The Design of Video Production Integrating the Cognitive Theory of Multimedia Learning for a Flipped Classroom Learning Model and its Impact on Student Engagement

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Abstract

This applied research project studied aspects of cognitive psychology including cognitive load and the cognitive theory of multimedia learning to identify effective strategies for video instruction that assist with increasing engagement for learners. Participants in the study were education professionals in a secondary education setting. Participants were asked to complete seven Likert-type questions to measure their levels of interest in learning new content in-person versus video lessons, as well as their interest in resources for creating their video lessons. The results showed that even though the participants would watch a video for learning new information, generally they preferred a teacher introducing the subject rather than a video. Additionally, if participants were given resources to maximize student engagement with video lessons 67% of participants agreed that they were more inclined to create video lessons while 33% of participants strongly disagreed that they would be more inclined to create video lessons. For this project, strategies were researched through the lens of the cognitive theory of multimedia learning on maximizing student engagement with video lessons. For example, video lesson designers should suppress intrinsic and extraneous load and emphasize germane load. In other words, lesson designers should limit the complexity of information and unnecessary information while focusing on establishing prior knowledge with new information. Videos should be short, the presentation is purposefully planned, and the video should be personalized by the instructor. These strategies will cognitively support learners' understanding of new information.

Chapter One

Purpose of the Study

The purpose of this study was to determine effective strategies for video production in a flipped classroom to maximize engagement for learners. The research question is: With an understanding of cognitive load and multimedia how can educators maximize engagement for students when delivering video lessons? The flipped classroom's objective is for learners to engage in new content outside of the classroom followed by engaging in experiences to support a student-centered learning environment. Over the last two years, since the acceleration of virtual and hybrid learning due to the COVID-19 pandemic, there has been an increase in technology being used to support learning, especially video lessons. Through research on the cognitive theory of multimedia learning and numerous pieces of literature on video production and its impact on engagement strategies, this study aimed to synthesize effective techniques to support educators and learners.

Students all across the globe are using technology more and more as part of curriculum and learning. Additionally, there is an increase in educational technology companies providing resources for teachers and students. A popular way in which students engage with technology is through videos. Educational technology companies like Khan Academy, Edpuzzle, and College Board use videos to help learners. With the increased supply of educational videos for educators and learners and the risk of students missing in-person synchronous learning due to COVID-19 research on video production engagement for educational videos merited further investigation.

Significance of the Study

When instruction is delivered through audio and visual outlets, the learner can store information on a deeper level (Artman, 2020). This idea, when used for video instruction,

harnesses both visuals and words which target audio and visual outlets, providing a more effective means of instruction (Paolo et al. 2017). This type of instructional delivery is the central theme of the cognitive theory of multimedia learning. This theory focuses on supporting learning through the auditory and verbal cognitive load channels (Almasseri & Alhojailan, 2019). Video instruction is different from in-person learning because video instruction is not live, therefore the learner has to rely on the video itself and other course materials rather than working with the teacher and other learners.

Understanding effective video instruction and how humans learn are important because of the popularity of online learning due to the increased access to technology as well as the need for connecting with learners virtually due to the COVID-19 pandemic. In a research study of a cyber-flipped course, Lin et. al (2019) concluded that learners who watched the instructional videos participated more in synchronous learning and were more likely to earn higher grades. In a similar study on computer programming and video instruction by Draus (2020) 87% of students preferred new topics explained in videos rather than in person.

The future needs of educational systems will continue to integrate technology and virtual instruction. Therefore understanding the mental processing of the human mind and how best to engage learners through video lessons will need to be continually refined. The following sections summarize the study assumptions, limitations, and definitions.

Assumptions

- All research participants were my colleagues in secondary education that held a teaching certification
- Likert-questionnaire data was collected anonymously from educators
- Participants created video lessons for students before participating in my study

- Generalizations, broad assumptions, or interpretations should not be made based on the results of this study

Limitations

- Survey participation was voluntary and was chosen based on convenience.
- The sample size of my participants was small, therefore the results may be skewed
- This study covered ways of engaging learners with multimedia through an understanding of cognitive load
- This study did not include students as participants
- Survey participants' engagement and participation varied depending on the time of day.

Definitions

- *Flipped Classroom Model*: A teaching strategy that involves the students learning new content for homework and then engaging in activities during synchronous lessons to support what they learned for homework
- *Cognitive Theory of Multimedia Learning*: Understanding how the human mind learns through multimedia.
- *Multimedia*: the combination of text, images, and audio to represent information

Summary

Flexible and virtual instruction requires effective strategies to engage learners in the content. Instructors that create video lessons for virtual instruction need to ensure they are using appropriate strategies to maximize engagement and minimize the extraneous load. Understanding how humans learn best through the lens of the cognitive theory of multimedia learning and the cognitive load theory can help the learner grasp content more effectively. In Chapter 2, findings from numerous literature will be presented about the cognitive theory of

multimedia learning, the cognitive load theory, and how best to engage learners in video instruction to effectively teach learners.

Chapter Two

Literature Review

Introduction

A flipped classroom is one of many technological trends that educators use to enhance learning experiences, increase motivation, and support active student-centered learning. The process of a flipped classroom is to reverse the traditional sequence of lectures in class followed by practice outside of class. The author states that "student's attention wanes quickly, the pace of the lectures is not adapted to all learners' needs and traditional lectures are not suited for teaching higher-order skills such as application and analysis" (Nouri, 2016, p. 1). Furthermore, Rutherford (2014), emphasizes the problem with traditional learning is that more time is spent on lower-order thinking skills: remembering and understanding. In the flipped classroom model, students learn new content outside of class by watching a video or engaging in reading and then come to class to practice the skills that were introduced. The purpose of this model is to focus on student-centered learning and develop more conceptual and analytical thinking.

In theory, the flipped classroom model is effective. Students discover new content on their own and then discuss the content in class with their peers through engaging group activities. In reality, students are expected to devote time and effort outside of class to make the in-class activities meaningful. If the instructional design of the lesson is not carefully crafted students may not effectively retain the content or be engaged.

It is important to highlight and discuss the benefits of the flipped classroom model because we are living in a world with better access to technology and online communication. Additionally, with the increase in online engagement, it is necessary to understand how students learn with multimedia. Multimedia is a combination of images, text, and audio to represent

information. The issue addressed in this literature review is student engagement within multimedia that has an emphasis on cognitive psychology. The benefit of this discussion is to understand human mental processing to provide effective video instruction.

How can the teacher design video instruction that not only engages the learner but also balances an appropriate amount of cognitive load? Through the lens of cognitive psychology, this literature review analyzes the framework of the Cognitive Theory of Multimedia Learning. In other words, the understanding of how humans process multimedia. Strategies for video production including video length, design, and instructor presence will be explained. Lastly, the impact of learners' engagement, both positive and negative, will be presented.

What is the Cognitive Theory of Multimedia Learning?

