The Role of Engagement and Motivation During Content Acquisition Podcasts

By

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Abstract

Teaching children to read has been one of the primary functions of education systems throughout history; however, not all children are adequately prepared for reading success. Students with disabilities, particularly those identified with Specific Learning Disabilities, demonstrate lower rates of reading proficiency than their nondisabled peers. In part, this discrepancy relates to the limitations of teachers' knowledge and skills to delivering effective reading instruction, especially to students with disabilities. Significant attention has been paid to integrating the five pillars of reading (i.e., phonemic awareness, phonics, fluency, vocabulary, comprehension) identified by the National Reading Panel (2000) within teacher preparation. Despite the critical role reading fluency plays as a bridge between decoding and comprehension abilities, research on teachers' knowledge and skills related to this area of reading instruction remains relatively limited. Researchers and teacher educators have sought to address these interconnected issues by improving the quality of teacher preparation and increasing teacher candidates' knowledge of evidence-based practices in reading. Using multimedia instruction through Content Acquisition Podcasts (CAPs) is one innovative approach to more adequately preparing preservice teachers to deliver reading instruction.

CAPs are a specific type of multimedia module aligned with theories of cognitive load and learner motivation. Past studies have documented the efficacy of CAPs for improving preservice special educators' knowledge of several reading constructs (i.e., phonological awareness, phonemic awareness, phonics, and vocabulary) through randomized controlled trials. However, researchers have not yet explored how and why CAPs work, nor have studies focused on building knowledge about reading fluency. Because of the selected research designs, these

studies have also not included learners' perspectives on their engagement and motivation while learning from a CAP.

Employing an explanatory sequential mixed methods design with a case selection variant, this study addressed the following research question: How do learner perceptions of their engagement and motivation while watching a CAP on reading fluency relate to differences in scores on a knowledge measure? The purposes for mixing were initiation, development, and complementarity, and mixing happened at the points of sampling, data collection, and data analysis. In the initial, quantitative phase, participants (N = 80) watched a reading fluency CAP and completed a pre-posttest knowledge measure using the Teacher's Knowledge of Reading Fluency Survey (Lane et al., 2009). After scoring, results from the pre-posttest were stratified by major and growth to identify four groups (i.e., top third and bottom third of each major). Selected participants from each stratum (n = 18) completed follow-up interviews using a stimulated recall protocol.

Results of this study indicate that participants learned about reading fluency from watching the CAP, and that engagement appeared to influence learning from a CAP more than motivation. Motivation was not variable across participants, but engagement differed between participants in the top and bottom strata. Participants who reported engaging through specific strategy use (e.g., notetaking, verbal rehearsal) were more likely to score in the top third for their major. Thus, engagement appeared to be more closely connected to learning than motivation. Additionally, findings from the qualitative phase highlight the use of video conditions (i.e., speed, closed captioning) as well as the lingering impact of COVID-19 related school closures on perceptions of multimedia learning.

These findings provide specific guidance for teacher educators on how to effectively integrate CAPs into their pedagogy, such as what types of content are suitable for CAPs and how to set clear expectations about their use. More generally, the results of this study also highlight the importance of scaffolding independent learning tasks by teaching and modeling specific strategy use, the dissonance between self-reports and assessment of knowledge, and student attitudes toward multimedia instruction. Implications for research include replicating this study within a reading course to explore contextualized learning, expanding the use of mixed methods research design to evaluate the effectiveness of teacher education, and enhancing the theoretical frameworks that undergird CAPs to include accessibility features and to acknowledge the influence of COVID-19 on multimedia learning.

To Elijah and Silas

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Looking back, it is hard for me to believe I am sitting where I am today. As a first-generation college student, a bachelor's degree often felt out of my reach and unbearably difficult. I persevered but was hardly eager to return to higher education. It was only when I found work worth doing that more education felt realistic. I completed my master's degree while working full-time as a paraprofessional and part-time as a respite provider, and then went on to earn two teaching licenses and an administrator license in seven years. I was eight months pregnant with my second child when I was accepted into the doctoral program, and I spent first semester studying in between pumping sessions. During my second semester, the COVID-19 pandemic began, prompting a hard pivot to virtual learning and the loss of our childcare. By rotating and patching our work hours together, my husband and I spent 13 months with at least one child home at all times and still maintained our jobs and coursework. Throughout this, I navigated being a disabled scholar and figuring out how to live with a dynamic disability that I previously tried to hide. Now, I am preparing to graduate and am excited to begin my career as a teacher educator. I am incredibly proud of the perseverance it took to reach this moment and extraordinarily grateful for the opportunity to earn a doctoral degree. It has never been easy, but it has always been worth it.

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Chapter 1: Introduction to The Problem

Historical Trends in Reading Achievement for Students with Disabilities

Reading achievement rates for students with disabilities have been significantly lower than those for students without disabilities since the National Assessment of Educational Progress (NAEP) began reporting disaggregated data by disability status in 2002. The NAEP is widely regarded as a measure of student achievement, as it includes national data for comparisons over time and is linked to the Every Student Succeeds Act (ESSA, 2015). Unlike many other standardized assessments, results are generated in aggregate and used to inform research, policy, and practice nationwide. Results are reported as average scores and the percentage of students attaining four levels: *Below Basic*, *Basic*, *Proficient*, and *Advanced*. NAEP Proficient is generally defined as strong academic skills and, more specifically in relation to reading, is determined by the ability to apply inferential and evaluative comprehension skills. Comparatively, students performing at NAEP Basic are more likely to demonstrate literal comprehension skills. As a result of the persistent gap in reading achievement between disabled and nondisabled students, a mere 13% of students with disabilities graduate high school reading proficiently, compared with 40% of their peers without disabilities (NAEP, 2019). These data indicate that 87% of students with disabilities graduate high school unprepared to apply the reading comprehension skills necessary for college, community, and career success. More alarmingly, reading achievement among students without disabilities in 4th and 8th grade grew modestly since 1992, while the percentage of students with disabilities reading at below basic levels has remained stagnant since 2002 (NAEP, 2019). The most recent data from NAEP indicate that 70% of 4th grade, 63% of 8th grade, and 68% of 12th grade students with disabilities

read below a basic level, indicating that they may not possess sufficient reading skills to locate key information in a text or use reading as a means to gain knowledge.

