstration was a use for instructional videos that dominated the qualitative responses from the teachers in this study. Teachers also expressed the value of *authentic content* for the use of videos in education in which content experts enhanced the learning process and took learning beyond the expertise of the classroom teacher. These findings contributed new uses for instructional videos to the literature for K – 12 classrooms.

Finding 4: Advantages of Using Instructional Videos

Many of the advantages to using instructional videos that were documented in the literature review were also identified by the participants in the current study. Research provided in the literature review for this study suggested that the use of instructional videos improved the time spent on task by students in various ways. One such practice included that students do not have to wait for instruction from the teacher when instructional videos were available (Ellis, 2011). More time was spent on task when students were engaged in self-directed learning (Giannakos, Chorianopoulos, Ronchetti, Szegedi, & Teasley, 2014; Sherer & Shea, 2011). Sever, Oguz-Unver, and Yurumezoglu (2013) also reported the use of instructional videos as a time saver since science videos could be used for direct and concise viewing of experiments that could be very time

consuming if done in class. The results of this study mirrored the existing research with qualitative data from educators that led to the themes of *maximize instructional time* and *teacher and student control.* Educators participating in this study made statements concerning keeping students on task by using instructional videos to advance students as needed. The domains that emerged from the *maximize instructional time* theme that matched the research included *best use of time, direct and concise,* and *distraction-free lessons.* These responses directly support the existing research.

The theme of *teacher and student control* that emerged from the advantages to using instructional videos also supported research provided in the literature review of this study. Teachers reported that the use of instructional videos allowed learning to occur anytime and anywhere as an advantage to using this instructional tool. Likewise, Ellis (2011) emphasized this same benefit, noting that students can engage in learning in "short bursts" when time is available at home, at school, or anywhere. This researcher suggested that the use of instructional videos allowed students to learn through the use of popular handheld devices. This medium took learning outside of the school walls, literally into the hands of the students.

According to Mills (2010), handheld devices and electronic resources were tools that *digital natives* preferred to use for learning. This study revealed that the electronic platform was the preferred learning methodology for students as well. Research suggested that multimedia messages accommodated the learning preference of today's students who have been exposed to multimedia extensively through both academic and personal use (Kay, 2014; Pai, 2014). Several researchers found that students preferred the convenience of digital learning (Herreid & Schiller, 2013; Pierce & Fox, 2012; Roehl,

Reddy, & Shannon, 2013). This study categorized the preferred learning method of digital learning in the *motivate* theme for the qualitative question concerning the advantages of using instructional videos. Comments from respondents in this study suggested that students in K – 12 environments prefer digital learning. Statements that support this stand include the following: "Most of our students like watching TV or going to the movies or playing video games so this is a 'way in' to their usual way of experiencing information," "Students like videos, especially from TV shows and things they know," and "A change in pace, the students don't often think of a lesson presented with a video as 'work' so they are more attentive. Also, many students are very conditioned to watching a screen so they are more attentive". Both the current study and the existing research suggested that today's students prefer digital learning.

Another advantage that emerged through the qualitative data in this study was the ability of the teacher to customize the videos to meet the needs of the students. This study revealed that teachers found the ability to edit videos as a benefit. Respondents reported that videos cater to student and lesson needs, which contributed to the theme of *multi-modal instruction*. Likewise, Sever, Oguz-Unver, and Yurumezoglu (2013) reported that the capability of the teacher to edit the instructional videos was advantageous since the videos may be edited in order to meet the needs of the specific group of students. The results from this study reinforced the existing research concerning the benefits to using videos that can be edited.

Timely information emerged as another theme in this study as an advantage to using instructional videos. This advantage was echoed in the research found in the literature review for this study as well. Pai (2014) reported that the timeliness of the

instructional videos available on YouTube and other websites including newscasts contributed to captivating, real-world applications for students.

Although many of the findings regarding the advantages of using instructional videos revealed support for the existing research on instructional videos, the results also contributed new information to this field of study. Additional advantages that surfaced through this research included the importance of using instructional videos to provide examples for the students, especially from content experts. Furthermore, the multi-modal advantages of using instructional videos allowed educators to accommodate the learning needs of students in all learning modalities. Teachers reported the benefit of videos creating consistency between teachers. Another common response included in the advantages of using instructional videos was to *break up the monotony*.