One of the main goals when designing video instruction for flipped classrooms should be for the learner to engage and effectively process information. The Cognitive Theory of Multimedia Learning (CTML) analyzes how humans process and learn information through multimedia. CTML is the backbone for engagement and processing information when designing video instruction for flipped classrooms.

Today's learners experience a great deal of content through digital textbooks and the world wide web. Therefore, it is essential to have an understanding of how humans learn and process multimedia. Richard Mayer, American Educational Psychologist, emphasizes that novice learners benefit most from CTML (Harvard, 2018). When designing video instruction for novice learners, the instructor needs to maintain engagement and maximize germane processing. The principles of CTML provide numerous strategies to help the learner and will be discussed in this literature review.

To design videos that deliver an efficient presentation for audiences to process and transfer knowledge, there is a need to understand the Cognitive Theory of Multimedia Learning. Mayer, whose most noteworthy work is with multimedia learning, merely summarizes CTML as utilizing words and pictures to help people understand (Harvard, 2018). Furthermore, a learner-centered attitude must be deployed to promote human understanding regarding multimedia learning (Almasseri & Alhojailan, 2019). From cognitive science, Mayer emphasizes multimedia learning on three principles: dual channels, limited capacity, and active processing (Harvard, 2018). Dual channels are the distinct channels for processing words and pictures such as eyes and ears. Limited capacity is the concept that humans can only pay attention to a few ideas at a time. Humans can only hold approximately five fragments of data at a time. Too much information will overload the working memory (Harvard, 2018). The active processing principle involves the learner selecting relevant information, assembling the information in working memory, and integrating prior knowledge (Davis, 2017). The Cognitive Theory of Multimedia Learning relies on the Cognitive Load Theory, which is information that is placed on working memory.

The Cognitive Load Theory consists of three types: intrinsic, extraneous, and germane. Intrinsic load is the complexity of information that a person is processing and paying attention to (Health Ed Solutions, 2012). The more intricate the information the greater the intrinsic load. Extraneous load is distracting or unwarranted information on working memory. For instance, if a car alarm goes off in the background the learner may be distracted by this noise. They may start to wonder if the alarm is their car, which fills their working memory with unnecessary data. This type of information should be avoided to maximize essential processing. Lastly, the germane load is the mental effort of

establishing connections to prior knowledge with novel information (Health Ed Solutions, 2012). Informal and formal checks for understanding and scaffolding are examples of germane load.

Cognitive Theory of Multimedia Learning Implications for Learning

To optimize the learning process, there are multiple instructional design principles that should be adopted. First, instructional designers should seek to minimize extraneous load through the following five principles. The coherence principle refers to minimizing extraneous information by removing unnecessary information (Davis, 2017). Mayer confirmed this in 22 of 23 experimental comparisons (Harvard, 2018). For instance, nice to know information may seem interesting and helpful, but it takes away from learning. Similarly, the signaling principle refers to highlighting important information, especially if instructors cannot take out extraneous information (Davis, 2017). Signaling techniques include changing font style, flashing or having a spotlight on text or graphics, giving related elements the same color, and providing gestures for related elements (Ibrahim, 2012). Next, the redundancy principle states learners gain an understanding best from animation and narration rather than animation, narration, and on-screen text that is similar to the narration (Davis, 2017). The addition of captions or on-screen text to an animation that already has a narration depresses performance (Harvard, 2018). Spatial Contiguity emphasizes placing words and pictures near each other (Harvard, 2018). If the instructor needs a key or has to use arrows to label animations and text, the additional effort for the learner is extraneous. Lastly, the Temporal Contiguity Principle states that narrations and animations should be presented simultaneously (Harvard, 2018). The instructor may think that displaying a graphic and then explaining the visual may help to reinforce the concept, but that hinders learning. Therefore, the narration of the animation should be concurrent with the graphic.

In addition to eliminating extraneous load, instructional designers should manage essential information. Mayer explains that the presentation should be broken down into parts, according to the segmenting principle (Harvard, 2018). Specific to video instruction, research has shown that chunking dynamic visualizations are helpful for novice learners, especially when the material is complex and the pace of the presentation is rapid (Ibrahim, 2012). Breaking down parts of the visualizations helps to not overload the learner with too much information. As previously stated, the working memory is finite and on average can only hold 5 pieces of data at a time. Five to ten-minute-long segmented videos help the learner digest the information before moving on (Artman, 2020). Similarly, Paolo et al. (2017) suggest that videos should be no longer than three to four minutes. Introducing key vocabulary and learning objectives at the start of the lesson is also essential. This concept, which is known as the pre-training principle, allows the learner to make connections to the vocabulary and objectives as multimedia is presented (Harvard, 2018). Rutherford (2014) mentions using Bloom's Taxonomy approach by linking the previous lesson to the coming lesson, supporting students' prior knowledge. Lastly, the modality principle is the idea that people learn better when the presenter is using spoken words with a graphic rather than printed words and a graphic (Harvard, 2018). If the learner has captioned words and a graphic they cannot focus on both the graphic and caption at the same time.

The last main goal is to maximize germane load (Health Ed. Solutions, 2012). The personalized principle states that the words presented should be more of a conversational style (Davis, 2017). The use of the first and second person should be emphasized throughout (Harvard, 2018). The last part of maximizing germane load is the voice principle which is the idea of using an actual voice rather than a machine voice (Harvard, 2018). This helps to personalize the learning experience.

The principles presented above synthesize the essential components of the Cognitive Theory of Multimedia Learning. With a heavy emphasis on cognitive load, CTML provides instructional designers with tools to optimize learning. CTML aims to utilize audio and visual throughputs. Strategies include signaling and cueing such as highlighting important information, chunking information, and weeding out distracting details to reduce extraneous processing (Draus, 2020). Words and pictures are presented together to have the greatest impact on learning. Additionally, spoken narration and animations presented simultaneously help the learner process information. These principles are scaffolding for video production in a flipped classroom.

Strategies for Video Production

CTML relies on numerous instructional methods. Therefore, details for video production need to be pre-planned in order to maximize student engagement. A study conducted on four different courses that analyzed over 6.9 million video views drew a few conclusions (Guo et al., 2014). Videos should be no more than six minutes. This was discovered when a majority of students made it less than halfway through videos longer than nine minutes (Guo et al., 2014). Gilboy et al. (2015) made a similar conclusion explaining that lectures should purposefully be chunked and the length of the lecture should be no more than 10-15 minutes. The reason is to reduce distractions and boredom. Guo et al. (2014) also write that each video should have a personal feel where the instructor's face/head is present throughout. Likewise, Paolo et al. (2017) state that educational videos should generate intimacy through verbal language, nonverbal body language, and including the instructor in the video. Moreover, Guo et al. (2014) point out that Khan Academy-style videos were more engaging. These types of videos use a tablet and draw on a blank slate which draws more engagement than PowerPoint-style slides or filmed lectures. Similarly, Gilboy et al. (2015) advised that faculty should modify how content is captured.