More than a third of the 7.3 million students receiving special education services are identified under the category of Specific Learning Disabilities (SLD), making SLD the most prevalent disability amongst students (NCES, 2019). Reading achievement rates are particularly dire for students with SLD, as 97% of 4th graders and 96% of 8th graders identified with SLD scored below proficiency in reading (National Center for Learning Disabilities, 2017). In addition to the scope of this problem, the lower levels of reading proficiency students with disabilities experience have pernicious long-term consequences including lower high school graduation rates, poor post-school outcomes, and higher rates of adjudication compared to their peers without disabilities (Hernandez, 2011; Lesnick et al., 2010; McDaniel et al., 2010; Shelley-Tremblay et al., 2007). Because reading skills place such a critical role for meaningful participation in society, reading and high-quality reading instruction are recognized as human rights by the International Literacy Association (Dwyer et al., 2019) and the United National Educational, Scientific, and Cultural Organization (UNESCO, 2002).

Scholars posit several explanations for the disparities in reading achievement including frequent school suspensions and systemic racism (Morris & Perry, 2016), poverty (Paschall et al., 2018), and the limitations of the general education environment, but a leading factor that is within the control of educators is quality of reading instruction (Gilmour et al., 2018). Researchers have identified several instructional practices most likely to result in increased reading achievement for students with disabilities, and a large body of research confirms that this group of students can make significant growth in reading achievement when provided with intensive and individualized instruction (Fuchs et al., 2012; Fuchs et al., 2015; McKenna et al.,

2015; Swanson, 2008). Thus, there is a clear and urgent need to emphasize high-quality, evidence-based instructional practices for reading within special education.

A Brief History of Reading Instruction

Attention to reading instruction has long been a focus of research in special education. Indeed, as a special issue of *Reading Research Quarterly* (RRQ) on reading instruction and special education noted, "from a historical perspective, difficulty in learning to read has been perhaps the most prominent manifestation of the learning difficulties that occupy the attention of those in the field of special education" (Reinking & Alvermann, 2006, p. 92). Even prior to the advent of federal special education law, Americans were concerned with scientifically "solving" the issue of limited reading proficiency since the 1950s (Alexander & Fox, 2004). Rudolph Flesh's controversial text, *Why Johnny Can't Read – And What You Can Do About It* was published in 1955 as a critique of the dominant whole language approach to reading instruction, which emphasizes reading words holistically and by sight rather than decoding (Goodman, 1986). Many researchers and educators expressed frustration with the field's inability to help all children develop the requisite skills for reading. In an attempt to address this, reading researchers turned to the growing field of behaviorism to identify discrete processes necessary for learning to read.

Reading instruction research during this period focused on using behaviorism to train students in the discrete skills required for reading. Jeanne Chall's groundbreaking work (1967) justified instructional emphasis on decoding and code-based reading instruction in contrast to a renewed interest in whole language instruction in the late 1960s through the 1970s. Code-based reading instruction emphasizes applying the relationships between written letters and spoken sounds to read and spell words (Cohen et al., 2017). With the influence of Noam Chomsky

(1957), learning and language were increasingly perceived as naturally developing and not requiring explicit instruction. In another swing of the pendulum, growth in the field of cognitive psychology generated interest in understanding the cognitive processes involved in reading as well as the impact of direct intervention on reading achievement through the early 1980s. Frustrations with limited gains from explicit instruction, the reinvigoration of sociocultural learning theories, and the advent of critical theory converged to result in changes to dominant views about reading instruction through the mid-1980s to the mid-1990s (Alexander & Fox, 2004).

Parallel to academic debates about reading development, Public Law 94-142 passed in 1975 as the *Education for all Handicapped Children Act* to codify free and appropriate public education for students with disabilities (U.S. Department of Education, 2022). This beginning of formal special education also facilitated the development of procedures to identify and serve students with disabilities in public schools. Reauthorizations in 1986, 1990, 1997, and 2004 coalesced to form the modern Individuals with Disabilities Education Act (IDEA, 2004). The number of students receiving special education services under IDEA has grown to 7.3 million nationally, with the largest disability category being SLD. Currently, 33% of students receiving special education services are identified within this category (NCES, 2021) and approximately 85% of those students have a SLD in reading (International Dyslexia Association, 2020). Dysfluent reading is one of the defining characteristics of reading disabilities (Meisinger et al., 2010), although a substantial body of research demonstrated this can be improved through specific intervention (Chard et al., 2002; Lee & Yoon, 2017; Stevens et al., 2017).

This rich history brought about the most recent era, defined as engaged learning by Alexander and Fox (2004). The role of motivation became central in reading research discourse

(Guthrie et al., 1996; Guthrie et al., 2000) and calls for accountability in education, which resulted in the type of high stakes testing that informs the NAEP data (Alexander & Fox, 2004). Likewise, the emphasis on accountability contributed to the formation of the National Reading Panel (NRP) and the publication of its subsequent report in 2000. The NRP was formed under the National Institute of Child Health and Human Development (NICHD) by a Congressional charge in 1997 and included 14 leaders in the field of reading research (NRP, 2000). The panel carefully reviewed research in five areas of reading instruction: alphabetics (i.e., phonemic awareness, phonics), fluency, comprehension (i.e., vocabulary, text comprehension), teacher education, and computer technology. The NRP was a watershed moment in reading research, as it solidified the five major components of reading instruction that are now ubiquitous in the field. As a result of this report, phonemic awareness, phonics, fluency, vocabulary, and reading comprehension became the central pillars of reading instruction research and practice.

In the 20 years since the publication of the NRP, researchers have made substantial contributions to what is known about how children learn to read (Petscher et al., 2020; Seidenberg, 2013). Researchers and educators in the field continue to engage in vigorous debate regarding best practices in reading instruction, with significant research centering on what is known as *the science of reading* (Hudson et al., 2021; Petscher et al., 2020). Simply put, the science of reading is "the accumulated knowledge about reading, reading development, and best practices for reading instruction obtained by the use of the scientific method" (Petscher et al., 2020, p. S268). This line of research highlighted the importance of systematic and explicit instruction in foundational reading skills (Ehri, 2020), as well as updated models for understanding reading processes. For example, Duke and Cartwright (2021) proposed an Active View of Reading to expand upon the Simple View of Reading framework developed by Gough

and Tunmer (1986). These models are particularly significant for helping PK-12 teachers understand the science of reading (Moats et al., 2018; Duke & Cartwright, 2021). Specifically, the Active View of Reading emphasizes the essential processes that bridge word recognition and reading comprehension (Duke & Cartwright, 2021). One such essential bridging process is reading fluency, as data show positive correlations between fluency and reading comprehension. It is essential that teacher preparation embrace such models and underscore the importance of bridging processes so that teachers are equipped with the necessary knowledge to deliver effective reading instruction.