Finding 5: Disadvantages of Using Instructional Videos

Although the use of instructional videos presented many benefits for educational use, the respondents reported disadvantages to the practice as well. This study suggested that good videos were hard to find, which was reported through the *lack of access* theme. Herreid and Schiller (2013) also suggested that finding high-quality videos that were tailored to the needs of the students were difficult to locate. The *lack of access* theme also included that students do not always have access to the technology at home. Mills (2010) reported this same downfall to the use of instructional videos indicating that economic conditions hinder the ability of students and schools to access online multimedia content.

Another disadvantage was categorized under the theme of *learning barriers* was that students do not always watch the videos that are assigned for home viewing. Herreid

and Schiller (2013) reported this same finding as a limitation to using instructional videos. Some students were still coming to class unprepared by not watching the videos that were assigned for homework. The advantages to using the flipped classroom only occurred if the students were willing and able to watch the videos outside of class. This research further supported the already documented disadvantage of students not actually watching the videos.

This study identified similar findings of other researchers in the areas of high-quality videos were hard to find, lack of access to the technology, and students being unprepared for class by not watching the videos. Moreover, some disadvantages were reported beyond those already uncovered in the previous research. Perhaps the most frequently mentioned disadvantage reported from the qualitative question concerning disadvantages to using instructional videos was that the teacher was often forced to present the videos through *full group viewing.* Students were unable to view the videos individually due to the lack of presentation options such as individual devices. Therefore, many of the advantages to individual viewing were diminished when videos had to be viewed by the full group at the same time. Students were unable to control the pace through segmentation when the entire class was viewing at once. Additionally, students were unable to revisit confusing or difficult to grasp concepts if all students were watching concurrently. Teachers specifically reported that this method of presentation was often most difficult for students who struggle. The pace was reported as too fast and presented problems with students processing the information. Interestingly, whole class viewing was consistently reported as a disadvantage to the use of instructional videos.

Yet, 97 % of the responses to the survey item pertaining to how the videos were viewed showed whole group presentations being used *always* or *often.*

Teachers also reported disadvantages related to the theme of *lack of interaction.* Reported in the data were concerns around students viewing the videos outside of school when the teacher was not present. One concern was the lack of student-teacher interaction during the viewing, which would make it nearly impossible for questions to be answered when they arise and very difficult for the teacher to check for understanding. Teachers also reported in the *learning barriers* theme that students often did not take the videos seriously and were bored with this instructional practice if instructional videos were overused.

This research contributed additional disadvantages to the literature on the use of instructional videos in K – 12 classrooms beyond those already documented. These obstacles presented issues revolving around full group viewing, the absence of segmentation options, and the lack of student-teacher interaction.

Finding 6: Mixed Results on Use of Design Features

Some of the 10 design principles of the cognitive theory of multimedia learning were present in the instructional videos used in K -12 classrooms more than others. The design features that were identified by teachers as being present *always* or *often* in the majority of the videos were signaling, personalization, pre-training, politeness, and voice. The design principles that were reported as being present *never or rarely* less than 50 % of the time in the instructional videos included redundancy, spatial contiguity, temporal contiguity, coherence, and segmentation. The design principles in order from most used

to least used were voice, politeness, pre-training, personalization, signaling, redundancy, spatial contiguity, temporal contiguity, coherence, and segmentation.

The voice principle was used most frequently, which seems understandable considering that Web 2.0 tools have made the recording of a narrator's voice easy. Hardware and software readily available to educators today are typically equipped with voice recording capabilities allowing a human voice to prevail over the once common computer-generated voice.

Although it seems likely that individuals should have control over the pace of an instructional video, the segmentation principle was used the least often of all 10 design principles that were analyzed. The qualitative data in this study explained that this principle was not used because large groups of students watched the videos together due to the lack of resources. The ability to control the pace should, under ideal circumstances, be a design feature that improves student learning.

The coherence principle was one of the five design features used the least and supports the inclusion of only necessary sounds and visuals in instructional videos. Perhaps teachers believe that using multimedia tools that are unnecessary to the learning, such as background music and special effects, make an instructional video interesting and, therefore, more effective. This is possibly a misconception about the effectiveness of instructional videos and warrants further study.