Instead of traditional lectures, Gilboy et al (2015) suggested using the Khan Academy style or TED Talks to deliver content. The instructors also used screen capture software when creating videos (Gilboy et al., 2015). Additionally, video creation should include enthusiasm from the speaker and the instructor should speak fast (Guo et al., 2014). Shorter segmented videos that personalize and concentrate content help to engage students' viewing experience. This is supported by the limited capacity of multimedia. The amount of information is limited in shorter videos which helps to reduce overloading in the working memory. Additionally, the idea of shorter videos supports lowering intrinsic load allowing a person to better process information and increase attention.

Kay and Kletskin (2012) found similar results in their research of problem-based video podcasts to teach mathematics in higher education. There was significant evidence of the CTML throughout the production of videos in this study. Key terms and ideas were written out to help reduce cognitive load, clear visuals were used to illustrate problems, important information was highlighted, and the teacher used a conversational style voice to personalize the learning. The strategies used in this research mirror the pre-training, segmenting, signaling, and personalized principles. Eighty-seven percent of the 190 students that used the videos found they were helpful. Moreover, Kay and Kletskin (2012) discovered that students favored dynamic visualization presentations compared to static presentations. This idea of spoken words and visualizations versus static words and graphics supports the modality principle. There was also a significant positive difference from pre- to post-test scores and a positive correlation between time spent watching videos and improvement in pre-calculus knowledge. The evidence in this research is significant because these techniques, which are rooted in CTML, support how humans learn which allows for students to engage more meaningfully with the content.

In addition to video length and presentation, students require more support to engage them in video lectures. Including reflection questions that relate to the video is an additional way to increase student engagement. Ninety-five percent of students in one survey agreed that questions throughout a video lecture helped them in learning (Haagsman et al., 2020). If students know there are questions following the video they are more likely to be active listeners rather than passively watching the video. The study completed by Smallhorn (2017) had instructors give students a summative five-question multiple-choice quiz testing surface understanding following each video. Seventy-nine percent of students reported having a positive attitude toward pop-up questions from video lectures (Haagsman et al., 2020). Evidence from Haagsman et al. (2020) suggested that just the presence of pop-up questions was enough to make an impact on testing performance. However, it was noted that there was no significant improvement between a specific pop-up question and the tested concept. Another technique to increase student engagement is gamification. Examples of gamification strategies include leaderboards, badges, and points for video viewing. While reflecting on research findings, Beatty et. al (2017) recommends gamification to increase student engagement. This recommendation mirrors the Khan Academy-style video production, which uses gamification. Questions related to video lessons and gamification strategies support the active role of students and provide meaningful engagement during the viewing experience.

Through the lens of the instructional design principles of CTML, more active and meaningful activities lead to increased student engagement. According to Maher et al. (2015), from numerous studies, when students worked together improvements in learning occurred including student confidence and overall enjoyment of coding. Gilboy et al. (2015) mention that grades in the flipped classroom were exceptionally higher than student grades in the traditional

class. Also, students appreciated the active learning strategies. Implementing active video creation, speaker enthusiasm, limited video length, and questions for students to answer, increases the chances that students will be more engaged and have a positive experience with the video lesson.

Student Engagement for Video Production in a Flipped Classroom

Measuring the engagement of the videos that students watch outside of class is not concrete. Therefore, researchers have to use CTML and supplemental parameters that suggest engagement. Smallhorn (2017), "defines student engagement as a multi-dimensional construct with three components: behavior, emotional, and cognitive engagement" (p. 45). The research conducted by Smallhorn (2017) collected data on student attendance, surveyed results, and academic grades. This data was then used in connection with video views. Guo et al. (2014) measured engagement with two metrics: video watching session length and whether a student attempted the follow-up problem after the video. Actual engagement is impossible to measure given the nature of the flipped classroom model. Therefore, researchers had to rely on secondary avenues for conjectures.

The use of surveys was a helpful avenue to extrapolate student engagement. Surveys administered to students from multiple professional sources indicated that video lectures and tutorials were helpful for student learning. Maher et al. (2015) discovered through surveys that students were pleased with the flipped classroom model. More significantly, with the use of a 7-point Likert scale, Maher et al. (2015) concluded that online videos had the highest average rating, and students feeling successful in the course were rated moderate to high. This is significant because when students feel successful and confident they are going to be more intrinsically engaged in the content. A survey conducted by Gilboy et al. (2015) used a 5-point

Likert scale which yielded similar results. The results indicated that 76% of students were more partial to video lectures compared to face-to-face lectures. Additionally, 70% of students felt a connection to their teacher through the virtual part of the flipped classroom (Gilboy et al., 2015). This relates to the personalized principle, which is about establishing a personalized connection to students in the delivery of multimedia. The personalized principle helps to support learning and engagement. Lastly, Haagsman et al. (2020) also used a 5-point Likert scale, noting that 97% of students found the video clips helpful when studying and learning content. This evidence suggests that video creation for flipped classrooms is appreciated and helpful for learning.

Long et. al (2016) found that students in their study highly ranked the instructor-developed videos. The instructor in this study provided students with authentic and personalized learning experiences. Additionally, the instructor was purposeful when adding multimedia. The strategies used by the instructor, including purposeful multimedia and personalization of the video, are examples found in the Cognitive Theory of Multimedia Learning. Students did suggest that the videos needed to be shorter, which is another common theme found in other studies.

The Controversy of the Flipped Classroom Model

In contrast, it is also worth noting potential concerns with video production in a flipped classroom, including a decreased number of views as a result of video length, too many videos, and challenging content. Maher et al. (2015) expressed that some students found the video lectures to be too long and not helpful for difficult content. In the study conducted by Xiu et al. (2018) students reported negative attitudes towards viewing videos stating the effort was burdensome. The length of the videos that students were watching was between 35-40 minutes, which could contribute to the viewings being burdensome. Smallhorn (2017) discovered that

there was no appreciable amount in student grades on the final exam for the students in the flipped classroom. These results compared final exam grades for students that had been in the traditional class versus the flipped classroom. Smallhorn (2017) goes on to note that other research investigating the impact of the flipped classroom yielded similar results of no academic gains. The flipped classroom model may not be suitable for every grade level and course. The selection of the flipped classroom model depends on available technology and the internet for students, as well as the curriculum. It may be more effective to select certain units or lessons within a course to apply the flipped classroom model.

Lack of participation in video viewing is relevant in other research. In the study conducted by Beatty et. al (2017) students in an introductory college, course were given weekly video chapter topics with an average length of 76 minutes. Each weekly video topic was split up into 2 to 4 videos. In other words, students were expected to watch 2 to 4 videos a week that ranged in the length from 19 to 38 minutes each. A significant pattern determined from video viewing data showed that fewer students watched the second, third, and/or fourth videos on a topic. Additionally, fewer students continued to watch the weekly video topics as the semester continued. These trends of fewer students participating in watching video lessons help to support conjectures made by Paolo et al. (2017), Artman (2020), Guo et al. (2014), and Gilboy et al. (2015) that video lengths should be significantly shorter to maximize student engagement.