Data on specific areas of reading further highlight the need for change in reading instruction, particularly related to reading fluency. Reading fluency is a critical but often neglected component of effective reading instruction (Daane, 2002). Oral reading fluency is defined as reading aloud with accuracy, appropriate rate, and sufficient prosody (i.e., expression) to facilitate reading comprehension (Armbruster et al., 2009; Daane, 2005; Lane et al., 2009). Fluent reading is correlated with improved reading comprehension due to the shift from using cognitive energy for word recognition to making meaning from written text (Perfetti, 2007; Sabatini et al., 2019). For many children, the shift to reading fluency occurs during 2nd and 3rd grade (Chall, 1996) and facilitates enhanced content knowledge acquisition as instruction move from learning to read to reading to learn around 4th grade (Chall, 1996; Meisinger et al., 2010).

In addition to its importance for reading comprehension, reading fluency is also more easily and efficiently assessed, making it a valuable source of data for monitoring students' reading development (Fuchs et al., 2001). Yet promoting fluency has not always been a priority in reading instruction. Findings have indicated that between 55% and 61% of 4th grade students read with fluency (Pinnell et al., 1995; Daane, 2005). Current data reveal that 36% of 4th grade

students read below NAEP Basic, indicating some ability to identify key information in text (e.g., literal comprehension) but with gaps in inferential and evaluative comprehension (White et al., 2021). These data were not disaggregated by disability status; however, disproportionate percentages of Black and Hispanic students, as well as students eligible for National School Lunch Program performed in the lowest category of Below NAEP Basic (White et al., 2021), furthering highlighting the urgent need for high-quality reading instruction as a social justice issue. Consequently, the Department of Education called for additional research on current approaches to fluency instruction and further investigation of reading achievement gaps based on demographic data (White et al., 2021).

Importance of Teacher Knowledge for Reading Instruction

Another component of the NRP is the critical role of teacher preparation in reading achievement and delineated directions for future research. Of particular significance for the current study, the NRP posed the question: "Does teacher education influence how effective teachers are at teaching children to read? If so, how is this instruction best provided?" (NRP, 2000, p. 1-3). Drawing from studies of teacher quality (Darling-Hammond, 2000) and NAEP data, the NRP (2000) concluded there was evidence of a correlation between formal teacher preparation and higher reading achievement for students. Since the publication of the NRP report, additional studies have demonstrated that the quality of teacher preparation is directly correlated to student reading achievement (McCutchen et al., 2002; Piasta et al., 2009), yet research shows that in-service teachers may not possess the requisite pedagogical content knowledge to teach reading. Several studies have demonstrated that educators need more robust knowledge and skills to provide effective reading instruction, particularly to students identified as struggling or at-risk (e.g., Cohen et al., 2017; Hudson et al., 2021; Washburn et al., 2010). As

the persistent gaps in reading achievement illustrate, there is an urgent need for improved teacher preparation with regard to reading instruction (e.g., Moats & Foorman, 2003; Shanahan, 2020; Solari et al., 2020). The NRP concluded that preservice teachers implement the instructional strategies learned during their preparation coursework, thus teacher education must deliver high-quality content on reading instruction because teachers cannot teach what they do not know (Cohen et al., 2017; Hudson et al., 2021).

Building Teacher Knowledge for Reading Instruction

Given the persistent gaps in reading achievement and the established relationship between teacher knowledge and student outcomes, there is a clear need for innovation and change in preparation of educators to teach reading (e.g., Moats & Foorman, 2003; NRP, 2000; Shanahan, 2020; Solari et al., 2020). A recent literature review conducted by Hudson and colleagues (2021) highlighted the impact explicit instruction on foundational reading skills can have on teachers' pedagogical content knowledge for reading instruction. The authors reviewed 20 empirical studies published between 2003 and 2021 to determine the efficacy of instruction on elementary teachers' knowledge of phonological awareness, phonics, and morphological awareness. Five of those studies also included a measure of student reading achievement. The findings of the review suggest that instruction improved teachers' knowledge of foundational reading skills, and that improved teacher knowledge generated improvements in students' word-level reading (i.e., decoding real and nonsense words). Additional research demonstrates the potential for integrating technology into instructional modalities. Technological interventions, such as Content Acquisition Podcasts (CAPs) and instructional simulations, are innovative and effective at increasing teachers' knowledge and skills for reading instruction (Smith & Kennedy, 2014; Zepp, et al., in preparation). Briefly, CAPs are a specific type of multimedia module that

combine images, text, and audio narration (Kennedy et al., 2013). Such approaches are designed to align with theories of learning to reduce cognitive load and maximize content acquisition (Kennedy et al., 2013). As a result of this alignment, researchers have posited that CAPs are more effective at enhancing preservice teachers' pedagogical content knowledge than traditional instructional modalities such as assigned readings and lectures (Kennedy et al., 2011; Kennedy et al., 2012). CAPs can also communicate large amounts of content in a small amount of time. In addition to their efficacy, CAPs maximize efficiency during the limited instructional time in teacher preparation (Kennedy et al., 2011; Kennedy et al., 2012). CAPs and other multimodal approaches to instruction allow for increased application opportunities within teacher preparation, which is increasingly important given the growing demands on the field (Leko et al., 2015).

Statement of the Problem

As evident by the national reading achievement data, preservice teachers need to understand the science of reading, so they are prepared to teach reading (Hudson et al., 2021; Shanahan, 2020; Solari et al., 2020). To address this, teacher educators need tools to enhance the knowledge and skills of preservice educators within existing time constraints (Kennedy et al., 2011; Kennedy et al., 2012). Technological innovations, such as CAPs, offer a potential solution for special education teacher preparation. The extant literature emphasizes the positive impact of CAPs on preservice special educators' knowledge of phonological awareness, phonemic awareness, phonics, and vocabulary (Alves et al., 2018; Carlisle et al., 2016; Driver et al., 2014; Ely et al., 2014; Kennedy et al., 2013; Peeple et al., 2019). Studies have not, however, investigated the potential for CAPs to influence preservice teachers' knowledge about reading fluency, which is a critical bridging process for reading proficiency (Duke & Cartwright, 2021)

and a common area of need for students with SLD in reading (Meisinger et al., 2010). Additionally, research has not investigated the role of engagement and motivation in learners' experiences with CAPs. By exploring a different area of reading and examining factors that may influence preservice teachers' learning from CAPs, this study can help teacher educators better address the gaps in teacher knowledge that ultimately impact reading achievement for students with disabilities.