Spatial contiguity and temporal contiguity were in the group of design principles used the least. Educators may be unfamiliar with these design principles considering training on instructional videos would likely need to be done to understand the need for

these two recommendations. Based on the results from this survey, teacher training on important design features of instructional videos is not a common practice.

Although extensive research presented in the literature review of this study suggested the importance of these design principles to maximize learning, no research was uncovered that actually sought to determine the actual use of these principles in K – 12 classrooms. This study contributed findings regarding the use of the design principles in multimedia content used in K – 12 classrooms in public schools.

Conclusions

This study sought to investigate the use of instructional videos in K – 12 classrooms. Surveying public school teachers served as the avenue to uncover the responses needed to answer the research questions. The data obtained from teachers in two school districts in southwestern Pennsylvania provided the information necessary to determine the percentage of teachers who used instructional videos, how frequently teachers used instructional videos, the ways that instructional videos were used, teachers' perceptions of advantages and disadvantages to using instructional videos, and the use of the design features set forth by the cognitive theory of multimedia learning in the instructional videos that were used.

The research questions were designed to investigate not only the problems that emerged due to the increased use of Web 2.0 tools in the educational community, but also to fill gaps in the research that also occurred as a result of the impact that Web 2.0 tools had on education. Because of the constant advances in technology, research continues to be necessary in the field of educational technology. The use of instructional videos is one such technical tool that has changed the educational landscape.

The results from this study provided the educational community with assurances that instructional videos are being used in K – 12 classrooms frequently and with great variation of video titles across grade levels as well as disciplines. This study identified advantages to using instructional videos yet also determined pitfalls that accompany this instructional method. After a deliberate investigation into the design features of instructional videos being used in classrooms, an abundance of data provided mixed results on the inclusion of effective design principles. Although this study provided many significant results for K – 12 educational communities, it could also serve as a catalyst for additional research.

Recommendations

This study raised questions that could be answered through additional research. Segmentation, or the ability of the viewer to control the pace of the video, was identified through the literature review for this study as a design principle that could improve learning through multimedia messages (Mayer, 2009). In order to have control of the pace of a video, a student must be viewing the video individually as opposed to a whole class watching simultaneously. Full group viewing limits the ability of the viewer to control the pace of the video. The qualitative data gathered from the participants in this study identified full group viewing as a disadvantage to using instructional videos but these same participants also reported using full group viewing in practice 97 % of the time either *always* or *often*. The respondents also indicated with an overwhelming response that students do not have the ability to control the pace of the videos. Some responses referred to the lack of resources as the cause. A future study could investigate

any additional reasons why teachers are presenting videos to the whole group even though they view this practice as a disadvantage.

Watching videos individually has benefits beyond the segmentation principle. Allowing students to control the pace of videos as well as watch videos on an as needed basis can easily be done when students have access to the technology and the classroom environment is designed for differentiated instruction. Students can work through projects both individually and collaboratively to meet curriculum guidelines. As students finish one activity, new learning can be gained through instructional videos and students continue to excel and advance to the next project. Such a project-based learning environment allows all students to thrive without individual differences, abilities, and experiences interfering with learning.

If a project-based learning environment is not practical for the content area, videos could also be used as a support system to help educators comply with the standards movement. Students viewing videos individually could assist educators in meeting the plethora of standards placed upon the educational community. Instead of continuing to reteach material that has already been presented, teachers could allow students to view videos on specific skills that have been either missed or not understood. Students could view instructional videos individually in order to meet necessary standards and prepare for mandatory testing.

Another question prompted by this study that could be further investigated is that teachers reported through qualitative data that good videos were hard to find, yet teachers reported having large collections of videos. Selecting instructional videos made by others requires extensive scrutiny by the educator to be sure that the videos are

appropriate. This practice requires a time commitment by the educator. Only 15 % of the respondents in this study reported making their own videos *always* or *often,* which is also time intensive. Further research could delve more deeply into the sources of videos to determine where educators are retrieving the videos. Also interesting would be studying websites to determine whether or not the sites that are used review the videos for appropriateness and quality. Additionally, future studies could be conducted to determine the length of time involved in locating appropriate instructional videos for the specific needs of the classroom and to determine why the majority of the teachers do not make their own videos very often.