Similar results to the study by Beatty et. al (2017) were determined in a cyber-flipped course study by Lin et. al (2019). The cyber-flipped course consisted of synchronous and asynchronous activities including weekly videos averaging 10 minutes. Results from the study showed that “only 25% of students watched more than 80% of prerecorded lessons and 63% watched less than 30% of the lessons” (Lin et. al, 2019, p. 1583). Since the video-watching

assignments were mainly passive for students, Lin et. al (2019) suggested creating videos that enable more interaction between the student and the video as a solution to increase overall student participation in video watching. Active video production strategies are a continual theme in numerous literature including Guo et al. (2014), Gilboy et al. (2015), Kay & Kletskin (2012), Haagsman et. al (2020), and Smallhorn (2017).

Conclusion

Video lesson production crafted with an understanding of the cognitive theory of multimedia learning can provide an effective impact on the viewer. With thoughtful consideration, video lessons can maximize engagement and deepen understanding. When creating a video lesson, the instructor should include the principles from the cognitive theory of multimedia learning. The instructor should limit intrinsic and extraneous load while supporting the learner's germane load. Additionally, the length of videos should be short, text and animations should be purposefully planned, and the instructor should speak with enthusiasm and include themselves in the video.

The educational system has seen a dramatic change as a result of the Covid-19 pandemic. As a result, technology resources, which include a heavy emphasis on multimedia, and student engagement have become a center-point discussion; how can we effectively reach our students? Understanding how humans mentally process multimedia and video will be an ongoing analysis as technology continues to be integrated into classrooms. Ultimately, educators need to know their students and differentiate their plan of action to equitably fit the needs of their students.

In chapter three I will discuss the methodologies including the setting and participants, the research design process, and how data was gathered and analyzed.

Chapter Three

Methodology

Introduction

The purpose of this study was to provide educators with effective strategies to engage learners through video lessons. The researcher sought to determine effective strategies to engage learners in video lessons by answering the following question:

1. With an understanding of cognitive load and multimedia, how can educators maximize engagement for students when delivering video lessons?

The literature reviewed on the cognitive theory of multimedia learning and the cognitive load theory was analyzed and synthesized into a convenient toolbox for educators to access and implement when designing video lessons. This toolbox is showcased in chapter five. This chapter will describe the setting and participants, the research design process, and how data was gathered and analyzed.

Setting

The setting for this project was a public high school located in Anne Arundel County, Maryland. Anne Arundel County serves approximately 83,000 students from numerous elementary schools to high schools. The high school, where this research took place, recently opened for the 2020-2021 school year and only housed ninth and tenth graders. The high school added a grade each school year and would be at full capacity, ninth grade through twelfth grade, by the 2022-2023 school year. The demographics of this high school consisted of approximately 58% White, 19% Black, 10% Hispanic, 7% Asian, and 6% of two or more races. Additionally, this was not a Title one school and 14% of students were eligible for free or reduced-price lunch. Throughout the virtual learning experience, due to the COVID-19 pandemic, all instruction,

meetings, and professional development were conducted virtually. Additionally, teachers were instructed to record their lessons due to frequent student absences. During this time, I instructed three foundations of computer science classes, one AP Computer Science Principles class, and one AP Computer Science A class. Each class had approximately 32 students.

Participants

Participants in the study were three teachers in a 9 - 10 public high school in the state of Maryland. My classroom was in the computer science and technology education hallway and therefore I asked three educators in that area for their input. Two of the three participants had taught high school for more than ten years and had taught multiple subjects including computer science, technology education, mathematics, business, and physical education. The third participant had only taught high school for one year, but he had taught at multiple universities and community colleges for numerous years before teaching high school students. These participants were selected using a convenience sample and approval was received from the Internal Review Board (IRB). Additionally, the principal was contacted for permission to connect with teachers. Once approved, three teachers were contacted via email with survey directions that included informed consent for the survey. Please see Appendix A for a copy of the IRB approval, Appendix B for a copy of the principal approval, and Appendix C and D for a copy of the teacher survey and Consent Form. As part of the research and described in the informed consent form, personal information from participants was not collected. The teachers provided feedback on the usefulness of video lessons for engagement and their interest in creating video lessons given researched strategies.

Research Design

This applied research project used a web-based survey. Participants were emailed a hyperlink that took them to a website containing the informed consent and the survey. They were asked to respond and complete the questions in the survey and submit responses through the website.

Instrumentation

An original web-based survey instrument, titled *Video Lecture,* collected responses on seven statements about video lectures. Qualtrics Survey was used to create the survey. Educators were instructed to respond to each of the seven statements using a five-point Likert scale that ranged from “strongly disagree” to “strongly agree”.

Data Collection Procedures

Once approval was granted by the principal, teachers that worked nearest my classroom were sent an email with a request to voluntarily participate in a survey that would take approximately five minutes. A hyperlink was provided at the end of the email that took participants to the survey. Before starting the survey participants were given a written notification about the study’s purpose, procedure, risk, and benefits. There were no major risks and participants did not directly benefit from participating in the survey. Additionally, no private information was collected, and participants' confidentiality was honored throughout the study. The survey was administered at the beginning of February 2022 and all data was collected and stored electronically on Qualtrics Survey and Google Drive. The data stored on Qualtrics Survey and Google Drive was password protected to ensure the security of the participant’s responses.

Data Analysis

All data analysis was conducted using Qualtrics Survey data reports. The data was first organized by field and included frequencies, percentages, and totals for each statement. Analysis

based on the level of agreement with each statement was compared to the question being investigated in the research. The results enabled the researcher to interpret participants' interest in learning new information through video or live teaching, ability to focus based on the length of the video, and interest in creating video lessons. This survey took place before developing my project to include participants' opinions in the final project.

Summary

This project used a five-point Likert scale to survey three STEM teachers in a public high school in Anne Arundel County, Maryland. Permission was granted by all necessary parties, and the participants provided feedback on their interest in using video lessons to learn as well as using video lessons to teach their students.

In the following chapter, the developed project will be described including the environment in which the project was intended to be utilized, all materials used in the creation of the project, a detailed account of the steps taken in the creation of the project, evaluation, and analysis from the survey, and how the project addressed the research question.

Chapter Four

Findings

Introduction

This study sought to answer the following research question:

1. With an understanding of cognitive load and multimedia, how can educators maximize engagement for students when delivering video lessons?

After reviewing literature and conducting a survey with teachers, a final project was created consisting of two videos to support educators in understanding cognitive load and multimedia as well as how best to engage learners in video lessons. The layout of this chapter will consist of a detailed description of the final project, how the project aligned to the research question, and an evaluation and analysis of survey results.