Purpose and Theoretical Framework

The purpose of this study is to understand how post-secondary students learn about reading fluency from a CAP. CAPs are a specific type of multimedia module first developed by Kennedy and colleagues (2011) to deliver content in special education and teacher education. The theoretical foundation of CAPs is Mayer's Cognitive Theory of Multimedia Learning (CTML; 2009). Drawn from theories of cognitive load and social cognitive theory (Bandura & McClelland, 1977; Sweller, 1998), CTML emphasizes the use of specific instructional design principles to accomplish three goals: (1) reduce extraneous processing, (2) manage essential processing, and (3) foster generative processing. Adherence to these instructional design principles theoretically supports learners by allowing them to focus on specific content, remain engaged throughout the instruction, and ultimately learn more content than from other instructional modalities (Mayer, 2009). A more detailed account of CTML is presented in Chapter 2.

A central theoretical underpinning to CAPs is the notion that people learn more effectively from a combination of images, words, and spoken language than from print alone; however, this should be considered the beginning of this research, rather than the end (Mayer, 2014). The extent to which people learn from CAPs addresses the first two instructional goals—

reduce extraneous processing and manage essential processing (Mayer, 2014). Prior research on CAPs has demonstrated that they meet these instructional goals by generating statistically significant gains on knowledge measures compared with other instructional modalities (e.g., reading a text, traditional lecture). Research on CAPs has not yet fully examined the third goal of multimedia instruction—fostering generative processing by considering the roles of engagement and motivation while watching a CAP (Mayer, 2014).

Using Mayer's CTML, the goal of this research is to examine the perceived roles of motivation and engagement that may mediate knowledge acquisition from a reading-related CAP. This study was guided by the following research question: How do learner perceptions of their engagement and motivation while watching a CAP on reading fluency relate to differences in scores on a knowledge measure?

Organization of the Manuscript

This manuscript is organized into five chapters. The first three chapters, beginning with this introduction to the problem, serve as the study proposal. Chapter 2 focuses on the theoretical framework undergirding the study and provides a review of the literature on two areas: (1) preservice special educators' knowledge related to reading fluency and (2) CAPs as an instructional modality in special education teacher preparation. The methods for the study are described in Chapter 3, including the mixed methods research design and purpose, setting and participants, measures, intervention, and procedures for data collection and analysis in both the quantitative and qualitative phases. The results of this study are detailed in Chapter 4, with main quantitative analysis presented first, followed by integrated results of the quantitative and qualitative phases. These data are organized around the most salient themes and those best positioned to answer the research question. Finally, Chapter 5 includes a summary of the

findings, discussion of the implications for teacher education and future research, and the limitations of the current study.

Chapter 2: Review of The Literature

This study will explore how learners' perceptions of their engagement and motivation during CAPs relate to differences in scores on a measure of reading fluency knowledge with the goal of expanding understandings of how and why CAPs work as an instructional modality in teacher education. The subsequent review is an examination of the current literature in the areas of: (a) preservice teachers' knowledge of reading fluency, (b) theories of cognitive load and multimedia learning, and (c) CAPs as an instructional modality in special education teacher preparation. This review serves to position the proposed study in current discourse on special education teacher preparation and teacher knowledge for reading instruction.

Effective Fluency Instruction for Students with Disabilities

Fluency is the third area of reading identified by the NRP (2000) and is defined as reading with accuracy, appropriate rate, and prosody. Before readers begin to develop fluency, their word recognition skills (i.e., phonemic awareness, phonics) must be solid. With decoding skills firmly in place, readers are ready to progress toward the goal of reading, which is comprehension. Fluency is recognized as a critical bridging process between word recognition and reading comprehension (Duke & Cartwright, 2021; Pikulski & Chard, 2005; Wolf & Katzir-Cohn, 2001), and research shows a strong correlation between fluency and comprehension, thus the ability to read fluently is integral to reading success (Stanovich, 1991). Although some students may learn to read fluently incidentally, many others, including students with disabilities, need systematic and explicit instruction to develop proper fluency (Hudson et al., 2005).

Effective fluency instruction for students with disabilities includes modeling fluent oral reading, embedding opportunities for repeated oral reading of connected text, and monitoring to provide corrective feedback (Hudson et al., 2005). Passages selected for oral reading fluency

should be at the student's independent reading level (i.e., 95-100% accuracy) (Allington, 2000; Hudson et al., 2005). Once a passage is selected, teachers should model fluent oral reading using a read aloud procedure that emphasizes reading with accuracy, appropriate rate, and prosody. Students can then read and reread the same passage aloud using a variety of strategies such as partner reading, choral reading, or audio assisted reading (Rasinski, 2003). By reading and rereading the same passage multiple times, students can read words more accurately and develop a more rapid pace. Repeated oral reading can also be timed for one minute to allow students to chart their oral reading rate and monitor their progress (Hudson et al., 2005). As students read, the teacher should monitor their reading and provide corrective feedback on their accuracy, rate, and prosody.

In addition to repeated reading, teachers should also continue reviewing word recognition and decoding for students with disabilities. This can be supplemented with explicit teaching of phrase boundaries to help students learn to chunk sentences into meaningful groups of words (Rasinski, 2003). Appropriately grouping words into phrases facilitates comprehension, as Rasinski notes with the following example: The young man the jungle gym. If the sentence is read with "the young man" as a single phrase, it makes no sense. Instead, the sentence should be read with "the young" as one phrase and "man the jungle gym" as another.

Just as phrase boundaries can be explicitly taught, teachers can also explicitly teach intonation and expression as part of developing prosody. To teach intonation, students can review the inflection associated with each punctation mark in familiar text (Blevins, 2001). For example, "We eat ice cream?" and "We eat ice cream!" can be modeled expressively to convey the different meaning in each sentence. Reader's Theatre, in which students practice and perform a play, can also help students practice reading with prosody (Hudson et al., 2005). When students

read with prosody, they also demonstrate accuracy and rate, as well as the ability to make sense of the text as they read it. Thus, fluent readers are better equipped to comprehend what they read. Given the critical role fluency plays in reading comprehension, it is essential that educators understand this concept and how to teach it.

Measuring Teacher Knowledge for Reading Instruction

Educational research has long noted the need to address teachers' knowledge for reading instruction. Referred to as the "Peter Effect", in short, educators cannot teach knowledge and skills that they do not possess (Applegate & Applegate, 2004; Binks-Cantrell et al., 2012). In a seminal study, Moats (1994) investigated in-service teachers' knowledge of foundational reading skills. This was particularly urgent given the complex pedagogical content knowledge required to teach students with reading and language disabilities who represent 75% to 85% of all students identified with learning disabilities (Moats, 1994). Many of these learners have difficulty with foundational reading skills such as phonological and phonemic awareness, phonics, and morphology (i.e., the study of word structure).