Because of the surprise response of a low number of teachers using instructional videos for online learning, a need for further study exists. Additional research could be done to determine the rate of growth for online learning in K – 12 classrooms as well as the predicted growth of the use of instructional videos for online learning purposes. The sample could also be expanded to include learning environments different from public schools such as charter and private institutions in order to make comparisons.

Similar to the findings concerning online learning, the flipped classroom environment was also not prevalent in this study. These results were unexpected considering the abundance of literature on this instructional practice. Teachers may be reluctant to commit to changing the classroom structure to a flipped environment. Students who are unable to watch the videos at home may be at a greater disadvantage in a flipped classroom environment. For some students, watching instructional videos at home could be an unrealistic expectation due to economic conditions. The *lack of access* for students in this situation is a real concern. Other students may be involved in

extensive extracurricular activities that limit time for watching instructional videos at home. The teachers concern that, if a video is not shown in class, it may not be watched is a legitimate issue. Additionally, the flipped classroom model is a completely different approach to teaching that transforms the teacher from the disseminator of information to a facilitator of learning. This dramatic change in instructional practice requires the teacher to be receptive to a change from the traditional classroom. Perhaps additional research into the use of flipped classrooms and the possible barriers to using this newer practice could provide some insight.

Training is another area that warrants deeper study. Given that many of the design principles supported by empirical research to improve learning were not thoroughly included in the instructional videos used in K – 12 classrooms, teachers would likely benefit from professional development on these design principles. Some principles were included often while others were not adhered to frequently. Teachers were asked on this survey if they ever received training on instructional videos. Seventy-nine percent of the respondents who use instructional videos reported not having received training on the use of instructional videos. Limited numbers of teachers create their own videos, which could be a result of the lack of training. Training on making videos may help teachers to customize their own videos and create effective videos based on the design principles of the cognitive theory of multimedia learning. Additional research investigating teacher training and teacher knowledge of the design principles could raise awareness to the educational community of the need for instructional videos to be designed effectively.

Other possible solutions exist to alert educators of the need for both teacher training and the importance of selecting effectively designed instructional videos.

Publications in professional journals concerning the advantages to using instructional videos along with the need for the videos to be designed according to the cognitive theory of multimedia learning recommendations could heighten awareness of teachers and administrators on the effective use of this practice. Online newsletters and professional learning networks could also be used to communicate with educators. Teacher preparation programs at the collegiate level may also be able to provide training in educational technology with specific content connected to the use of instructional videos.

This study could be replicated to include an expanded sample. By expanding the sample to different demographic areas, additional studies could compare the use of instructional videos in schools with various socioeconomic conditions. A diverse sample could provide a basis for identifying relationships in the use of instructional videos.

These results could be used to support a quest for funding to expand technical access for teachers and students. Funding could improve the disadvantage *lack of access* theme that emerged from the qualitative data gathered from educators in this study. It could also improve the *full group viewing* disadvantage that was presented in disadvantages as well. If schools had the tools that provide access to instructional videos in the hands of the students, the disadvantages of *full group viewing* and *lack of access* could be eliminated. Likewise, the segmentation principle would be available by allowing students to control the pace of the videos. Otherwise, the major benefit of using instructional videos revolving around students controlling the pace is lost with full group viewing.

Studying the use of educational technology is necessary because the constant evolution of technology continues to affect instruction. Advancements in technology

have the potential to make positive changes in education. Studies such as this one could provide educators with instructional practices that improve teaching and learning. Instructional videos are a resource readily available to educators as they seek to meet the needs of today's students.