Project Description

The final product for this applied research project was a two-episode mini-series video published on Instagram. The first video, titled *Cognitive Load & Multimedia,* discussed past research findings on multimedia, the cognitive theory of multimedia learning, and the cognitive load theory. From these topics, the first video explained how humans learn best which allows for better viewing retention and more engaged learners during video lessons. The second video, titled *Maximizing Engagement Video Lessons,* presented what to specifically focus on and avoid when creating video content for learners. The contents of this project were supported entirely by professional journals and will be explained in the next sub-section.

The intended audience for this project was instructional designers, curriculum writers, educators, and anyone creating video lectures for a group of learners. Although the project could have applied to many subgroups, the primary focus was on secondary educators with students in

grades 9 - 12. During the peak of the COVID-19 pandemic, when many schools were conducting virtual learning, educators were asked to record the core components of their lessons. Since student attendance regularly fluctuated, it was necessary to have recorded lessons that were meaningful and engaging for all learners. This project could be part of a school's professional development training. Educators could watch both videos and reflect as a school and within their departments on how best to utilize these strategies in their content and for their students. The project was shared on Instagram because of its popularity and convenience within education. Many educators use Instagram as a community to engage in professional development, share resources, and communicate with other professionals in a global manner.

Numerous tools were used for the creation of this project. The content was synthesized from numerous professional literature, which is formally presented in Chapter 2. Google Slides was used to display the content. We Video was chosen to screen record the slides as well as record video and audio of the presenter. Lastly, Instagram was selected to showcase the final project.

Project Alignment to Research

Online learning has been a source of interest and convenience for many students and educators. Over the course of the COVID-19 pandemic, online learning became a necessity for much of the world. Synchronous and asynchronous lessons became the new normal. The hardship of attending live lessons was not always possible for students and teachers. When educators and health experts saw no end in sight for virtual learning the need to engage students, when distractions for students were arguably at their peak, was essential. Therefore, educators needed to create asynchronous lessons that engaged learners and maintained learners' academic growth.

The goal of this Applied Project was to compile effective techniques and strategies that educators could use to engage learners in an online learning environment. To engage learners, it was first important to understand multimedia and working memory. The first of two videos for this project explained what cognitive load is and how to effectively use multimedia to maximize a person's working memory. Cognitive load is the amount of information placed on the working memory and consists of three parts: intrinsic load, extraneous load, and germane load (Health Ed Solutions, 2012). Intrinsic load is the complexity of information that a person is focusing on (Health Ed Solutions, 2012). For example, learning to program is considered to have a high intrinsic load because students have to understand reading and writing syntax, language-specific rules, and algorithms. Extraneous load is distracting information that is not necessary for learning (Health Ed Solutions, 2012). For instance, if a student is learning to code and then their computer notifies them they have a new email, the student's working memory may now be filled with questions about what the email contains or who it is from. Germane load is the mental connection from preexisting knowledge to new knowledge (Health Ed Solutions, 2012). Connecting English grammar to programming syntax would be an example of germane load. On the other hand, the Cognitive Load Theory relies on the Cognitive Theory of Multimedia Learning. CTML is the theory of how humans process and learn information through words and pictures and it is the backbone for engagement and processing information (Harvard, 2018). Similarly, CTML consists of three parts, dual channels, limited capacity, and active processing. Dual channels are a person's eyes and ears used for understanding words and pictures. Limited capacity is the amount of information a human can hold at one time on the working memory. Humans can hold approximately five fragments of data at a time (Harvard, 2018). Active processing is when a human organizes relevant new information and makes connections to prior

knowledge (Davis, 2017). This focus on cognitive psychology addressed one of the central parts of the research question. Understanding how humans think and learn best through multimedia allows the creator to methodically design lessons.

The second video focused on the other main theme for this research, strategies, and techniques when designing lessons that increase engagement for the learner. To help the learner, the teacher should focus on minimizing distractions through the following five principles: coherence principle, signaling principle, redundancy principle, spatial contiguity principle, and temporal contiguity principle. The coherence principle involves removing unnecessary information and minimizing extraneous load (Davis, 2017). The signaling principle refers to emphasizing specific text. This can include changing the font style, color coding, and providing gestures for related elements (Ibrahim, 2012). The redundancy principle calls attention to eliminating redundant on-screen text like subtitles that is already in addition to visualizations and narrations (Davis, 2017). The idea of the spatial contiguity principle is to purposefully place words and pictures (Harvard, 2018). Lastly, the temporal contiguity principle explains that the teacher should simultaneously present the animation with the narration, rather than displaying the illustration and then explaining the visual (Harvard, 2018).

In addition to minimizing distractions, the teacher should also manage essential information when creating video lessons. Both the length of the video and content should be chunked to not overload the working memory, which can only hold approximately five pieces of data at a time (Ibrahim, 2012). Guo et al. (2014) concluded that videos should not exceed six minutes as a result of a majority of students watching less than half of videos longer than nine minutes. When recording the video, the teacher should include their face, voice, and enthusiasm when speaking (Guo et al., 2014). This will add a personal feel and help engage learners.

Another strategy is to stray away from PowerPoint-style lessons and draw on a blank slate, like the Khan Academy videos (Guo et al., 2014). These strategies and techniques, which are supported through research, align with my Applied Project to help engage students when delivering video lessons. Both videos for my Applied Project are accessible and tangible resources that educators could use immediately in their practice to increase student engagement.

Evaluation and Analysis of Survey Results

As part of my final product in my video mini-series, I included conclusions from a survey administered to three educators at my school. Educators were selected based on convenience and proximity to my classroom. Data was collected from educators asking about their interest in viewing videos for learning versus in-person learning. All three participants showed interest in watching videos for learning. Additionally, the results showed that even though the participants would watch a video for learning new information, generally they preferred a teacher introducing the subject rather than a video. This could be for several reasons, but my thought was that the videos lacked effective strategies to engage learners and the creators did not consider ways of utilizing the working memory. When participants were asked if they were interested in creating video lessons for their classroom the results were evenly spread from no opinion, agree, and strongly agree. Each of the three teachers that I surveyed taught different content, therefore I believe their answers were spread as a result of the varied needs in their content area. If participants were given resources to maximize student engagement with video lessons, 67% of participants agreed they were more inclined to create video lessons while 33% of participants strongly disagreed. There are a few possible reasons why one of the teachers strongly disagreed with engaging students with video lessons. For one, teachers were just coming back from a full year of virtual instruction and the teacher possibly did not have a positive experience with

technology and recording daily lessons. Another reason could be that their teaching philosophy, regarding student engagement, does not value video lessons. The results from the survey indicate that teachers are curious about increasing student engagement in their classrooms, but they also may not fully understand the implications of cognitive load and multimedia. If properly educated on cognitive load and multimedia, I believe educators would be vested in creating video lessons for students. Surveying more educators is necessary to provide more conclusive results.