To understand teachers' existing knowledge related to these foundational skills, Moats administered a survey to 89 in-service reading teachers, general education teachers, special education teachers, and other instructional staff. Results of the survey indicated significant gaps in teachers' knowledge of language and literacy concepts. As such, participants struggled to distinguish between key terms (i.e., phonetics, phonology, and phonics) and were unable to define essential vocabulary (e.g., phonological awareness, phoneme). Approximately 10 to 20% of participants were able to consistently identify common phonics patterns and only 27% could identify morphemes in words (e.g., unbelievable and attached each have three morphemes). This survey serves as a foundation for understanding the reading instruction knowledge and skills that

educators in the field possess. Additionally, Moats emphasized the importance of this knowledge for teachers to analyze and correct student errors, design and deliver systematic instruction, and integrate linguistic concepts into their pedagogy. To address the surveyed knowledge gaps, Moats called for teacher educators to ensure teacher candidates are adequately prepared with knowledge and skills related to foundational reading skills.

As an extension of this line of research, Moats and Foorman (2003) conducted a four-year longitudinal study to understand teachers' knowledge of reading concepts. Results of this study showed a modest yet significant relationship between teacher quality and students' reading achievement during third and fourth grade in two high-poverty, urban schools. Teachers' knowledge of foundational reading skills was predictive of students' reading performance at one of the two study locations. Researchers employed three phases of surveys to assess knowledge of early elementary teachers (n = 50), second and third grade teachers (n = 41), and third and fourth grade teachers (n = 103). Phase 1 results showed that teachers possessed minimal knowledge of phonological and phonemic awareness concepts, while Phase 2 results showed some understanding of phonological and phonemic awareness, as well as some accuracy applying morphological concepts, but continued challenges with identifying syllable types and applying common phonics patterns to encoding (i.e., spelling). In Phase 3, only 34% of teachers demonstrated a high level of content knowledge and 21% showed very limited understanding of foundational reading skills. Given these findings, the authors concluded that it was reasonable to expect teachers to have difficulty analyzing student assessment data and designing reading instruction.

In addition to the survey developed by Moats and Foorman (2003), researchers often draw from the work of Joshi and colleagues (2009) to craft knowledge measures for pre-posttest

assessment (Driver et al., 2014; Kennedy et al., 2013). These researchers created the *Survey of Language Constructs Related to Literacy Acquisition* to understand the mastery of linguistic concepts by teacher educators (N = 78) assigned to teach reading courses within university-based teacher preparation programs. The findings of this survey indicated that teacher educators may not possess the requisite pedagogical content knowledge to successfully teach reading methods to preservice teachers. For example, participants' knowledge of phonology was strongest (m = 78.97) while knowledge of morphology was weakest (m = 34.36). Knowledge of phonics and comprehension were more intermediate, with about half of the items answered correctly. Interestingly, the scores achieved by participants did not match teacher educators' self-perceptions, as the highest average ratings were reported in vocabulary and comprehension. As a result of these findings, the researchers suggested that improvements in teacher preparation are needed.

Several other studies measuring teacher knowledge of reading reported similar results, and taken together, measures of teacher knowledge for reading instruction call attention to an important issue: many teachers and teacher educators do not possess the content knowledge necessary to teach reading, especially to students with disabilities (Bos et al., 2001; Cunningham et al., 2004; Mather et al., 2001; McCutchen et al., 2002; Piasta et al., 2009; Washburn et al., 2010). More recently, Cohen and colleagues (2017) surveyed in-service elementary teachers (N = 114) regarding their knowledge of code-based reading instruction. The results of this survey showed that teacher knowledge for reading instruction has only grown slightly and remains too low to effectively teach struggling students. Specifically, participants in this study answered 69.07% of the definition questions and 65.41% of the application items correctly. These results were consistent across demographic variables, including experience implementing a code-based

reading intervention. This study is particularly important because it compared results between two groups of teachers: those who had experience teaching a high-quality reading intervention and those who did not. The researchers found that those with experience implementing the intervention did not possess more reading content knowledge and ability to apply that knowledge. Thus, it is particularly critical that teacher candidates leave their preparation programs equipped with this knowledge, as they are unlikely to acquire it through exposure in the field.

A recent literature review conducted by Hudson and colleagues (2021) provides hope for enhancing teachers' knowledge of effective reading instruction. The authors reviewed 20 empirical studies to investigate the influence of teacher preparation and professional development on elementary teachers' knowledge of phonological and phonemic awareness, phonics, and morphological awareness. Overall, the findings strengthen the rationale for focusing on reading knowledge during teacher education, as programs were generally found to be effective at increasing participant knowledge. Three studies using CAPs were included in the review (Carlisle et al., 2016; Driver et al., 2014; Kennedy et al., 2013) and the authors rated these as acceptable to high quality and determined that high-quality interventions produced larger effects. Additionally, these three studies reported moderate to large effects but took considerably less time than other reviewed interventions. Results of this literature review highlight the substantial impact well-designed interventions can have on teachers' knowledge and support the identification of CAPs as a high-quality intervention.

Knowledge of Reading Fluency

Reading fluency is a complex process that is often defined as reading with accuracy, appropriate rate, and proper prosody (NRP, 2000). Additional definitions emphasize accuracy,

automaticity, and prosody (Hudson et al., 2009). As one of the five areas of reading identified by the NRP (2000), fluency should be addressed in comprehensive reading instruction; however, it may receive less instructional emphasis than other areas of reading. Using a subgroup of students participating in the reading assessment conducted by the NAEP, Pinnell and colleagues (1995) found that 44% of fourth grade students may be unable to read with fluency. This is particularly alarming given the critical role of fluency as a bridging process to help readers move from word recognition to reading comprehension (Duke & Cartwright, 2021; Pikulski & Chard, 2005; Wolf & Katzir-Cohn, 2001).

Although essential, reading fluency is not often the focus of teacher education and research on teacher knowledge (Walsh et al., 2006). Moats and Foorman (2003) included some questions about fluency on the Teacher Knowledge Survey Form #2. They found approximately one-third of second and third grade teachers surveyed (n = 41) were unable to identify instructional strategies for teaching fluency. Spear-Swerling and Cheesman (2012) also included fluency as one component on a survey of teachers' knowledge for implementing Response-to-Intervention in reading. They reported that only 27% of educators (N = 142) correctly identified prerequisite skills for fluency and 65% were unfamiliar with fluency curricula. Overall scores on the fluency knowledge questions were among the lowest, although 33% of respondents reported teaching fluency.