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APPENDICES

Appendix A

Sources for Instructional Videos

a. MathTV
b. Knowmia
c. TeacherTube
d. SchoolTube
e. Next Vista
f. Academic Earth
g. How Stuff Works
h. Vimeo
i. Dot Sub
j. TedEd
k. The Faculties
l. Cassiopedia Project
m. FORA TV
n. Untamed Science
o. Learners TV
p. Documentary Heaven
q. DocumentaryZ
r. The Teaching Channel
s. Explania
t. Discovery Channel
u. MonkeySee
v. Explore
w. Free Video Lectures
x. Watch Know Learn
y. Math A Tube
z. Art Babble
aa. Thinkfinity
bb. NeoK12
cc. National Geographic Video
dd. History Channel Video
ee. C-Span Video Library
ff. iTunes Education Podcasts
gg. Newtons Apple Video
hh. Chemistry Video Collection
ii. Science Hack
jj. MathActive
kk. Smithsonian Channel
ll. Science Kids Video

Appendix B

Instructional Video Survey

1. Have you ever used an instructional video for teaching purposes?
   If no, the survey ends. If "yes", the survey continues. (*Use skip logic in Qualtrics*)

2. Please complete the Likert scale to rate the frequency with which the following design features or instructional practices occur in regard to your use of instructional videos.

Design features (*Use matrix format in Qualtrics*)	Never	Rarely	Often	Always
1. The whole class views the videos at the same time.				
2. Students view the videos individually.				
3. Students are able to control the pace of the videos with a pause/play button.				
4. General concepts and/or key vocabulary are taught prior to students viewing the videos.				
5. Information that is NOT essential to the learning is included in the videos to add interest.				
6. Cues (such as changes in voice, highlighting, arrows, etc.) are used in the videos to draw attention to important information.				
7. Text is included on the screen at the same time that a narrator is speaking.				
8. Text is included on the same screen as the picture or footage for which it applies.				
9. The voice of the narrator is personalized, such as using terms like "you" and "I" as opposed to third-person narration.				
10. The voice of the narrator is a computer-generated voice.				
11. The voice of the narrator is a human voice.				
12. The voice of the narrator is that of a foreign accent or is unfamiliar to the students.				
13. The voice of the narrator is that of a				

standard accent or is familiar to students.				
14. The narrator speaks politely such as "let's complete a problem."				
15. The narrator speaks directly or firmly such as "complete a problem."				
16. The videos contain pictures/video footage AND on-screen text AND narration all simultaneously.				
17. The videos are used with students who have prior knowledge in the subject area.				
18. The videos are used with novice learners in the subject area.				
19. The videos used are created by the teacher.				

Frequency of use, technical design, & demographics (*Use Multiple Choice with "other" option in Qualtrics*)

3. How frequently do you use instructional videos?
    a. Daily
    b. Once a week
    c. Once a month
    d. Once a quarter
    e. Once a semester
    f. Once a year
    g. Other _____

4. Approximately how many different video titles do you use in one academic year?
    a. 1 to 5
    b. 6 to 10
    c. 11 to 20
    d. 21 to 30
    e. Other _____

5. Which of the following would describe the videos you use? Select all that apply.
    a. Worked example
    b. Screen capture
    c. Classroom lecture
    d. Demonstration
    e. Other _____

6. What grade level do you teach? Select all that apply.
    a. Grades K – 5
    b. Grades 6 – 8
    c. Grades 9 – 12
    d. Other _____

7. How many years have you been teaching?
    a. 1 to 7
    b. 8 to 15
    c. 16 to 23
    d. 24 to 31
    e. over 31

8. What subject area do you teach? _____

9. Have you ever received training related to the use of instructional videos?

Open Ended

10. Are instructional videos being used in a flipped classroom environment? (*Use skip logic in Qualtrics*)

11. If yes, please explain how you use the instructional videos in a flipped classroom environment.

12. Are instructional videos being used in an online learning environment? (*Use skip logic in Qualtrics*)

13. If yes, please explain how you use the instructional videos in an online learning environment.

14. Please explain any additional ways that instructional videos are used in your classroom.

15. What do you perceive as advantages to using instructional videos?

16. What do you perceive as disadvantages to using instructional videos?

17. Please include any additional information that would help capture the essence of how you use instructional video technology.

18. Please list any websites and other resources that work for you and would be helpful to other educators.

Thank you for your participation in this research project.

Appendix C

Site Approval Request Letter

Dear Sir or Madam:

I am currently researching the use and design of instructional videos in K - 12 classrooms as part of a doctoral dissertation at Indiana University of Pennsylvania (IUP). I am writing to ask for your permission to invite your professional staff to complete a short, online survey on the use of instructional videos. Their participation would be fully voluntary and anonymous. They would either click on a link to participate or delete the e-mail.