Summary

My Applied Project consisted of understanding cognitive load, multimedia, and harnessing the working memory when designing video lessons. With this understanding, educators can increase student engagement when delivering video lessons, which aligns with the research question. The results of the survey indicate various attitudes and beliefs about using video lessons for student learning. Further research is needed from learners and educators to determine the satisfaction and effectiveness of video lessons for learning. In the following chapter, the Applied Research Project will be shared including both videos and Google slide presentations.

Chapter five will present my entire Applied Research Project, including links to my Instagram page and Google Site.

Chapter Five

Applied Project

The purpose of my research was to develop tools that educators could learn from and use for creating video lessons. My applied project consists of two videos. The first video explains cognitive load and multimedia. The purpose of this video is to explain how humans learn. The second video builds on the first topic by providing strategies and techniques for developing video lessons that focus on working memory and multimedia. The video series was originally published on an Instagram account that I made for this project. It can be found here: Applied Research Project *Instagram*. After careful consideration, I also posted the video series on a google site to make the content more accessible for everyone. The project via the google site can be found here: Applied Research Project: *Google Site*.

Chapter Six

Summary and Conclusion

For my applied research project, I created a two-episode mini-series video published on Instagram and Google Sites. The first video, titled *Cognitive Load & Multimedia,* explained how multimedia interacts with the working memory. This video's purpose was to inform the viewer on how humans process and absorb words and pictures. My second video, titled *Maximizing Engagement Video Lessons,* provided specifics of how to apply the Cognitive Theory of Multimedia Learning and the Cognitive Load Theory to maximize engagement for video lessons. I also collected qualitative data from three educators using a Likert scale via Qualtrics Survey. Educators were asked about their interest in viewing videos for learning versus in-person learning. Participants were also asked about their interest in creating video lessons for students.

Globally, technology is being used in many ways to learn. One notable example of technology implementation is video lessons. Video lessons are being created by educational technology companies, colleges and universities, and secondary education school systems. Additionally, due to the COVID-19 pandemic, much of the world relied on virtual instruction to learn. During online learning, as a result of the pandemic, my students and many others struggled with learning and engagement and there were numerous factors as to why students struggled to engage in learning. Much of which was beyond my control. Consequently, as an educator that reflects on my pedagogy, I wanted to research how to effectively engage my students through video instruction. This spawned the research question for my project, "With an understanding of cognitive load and multimedia, how can educators maximize engagement for students when delivering video lessons?" Educators can maximize engagement by understanding how the human mind works to process words and images (multimedia). This requires an elegant and

purposeful mesh of carefully chosen words and images deliberately placed near each other (Harvard, 2018). Content should be strategically selected as to be essential only to avoid overloading the working memory (Davis, 2017). Throughout this process, it is important to weave in prior knowledge from long-term memory to establish connections to the working memory (Ibrahim, 2012). When recording video lessons, the presenter should include their head and voice to make the lesson more personable (Guo et al., 2014). Additionally, new vocabulary should be presented early to prime the learner for future references (Davis, 2017). Lastly, videos should be chunked between five to ten minutes long so that the learner can digest all information (Artman, 2020).

Educational Implications

My research has various educational implications for educators and students. The overall goal of my study was to provide educators with resources to help increase student engagement when delivering video instruction. For educators, my study can help them understand the connection between cognitive load and multimedia as it applies to video lesson production. This understanding can provide educators with additional strategies to increase student engagement in their classrooms. As for students, the implications of this study provide them with a varied and purposeful way of learning content. Traditionally, students are familiar with live instruction, but this approach to learning should be helpful for some students and not detrimental to other students.

The goal of this project was to provide educators with resources to help increase student engagement through video instruction. Further research and observations should be done to determine the effectiveness and impact that these resources and recommendations have on student learning.

Recommendations

In this section, I provide recommendations concerning gaps in the research, things I wish I had done differently, and things that I saw the need for as a result of my research. My literature review included research findings on the Cognitive Theory of Multimedia Learning, the Cognitive Load Theory, student engagement in flipped classrooms, and student engagement with video instruction. A similarity between my project and the research is that my project included the strategies from the research that could be used when designing video instruction to increase student engagement. For instance, one of the recurring strategies that multiple sources mention, including Artman (2020), Gilboy et al. (2015), Guo et al. (2014), and, Paolo et al. (2017), stated that video lengths should be significantly shorter to maximize student engagement. A significant gap in the research was the application of CTML and CLT on video lessons for novice learners in secondary education and teacher and student feedback. Richard Mayer explained that CTML works best with novice learners (Harvard, 2018). Therefore, I recommend more studies applying these theories and recording student and teacher feedback on engagement.

If I was to redo this project I would apply my project findings to measure student engagement, because there is a need for testing the CTML. This research would include having experimental and control groups, measuring student success of learning targets, as well as qualitative data findings on student interest in the learning methods. It is also important to mention that measuring student engagement with the application of CTML and CLT for video instruction should vary by student age, curriculum, setting, and cultural background of students. This project is not a one size fits all approach to increasing student engagement and should be purposefully used in situations that the teacher believes will best support their students' learning needs.

Limitations

A significant difference in the research compared to my project included the application of CTML and CLT with video instruction as well as students' testimonies and results of meeting learning targets. Therefore, limitations in my research exist. The most significant limitation of my project is the application of these strategies and students' feedback. The application of CTML and CLT is a limitation because I only synthesized significant findings, rather than use them in practice. Additionally, lack of student feedback is a limitation because their thoughts and opinions matter regarding how they learn best, video lesson instruction, and engagement. The purpose of my project was to provide educators with resources to improve their practice, therefore it is natural these limitations exist. As a result, it is recommended that further research includes applying the ideas of CTML and CLT to video instruction and measuring student success.

Applications for Practice

The following actions are recommended for educators. I recommend reviewing the entire project I developed before implementation. More importantly, you must know your students, their cultural backgrounds, interests, and learning needs. If you determine that video instruction suits your learner's needs, your teaching style, and the mission statement of your school, then the implementation of video instruction should be purposefully used. It is not recommended to use video instruction for every unit and lesson, because excess use may reflect negatively on student engagement. Novice learners need a variety of support, therefore instructional strategies should vary often. Consider the content and learning targets as well as the learning needs of your students. As a result of reviewing my project, educators may change their instructional design and implementation. Modifying instructional design and implementation may improve the

cognitive thinking skills of students, increase engagement and curiosity, as well as help to meet the learning needs of all students. Due to the potential growth in understanding learning targets, as a result of reviewing my Applied Research Project, educators may use video editing software more and students may watch more video lessons.