In a similar but more recent survey, Clark and colleagues (2017) found that preservice teachers answered 44% of reading fluency questions correctly. Participants (N = 89) scored lowest on the fluency items, with higher average scores reported in phonemic awareness, phonics, vocabulary, and comprehension. When asked to identify instructional strategies for teaching reading fluency, 82% of participants answered incorrectly. Interestingly, 92% of

participants were able to identify disfluent student reading but did not know how to adjust instruction based on that assessment.

Lane and colleagues (2009) surveyed elementary teachers (N = 133) about their knowledge of reading fluency. The survey consisted of five open-ended questions focused on defining, assessing, and providing effective instruction to build reading fluency. Using open-ended questions allowed the researchers to collect broad knowledge related to fluency without relying on prompts used in other question formats. Participants reported using modeling and repeated reading most often to promote fluency; however, only 35% of respondents indicated that they modeled fluent reading and 33% said they incorporated repeated reading.

In addition to collecting data on teachers' knowledge of fluency, the researchers also measured student achievement using the Dynamic Indicators of Basic Early Literacy Skills (DIBELS, Kaminski & Good, 1996) Nonsense Word Fluency and Oral Reading Fluency subtests. The results of this study emphasize the importance of teacher knowledge related to reading fluency for student achievement. More knowledgeable teachers taught students to read with more accuracy and automaticity. Specifically, the researchers found that understanding why reading fluency was important was correlated with higher student achievement (Lane et al., 2009).

Research indicates that instruction can increase preservice teachers' knowledge and skills for teaching reading fluency. For example, Sharp et al. (2016) found that preservice teachers (N = 70) rated their self-efficacy for teaching reading fluency among the lowest of 10 categories, with only scaffolding instruction was rated lower. At baseline, participants' scores indicated limited knowledge of reading fluency. For example, when asked how to effectively increase students' reading speed, 61% answered correctly; however, only 57% of participants could

identify instructional reading levels based on accuracy. Over the course of two semesters, participants' self-efficacy for teaching fluency grew to among the highest; only the assessment and comprehension/vocabulary categories had higher rates of self-efficacy. The researchers also reported statistically significant increases in correct responses to the fluency knowledge questions. Results from the final administration of the knowledge measure showed that 84% of participants could identify effective ways to improve reading rate, 83% could identify instructional text based on reading accuracy, and 93% correctly identified a scenario most likely to build reading fluency.

Park and colleagues (2019) conducted the most recent study to investigate teachers' knowledge of reading fluency. This study specifically focused on special education teachers, the instructional strategies they used to promote fluency, and the achievement of students identified with specific learning disabilities. Participants (N = 42) completed the *Reading Fluency Survey* (Lane et al., 2009) to assess their knowledge of reading fluency. The researchers also analyzed observations of teachers using the Fluency Observation Guide to understand their fluency instructional practices. Data were collected on student achievement using the DIBLES Oral Reading Fluency subtest (Kaminski & Good, 1996). The researchers found that special educators' knowledge of fluency predicted fluency achievement for students with learning disabilities. Surprisingly, the researchers found that teacher knowledge did not predict the amount of time special educators spent instructing students on reading fluency. Despite the surprising findings regarding the relationship between knowledge and time devoted to instruction, the results of this study support the assertion that teachers' knowledge matters for student achievement.

Taken together, the body of research on teachers' knowledge of reading and specifically, reading fluency, is insufficient to deliver high-quality instruction to students with disabilities. Given that increased teacher knowledge is associated with improvements in students' reading fluency (Lane et al., 2009; Park et al., 2019), there is a clear need to ensure preservice teachers are prepared with adequate knowledge of reading fluency. Aligning instruction in teacher preparation coursework with theories of learning may be one approach to address gaps in teacher knowledge.

Theoretical Framework

Cognitive Load Theory

Cognitive load theory considers how people learn from instruction (Sweller, 1988; 1994). Specifically, cognitive load theory outlines the mental structures, also called cognitive architecture, involved in learning and the ways in which different learning experiences are processed by those mental structures. Put simply, the structures of the brain can only process a set amount of information at one time, and thus, effective instructional design should be intentional about the demand it places on a learner's mental structures.

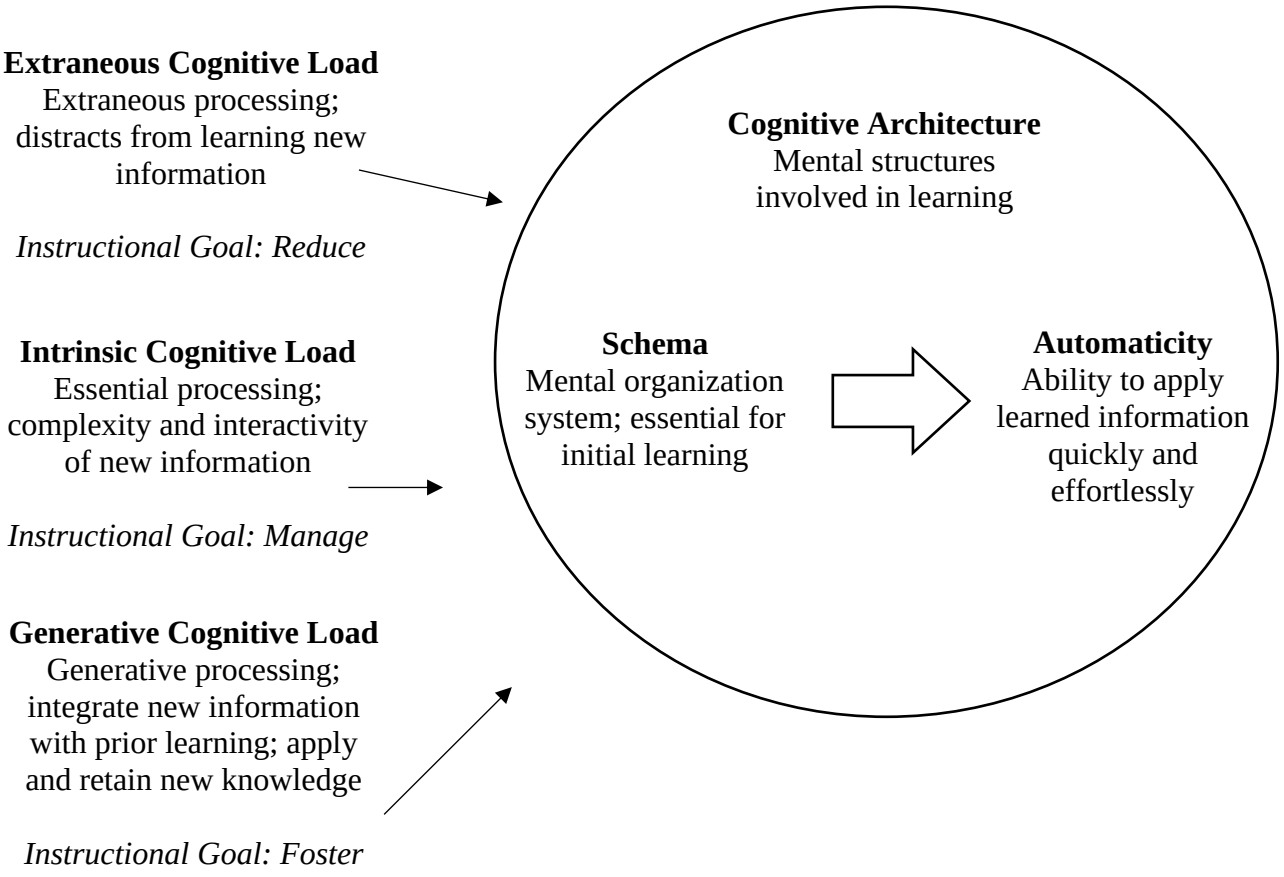
Cognitive load theory defines cognitive architecture as the mental mechanisms involved in learning (Sweller, 1994). This cognitive architecture is comprised of two interrelated structures: schema and automaticity. S*chema* refers to the mental organization system for learned information, which allow people to learn and store new knowledge for future use. *Automaticity* describes how learners apply knowledge to new situations quickly and effortlessly through repeated practice and over time. Thus, learners need to activate schema and develop automaticity to successfully complete cognitively demanding tasks. Automaticity can also be referred to as transfer because it includes learners' ability to generalize new information to other contexts.