As a result of increased accessibility to instructional video technology, educators are using this tool to improve learning. The purpose of this study is to determine how often the use of instructional videos occurs in K - 12 classrooms, how the videos are being used, teachers' perceptions of the advantages and disadvantages of using video, and the design principles included in the instructional videos.

If you are receptive to your staff being invited to participate in this survey, I would simply need your approval in writing to conduct the study. I would also need your assistance in distributing the link to the online survey through your school e-mail system. Attached is a sample approval letter for your convenience in case you are agreeable to your staff participating. If you are willing to include your staff in this study, please print the approval letter on school letterhead. Please include your signature and either e-mail it back to me at xnwmhab@iup.edu or send it to the following address:

Carleen Allison
200 Thorncrest Drive
McKees Rocks, PA 15136

If you provide me with written permission to include your district in the study, I will then apply for approval through IUP's Institutional Review Board. Once IUP approves the research, I would be in touch with you again to actually distribute the survey. I hope you will allow your learning community to participate in this educational research. Please contact me if you have any questions or concerns. Thank you so much for your time and consideration.

Sincerely,

Carleen Allison
Doctoral Candidate
412-527-0049
xnwmhab@iup.edu

Attachment

Appendix D

Letter to Participants

(To be distributed by the district administration through the mass e-mail system)

Dear Educator:

I would like to invite you to participate in an online survey on the use of instructional videos in the classroom. Your participation in this survey is completely voluntary. The superintendent of your district supports this research; however, your participation is not a requirement of your employment. The purpose of this educational research is to determine how often the use of instructional videos occurs in K - 12 classrooms, how the videos are being used, teachers' perceptions of the advantages and disadvantages of using video, and the design principles included in the instructional videos.

If you do not use instructional videos, your response will be very quick and is still very important for the study. So please, take just a few minutes to follow the link below and complete the online survey. If you do use instructional videos, please take approximately 15 minutes to complete the survey. What do I mean by instructional video? For the purposes of this study, an instructional video is designed to explain a specific concept, assignment, or lecture. The videos could be screen capture, worked example, classroom lecture, or demonstration.

The results of the study will be used to add to the field of educational research. Some potential benefits include a collection of practical examples of the use of instructional videos in the classroom, research-based video design elements that may improve learning, and educational resources that work for educators. A link to a PDF of the final dissertation will be e-mailed to all potential participants upon completion.

This study is part of a doctoral dissertation being done by Carleen Allison. Although I am your colleague at Franklin Regional, I am acting as a researcher independent of my employment at Franklin Regional. The survey is anonymous, meaning that no identifying information of participants will be included with the data. The researcher will not be aware of the names of those who complete the survey; therefore, your choice to participate or not to participate will not affect your relationship with the researcher or the district. If you decide once you start the survey that you no longer want to continue, simply close out of the survey. Your responses will not be included in the analysis. The level of risk for participants in this study is minimal.

If you have any questions or concerns, please contact Carleen Allison or Dr. Jennifer V. Rotigel at the following:

Principal Investigator:
Carleen Allison, Doctoral Candidate
200 Thorncrest Drive
McKees Rocks, PA 15136
Home phone: 412-875-0395
Cell phone: 412-527-0049
e-mail: xnwmhab@iup.edu

Faculty Sponsor:
Dr. Jennifer V. Rotigel, Professor
Dept. of Professional Studies
Davis Hall 111
Indiana, PA 15705
Phone: 724-357-5694
e-mail: jrotigel@iup.edu

Indiana University of Pennsylvania's Institutional Review Board for the Protection of Human Subjects has approved this project (Phone: 724-357-7730). I am hopeful that you will participate in this survey. Your experiences truly add to the field of education.

Sincerely,

Carleen Allison

Appendix E

Review Panel Feedback Form

Dear Reviewer,

Thank you so much for reviewing this document. The purpose of this study is to determine how often the use of instructional videos occurs in K - 12 classrooms, how the videos are being used, teachers' perceptions of the advantages and disadvantages of using video, and the design principles included in the instructional videos. Please examine each item in terms of the following:

1. Language clarity – Is the statement understandable in the context of the survey?
2. Appropriateness – Is the statement appropriate for the purpose of the study?

Please feel free to markup the survey. I appreciate any and all feedback that you can provide.