Applications for Policy

The application for policy could start at the school level. An action that I recommend is to present this project during a segment of professional development required by educators. A recommendation could be for school leaders to include this in teachers' professional practice goals for the upcoming school year. More specifically, school leaders could require educators to integrate at least one video lesson during the upcoming school year and then reflect on the experience and discuss the next actions by department or grade level. Policy, in other words, teacher observation frameworks, may change to include video instruction as a way to increase student engagement. Including video lesson instruction as part of teacher pedagogical frameworks can help to develop a more inclusive and engaging learning environment for all students.

Conclusion

The instructional design and implementation of a lesson will always require educators to know their students, the curriculum, and the school, state, and national standards. The design of instruction will change year by year based on the needs of your students. Educators should be purposeful with their planning, know the cultural backgrounds of their students, and design rich instruction that seeks to engage and motivate students to meet learning targets. Video lesson instruction is one of many pedagogical strategies that can be used to support student learning. Just like with implementing any strategy in the classroom, using video lesson instruction should

be thoroughly researched, the pros and cons weighed, as well as executed to the best of your ability. The focus of every lesson should be for the educator to equitably support and engage all learners using the most efficient pedagogical strategies that reach every student.

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Appendix A

IRB Approval

The College of St. Scholastica

Institutional Review Board

DATE:	December 31, 2021
TO:	Thomas Devane, [*Dr. Annette Miller*]
FROM:	The College of St. Scholastica, Institutional Review Board
STUDY TITLE:	The Design of Video Production Integrating the Cognitive Theory of Multimedia Learning for a Flipped Classroom Learning Model and its Impact on Student Engagement
IRB PROTOCOL #:	1846214-1
SUBMISSION TYPE:	New Project
ACTION:	EXEMPT
REVIEW TYPE:	Expedited Review

Thank you for your submission of materials for this research project. The College of St. Scholastica IRB has reviewed your application and determined that the proposed activity meets the federal guidelines as exempt from full-board review under 45 CFR 46(1).

Ongoing review and approval for this activity is not required. However, if you make modifications to the design or procedures of this study that may change its exempt status, it is necessary to inform the IRB by completing the Protocol Amendment Form and submitting it to IRBNet.

If you have any questions, please contact Nicole Nowak through the project email function in IRBNet or nnowaksaenz@css.edu. Please include your study title and reference number in all correspondence with the IRB office.

Best regards,

Nicole T. Nowak

Nicole T. Nowak, Ph.D.
Chair, Institutional Review Board
The College of St. Scholastica
Duluth, MN 55811

Appendix B

Principal Approval

Devane Applied Research Permission

Feuerherd, Kathryn A <KFEUERHERD@aacps.org>
Thu 12/2/2021 3:10 PM
To: Devane, Thomas J <tdevane@AACPS.org>
Cc: amiller19@css.edu <amiller19@css.edu>

Good afternoon Ms. Miller,

The following project, Mr. Devane's capstone project, has my administrative approval.

- Who is participating in the research project?

Two to four employees at Crofton High School will be participating in an anonymous survey.

- When is the research project to occur?

January 2022

- What is this research project about?

The purpose of this study is to determine effective strategies for video production in a flipped classroom to maximize student engagement. The final project will be a repository of resources for educators to use in order to create engaging video lessons.

- Why is this research project important?

The flipped classroom model's objective is for learners to engage in new content outside of the classroom followed by engaging in experiences to support a student-centered learning environment. Over the last two years, since the acceleration of virtual and hybrid learning due to the COVID-19 pandemic, there has been an increased need in technology being used to support learning, especially video lessons.

- Where will this research project occur?

The survey portion of this project will occur on Qualtrics, a web-based survey tool to conduct survey research.

Please let me know if you need any additional information.

Sincerely,

Katie Feuerherd
Principal
Crofton High School
Home of the Cardinals
410-451-5300

Appendix C

Survey Questions - page 1 of 2

Q1 Select your level of agreement for each statement.

	Strongly disagree (1)	Disagree (2)	No opinion (3)	Agree (4)	Strongly agree (5)
I like watching videos for learning new information. (1)	○	○	○	○	○
I would rather watch a teacher introduce the lesson rather than watch a video lesson. (2)	○	○	○	○	○
I am more engaged watching a video lesson rather than watching a teacher introduce the lesson. (3)	○	○	○	○	○
I can remain focused watching a video lesson that is greater than 10 minutes. (4)	○	○	○	○	○
I can remain focused watching a video lesson that is between 4 and 6 minutes. (5)	○	○	○	○	○
Creating video lessons is something I am interested in doing in my	○	○	○	○	○

Page 4 of 5

classroom. (6)					
If I had a resource about maximizing student engagement with video lessons I would be more inclined to create video lessons. (7)	○	○	○	○	○

End of Block: Default Question Block

Appendix D

Consent Form - page 1 of 2

The College of St. Scholastica

The Design of Video Production Integrating the Cognitive Theory of Multimedia Learning for a Flipped Classroom Learning Model and its Impact on Student Engagement

Informed Consent

You are invited to participate in an applied research project asking your opinion on video lessons and your level of engagement. This study is being conducted by Thomas Devane, a graduate student in the Department of Education under the supervision of Annette Miller. You were selected as a possible participant because you work in education. I ask that you read this form and ask any questions you may have before agreeing to be in the study.

Study Purpose

The purpose of this study is to determine effective strategies for video production in a flipped classroom to maximize student engagement.

Study Procedure

If you agree to participate in this study, I ask that you complete an anonymous survey via Qualtrics. The online survey could be completed in 10 minutes. I will not be collecting personal identifiable information from you as part of my research.

Risk of Study Participation

This applied research project poses minimal risk. Your participation is voluntary and there are no repercussions for lack of participation.

Benefits of Study Participation

Any participants will not directly benefit from participating in the research process. However, the information may benefit future students, teachers, and educational researchers.

Confidentiality

In this study, no private information will be collected and questions from the Likert-questionnaire are not intrusive. You are allowed to skip questions for any reason.

In any publication or presentations, I will not include any information that will make it possible to identify you as a participant. Your record for the study may, however, be reviewed by individuals at CSS with appropriate regulatory oversight. All data collected will be stored in a locked filing cabinet and/or on a password protected computer. To these extents, confidentiality is not absolute. Your consent form and data will be retained securely for five years after which time it will be destroyed.

Voluntary Nature of the Study

Participation in this study is voluntary. You may withdraw your participation without consequences at any time.

Contact and Questions

The researcher conducting this study is Thomas Devane. You may ask any questions you have now.

If you have any questions or concerns regarding the study and would like to talk to someone other than the researchers, you are encouraged to contact the following individuals:
Dr. Chery Lucarelli, Chair of Graduate Education Programs: 218-723-7052; clucarelli@css.edu
Dr. Brenda Fischer, Dean of School of Education: 218-723-723-5971, bfischer1@css.edu
Dr. Nicole Nowak-Saenz, Chair of the CSS Institutional Review Board: 218-625-4988, nnowaksaenz@css.edu, irb@css.edu

You may also contact any of the above-named individuals in writing or in person at The College of St. Scholastica, 1200 Kenwood Ave, Duluth, MN 55811.