Many skills relate to schema and automaticity. For example, readers are able to decode unfamiliar words using a schema about the alphabetic principle, but this process occurs differently based on the level of automaticity the learner has in using the alphabetic principle schema. A beginning reader may sound choppy or stilted when reading aloud, while a more advanced reader could read the same text with prosody because they have developed automatic decoding skills.

In addition to theorizing how the internal mental processes of learning operate, Sweller (1994) also suggests that external factors like instructional design impact learning. Because the brain can only process so much information at one time, cognitive load theory suggests that instruction should be designed to prioritize the most important content or task so that mental structures are not overwhelmed. There are three external processes involved in cognitive load: *intrinsic cognitive load*, *extraneous cognitive load*, and *generative processing*. Figure 1 depicts the role of intrinsic cognitive load, extraneous cognitive load, and generative cognitive load in relation to cognitive architecture.

Figure 1

Cognitive Load Theory



Intrinsic cognitive load is related to the material or content being learned, and thus cannot be altered by instructors. It is the "what" of instruction. For example, in beginning reading, essential content includes the letter sounds or phonemes. This content cannot be changed and for this reason, it is also referred to as essential processing. Content that includes interactions between many components requires higher cognitive load, while tasks that can be taught in discrete segments imposes lower cognitive load. For example, learning phonemes has lower cognitive load than reading unfamiliar multisyllabic words, which involves the integrated use of the alphabetic principle, phonics, advanced decoding, and oral vocabulary.

In contrast with intrinsic cognitive load, extraneous cognitive load is malleable, because it is increased or decreased by the instructional design. It refers to everything that the brain is asked to process that is not the essential content. Using well-designed instructional modalities can reduce extraneous cognitive load, thus making learning content that requires high intrinsic cognitive load more manageable (Sweller, 1994). Many components of teacher education, such as methods courses and those related to educational law, could be categorized as involving high intrinsic cognitive load due to their complexity and interactivity. For example, preservice teachers must combine content they learned from courses on reading methods, assessment, and classroom management and apply that pedagogical content knowledge to create a lesson with differentiated content for a heterogenous group of learners. Teacher educators should, therefore, consider cognitive load theory when designing instruction to ensure that cognitive demand does not exceed preservice teachers' capacity for cognitive processing (DeLeeuw & Mayer, 2008).

Generative cognitive load describes how learners organize new knowledge and integrate it with prior knowledge so that they can apply the knowledge and retain it for future use (DeLeeuw & Mayer, 2008). This process reflects deep, meaningful learning. For example,

generative processing could be evidenced by a beginning reader applying phonics to read a book about their favorite food or by a preservice teacher reflecting on how they might utilize content from coursework in their field experience. Although generative processing can be fostered through intentional application of instructional design principles, it is also dependent upon the individual learner's motivation (DeLeeuw & Mayer, 2008). A more motivated learner may reflect on new information, consider connections with prior knowledge, and seek opportunities to apply new learning over time. A less motivated learner may not identify connections or attempt to apply the new information and is therefore less likely to retain it. Instructional design can foster generative processing; however, the individual learners' disposition toward the learning may play a more significant role in doing so.

DeLeeuw and Mayer (2008) examined the three cognitive load processes during multimedia instruction. First, they examined how to reduce extraneous processing by avoiding redundancy. This was accomplished by minimizing the amount of on-screen written text that is the same as the narrated text. Next, the researchers sought to manipulate intrinsic cognitive load by simplifying explanations of content in the module. For example, using less complex sentences reduced the overall mental energy required to understand the content. Finally, the researchers identified two learner profiles to help explain generative processing during multimedia instruction: high-transfer students and low-transfer students. Students described as high-transfer demonstrated automaticity with the new information by scoring higher on an application measure, while students described as low-transfer did not demonstrate automaticity with the new information and had low scores on the application measure.

The application measure was a problem-solving assessment designed to measure their ability to generalize the new knowledge. The researchers suggested that the high-transfer

students were more likely to have employed generative processing while watching the multimedia module, and consequently, scored higher on a test of problem-solving after receiving instruction. In contrast, low-transfer learners scored lower on the problem-solving assessment and were less likely to have utilized generative processing while learning. This work reinforced the notion of the three elements influencing cognitive load (i.e., intrinsic processing, extraneous processing, and generative processing) and highlighted how each process can be manipulated by components of instructional design.