Once again, thank you for your assistance.

Carleen Allison

Instructional Video Survey

If you believe the statement is clear, check the "Clear" box. If you believe it is unclear, check the "Not Clear" box. Please include any suggestions you may have to help clarify the statement. If you believe the statement is appropriate for the purpose of the study, check the "Useful" box. If you believe it is not appropriate, check the "Not Useful" box.	Clear	Not Clear	Useful	Not Useful	Comments
1. Have you ever used an instructional video for teaching purposes? ***If "no", the survey ends. If "yes", continue with survey.***					
2. Where do you get the videos that you use? Choose all that apply, and please list any and all websites that you can recall.					
a. YouTube					
b. Khan Academy					
c. Self-created					
d. Other websites _____					
3. If you make your own videos, what technical tools and or software programs do you use?					

4. Approximately how many ***different*** videos do you use in one academic year?					
5. How frequently do you use instructional videos? Daily, weekly, monthly, once a quarter, once a semester, once a year, other.					
6. Select from the list below the environment in which you use instructional videos (select all that apply)?					
a. Online learning classroom (not face-to-face)					
b. Blended learning classroom (partially online and partially face-to-face)					
c. Flipped classroom					
d. Face-to-face classroom					
e. Other _____					
Please select one of the videos that you use most often and consider the design features of that particular video while answering the following questions. For the purposes of this study, voiceover is considered narration or verbal speech recorded within the video.					
7. Does your video allow the viewer to control the pace of the video by offering a pause/play button? Yes/no					
8. Do you teach general concepts or vocabulary included in your video prior to the students viewing the video? Yes/no					
9. Does your video provide pictures and narration? Yes/no					
10. Is information that is not essential to the learning included in the video to add interest? Yes/no					
11. Does your video include cues to draw attention to important information in the video? Yes/no					
a. If yes, which of the following is used:					
i. Annotations					
ii. Change in voice					
iii. Arrows					
iv. Highlighting					
v. Other _____					
12. Does your video contain on-screen text? Yes/no					
a. If yes, does your video contain text on the screen that is also spoken by a narrator (voiceover)? Yes/no					

b. If yes, does your video contain text on the same screen as the pictures or footage for which it applies? Yes/no					
13. Does your video include narration (voiceover)? Yes/no					
a. If yes, is the narration in your video played simultaneously with the pictures or video for which it applies? Yes/no					
b. If yes, is the narration in your video personalized, such as having the narrator say "you" and "I" as opposed to third-person narration? Yes/no					
c. If yes, does your video contain a human voice or a computer-generated voice?					
i. Human voice					
ii. Computer-generated voice					
d. If yes, does the speaker have a standard accent that is familiar to your students or a foreign accent that may be unfamiliar to your students?					
i. Standard/familiar accent					
ii. Foreign/unfamiliar accent					
e. If yes, does the narrator speak politely such as "let's click next" opposed to more direct speech such as "click next"?					
i. Polite narration					
ii. Direct narration					
14. Does your video contain pictures/video AND on-screen text AND narration all at the same time? Yes/no					
15. Do you use the video with novice learners or do your students have a great deal of prior knowledge in the subject area?					
a. Novice learners in subject area					
b. Prior knowledge in subject area					
16. Approximately how long (in minutes) is your instructional video?					
17. Which of the following would describe your video? Select all that apply.					
a. Worked example					
b. Screen capture					
c. Classroom lecture					
d. Demonstration					
e. Other _____					
18. Have you ever received any training on the design of instructional videos? If yes, please					

describe the training.					
Open Ended Questions					
19. In what ways are you using instructional videos in your classrooms?					
a. Are instructional videos being used in a flipped classroom environment? If yes, please explain how you use the videos.					
b. Are instructional videos being used in an online learning environment? If yes, please explain how you use the videos.					
c. Please explain any additional ways that instructional videos are used in your classroom.					
20. What do you perceive as advantages to using instructional videos?					
21. What do you perceive as disadvantages to using instructional videos?					
22. Please include any additional information that would help capture the essence of how you use instructional video technology in the classroom.					
23. What grade level do you teach?					
24. What content or subject do you teach?					
25. How many years have you been teaching?					

Thank you for your participation in this research project.