Appendix E

Teacher Survey Results

#	Field	Strongly disagree	Disagree	No opinion	Agree	Strongly agree	Total
1	I like watching videos for learning new information.	0.00% 0	0.00% 0	0.00% 0	66.67% 2	33.33% 1	3
2	I would rather watch a teacher introduce the lesson rather than watch a video lesson.	0.00% 0	0.00% 0	0.00% 0	66.67% 2	33.33% 1	3
3	I am more engaged watching a video lesson rather than watching a teacher introduce the lesson.	0.00% 0	66.67% 2	0.00% 0	33.33% 1	0.00% 0	3
4	I can remain focused watching a video lesson that is greater than 10 minutes.	0.00% 0	33.33% 1	33.33% 1	33.33% 1	0.00% 0	3
5	I can remain focused watching a video lesson that is between 4 and 6 minutes.	33.33% 1	0.00% 0	0.00% 0	33.33% 1	33.33% 1	3
6	Creating video lessons is something I am interested in doing in my classroom.	0.00% 0	0.00% 0	33.33% 1	33.33% 1	33.33% 1	3
7	If I had a resource about maximizing student engagement with video lessons I would be more inclined to create video lessons.	33.33% 1	0.00% 0	0.00% 0	66.67% 2	0.00% 0	3

Capstone Presentation

Purpose of the Study

Asynchronous learning, flipped classrooms, and online educational learning are popular and convenient ways to learn.

Research Question: With an understanding of cognitive load and multimedia, how can educators maximize engagement for students when delivering video lessons?

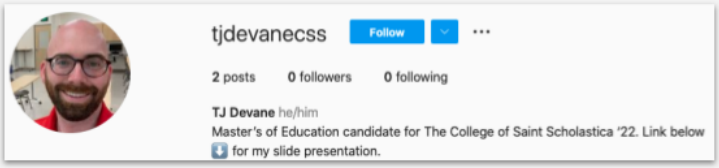
Significance of the Study

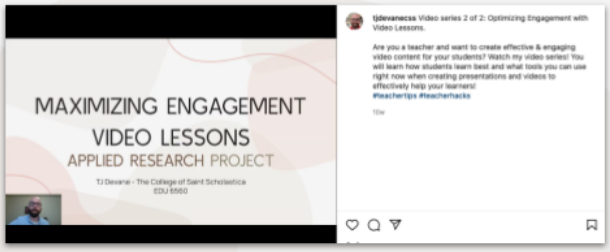
Since there is popularity among online learning and greater access to technology for students, it is important to understand how to engage learners in video lessons.

Procedure

- The setting for this project was a public high school in Anne Arundel County, Maryland
- Participants in the study were three teachers in a high school for 9th-10th
  - They were selected using a convenience sampling
- Participants provided feedback on the usefulness of video lessons for engagement and their interest in creating video lessons
- They were instructed to respond to each of the seven statements using a five-point likert scale that ranged from "strongly disagree" to "strongly agree"
- There were no major risks and participants did not directly benefit from participating in the survey
- All data analysis was conducted using Qualtrics Survey data reports
  - The data was first organized by field and included frequencies, percentages and totals for each statement

Results





Minimize Extraneous Load

- **Coherence principle** refers to minimizing extraneous information by removing unnecessary information (Davis, 2017)
  - Nice to know information
- **Signaling principle** refers to highlighting important information, especially if instructors cannot take out extraneous information (Davis, 2017)
  - changing font style, flashing or having a spotlight on text or graphics, giving related elements the same color, and providing gestures for related elements (Ibrahim, 2012)
- **Redundancy principle** states learners learn best from animation and narration rather than animation, narration, and on-screen text that is similar to the narration (Davis, 2017)

Manage Essential Information

- Mayer explains that the presentation should be broken down into parts, according to the **segmenting principle** (Harvard, 2018).
- Chunking dynamic visualizations are helpful for novice learners, especially when the material is complex and the pace of the presentation is rapid (Ibrahim, 2012)
  - Breaking down parts of the visualizations helps to not overload the learner with too much information
  - working memory is finite and on average can only hold 5 pieces of data at a time
- Five to ten-minute-long segmented videos help the learner digest the information before moving on (Artman, 2020)
  - Videos should be no more than six minutes. This was discovered when a majority of students made it less than halfway through videos longer than nine minutes (Guo et al., 2014).

Additional Instructional Video Design

- Guo et al. (2014) also writes that each video should have a personal feel where the instructor's face/head is present throughout
- Video creation should have enthusiasm from the speaker and the instructor should speak fast (Guo et al., 2014)
- Guo et al. (2014) points out that Khan Academy-style videos were more engaging.
  - These types of videos are ones that use a tablet and draw on a blank slate which draws more engagement than PowerPoint-style slides or filmed lectures
- Students require more support in order to engage them in video lectures
  - Including reflection questions that relate to the video is an additional way to increase student engagement
  - If students know there are questions following the video they are more likely to be active listeners rather than passively watching the video
- Another technique to increase student engagement is "gamification"
  - gamification strategies include leaderboards, badges, and points for video viewing

Data Results

#	Field	Strongly disagree	Disagree	No opinion	Agree	Strongly agree	Total
1	I like watching videos for learning new information.	0.00% 0	0.00% 0	0.00% 0	66.67% 2	33.33% 1	3
2	I would rather watch a teacher introduce the lesson rather than watch a video lesson.	0.00% 0	0.00% 0	0.00% 0	66.67% 2	33.33% 1	3
3	I am more engaged watching a video lesson rather than watching a teacher introduce the lesson.	0.00% 0	66.67% 2	0.00% 0	33.33% 1	0.00% 0	3
4	I can remain focused watching a video lesson that is greater than 10 minutes.	0.00% 0	33.33% 1	33.33% 1	33.33% 1	0.00% 0	3
5	I can remain focused watching a video lesson that is between 4 and 6 minutes.	33.33% 1	0.00% 0	0.00% 0	33.33% 1	33.33% 1	3
6	Creating video lessons is something I am interested in doing in my classroom.	0.00% 0	0.00% 0	33.33% 1	33.33% 1	33.33% 1	3
7	If I had a resource about maximizing student engagement with video lessons I would be more inclined to create video lessons.	33.33% 1	0.00% 0	0.00% 0	66.67% 2	0.00% 0	3

Conclusion

- The overall goal of my study was to provide educators with resources to help increase student engagement when delivering video instruction.
- I *recommend* more studies applying CTML and CLT and then record student and teacher feedback on engagement
- In order to provide effective strategies, extensive research on how humans learn best is needed
    - Understanding cognitive load & the cognitive theory of multimedia
- This project is not a one size fits all approach to increasing student engagement and should be purposefully used in situations that the teacher believes will best support their students' learning needs.