Past studies in education and teacher education have used cognitive load theory to understand implications for instructional design (Kirschner, 2002), recognize the role of collaboration in working memory (Janssen et al., 2010), and explore challenges faced by student teachers during field placement (Moos & Pitton, 2014). Cognitive load theory is well-aligned with the purpose of this study because it undergirds the development of instructional design principles, specifically those that frame the design of multimedia instruction. Further, cognitive load theory encompasses both the contextual and internal factors that influence learners' experiences during instruction. Using this theoretical framework helped shape the instructional design for the intervention used in this investigation and emphasized the potential role that individual learners' engagement and motivation may play in their learning from a multimedia module.

Mayer's Cognitive Theory of Multimedia Learning

Building from cognitive load theory, Mayer (2001) first proposed a Cognitive Theory of Multimedia Learning (CTML) and has continued to refine and build upon this theory since then. The most recent iteration is from 2020 and includes the growing research base on CTML, an expanded set of multimedia principles, and a more robust emphasis on fostering generative

processing. Mayer defines multimedia learning as the combination of images and words aimed at facilitating learning. Further, he suggests that multimedia instruction should be designed in alignment with theories of learning and research. To achieve this, Mayer (2001) began with seven specific instructional design principles aimed at reducing extraneous processing. Six principles were later added to focus on managing essential processing (Mayer, 2009). The most recent edition describes 15 specific instructional design principles developed to address the three components of cognitive load including coherence, redundancy, spatial contiguity, temporal contiguity, modality, multimedia, signaling, segmenting, pre-training, personalization, voice, image, embodiment, immersion, and generative activity (Mayer, 2020). Table 1 provides an explanation of the instructional design principles and how they align with the three cognitive processes.

Table 1

Alignment Between Instructional Goals, Design Principles, and the CAP

Multimedia Instructional Goals	Instructional Design Principle	Application in CAP
Reduce extraneous processing	Coherence principle	The CAP only contains information specific to the topic.
	Signaling principle	It is clear when a new section of the CAP was beginning.
	Redundancy principle	Only carefully selected key words are written on the CAP slides.
	Spatial contiguity principle	The pictures and text on each slide are close to each other.
	Temporal contiguity principle	The pictures and text correspond to the audio narration.

	Segmenting principle	The CAP is broken into segments and instructions for pausing the CAP between sections are clear.
	Modality principle	The CAP uses spoken words rather than print alone.
Manage essential processing	Multimedia principle	The CAP combines words and pictures rather than words alone.
	Pre-training principle	The CAP begins with a statement of purpose and key terms are explained.
	Guided discovery principle	The CAP provides feedback as learners check their understanding during viewing.
Foster generative processing	Personalization, voice, and image principles	The narration of the CAP is not too fast or too slow, presented clearly and in a conversational tone, and is easy to understand. A static image of the instructor is not included.
	Embodiment principle	The CAP does not include a static image of the instructor, but rather a virtual instructor with human-like movements.
	Immersion principle	An immersive 3D experience will not necessarily be a more effective learning experience.
	Generative activity principle	The CAP includes opportunities for learners to engage in generative learning activities (e.g., summarizing, imagining, self-testing, teaching).

Note: This table was adapted from the linkage created by Kennedy and colleagues (2014) and expanded to include the three most recently proposed CTML instructional design principles (Mayer, 2020).

The CTML instructional design principles work in ways that can reduce the cognitive load of learners. For example, extraneous processing can be reduced by adhering to the coherence and signaling principles. The coherence principle states that only content related to the learning goal is included in the instruction so that learning is maximized. The signaling principle ensures that content is well organized, and cues are provided to emphasize that organization.

Essential or intrinsic processing is managed through the segmenting and modality principles, which state people learn more effectively from content presented in self-paced sections and through the combination of images and spoken words. Generative processing is fostered through the personalization, voice, and image principles. These principles purport that people learn more when content is conveyed in an appealing, conversational tone and without the distraction of a static image of the instructor. Additional design principles were summarized in Table 1, along with their alignment with elements of cognitive load. Taken together, these design principles serve as the foundation for multimedia learning in countless fields such as healthcare (e.g., Athilingham et al., 2016; Yue et al., 2013), accounting (e.g., Aldamen et al., 2015; Ritchi et al., 2020), language acquisition (e.g., Chan et al., 2018), chemistry (e.g., Seery, 2015), and teacher education.

Motivation and Multimedia Learning

Instructional modalities developed with CTML seek to foster generative processing by manipulating instructional inputs. However, learning is a complex process which is not achieved with high-quality instructional materials alone. Instead, learners' motivation and engagement play substantial roles in their learning. As explained by Moreno and Mayer (2007), "Motivational factors mediate learning by increasing or decreasing cognitive engagement" (p. 310). Despite the relationships between these factors, research has not sufficiently focused on the role of motivation in learning from multimedia modalities.

One theory that attempts to explain the role of motivation in multimedia learning is Moreno's (2005) Cognitive-Affective Theory of Learning with Media (CATLM). This theory draws from cognitive load theory to complement CTML, suggesting that learning requires students to meaningfully attend to and actively select information for processing in working

memory (Moreno & Mayer, 2007). Motivation and metacognition mediate learning in this process. For example, learners who have accurate perceptions of their knowledge and understand strategies that best support their learning are more likely to engage in self-monitoring during cognitive processing, which can result in deeper understanding. Recognizing the role of motivation in learning, Moreno and Mayer suggest instructional design principles and approaches such as simulations and games to enhance learners' motivation.

Mayer (2014) summarizes the three approaches to influencing learner motivation and engagement detailed in CTML and CATLM as: (1) less-is-more, (2) more-is-more, and (3) focused-more-is-more. The less-is-more approach consists of eliminating extraneous information to better manage essential processing. In the more-is-more approach, educators use design features like images and difficult learning situations to motivate learners. In the focused-more-is-more approach, images are selected based on close alignment with the learning objectives and difficult learning situations are included with scaffolding to reduce extraneous processing. In each of these approaches, instructional design is the primary factor in learner motivation.

Because of this framework for operationalizing cognitive load theory and for instructional design, CTML is well suited to guide this study. Additionally, CTML frames the role of motivation in multimedia learning with substantial emphasis placed on the role instructional modality and design features play in learner motivation. The instructional design principles included in CTML directly address each of the three processes of cognitive load; thus, technology developed in alignment with these principles is more likely to result in meaningful learning. Additionally, in the most recent iteration of CTML, Mayer (2020) notes the vital role of motivational and affective processes during learning from multimedia instruction. These are critical steps toward addressing the problem statement outlined in Chapter 1, as CTML calls for

the integration of effective multimedia instruction that fosters learner engagement to maximize generative processing. A potential result of applying CTML to instructional design within teacher preparation is that preservice teachers acquire and apply deeper pedagogical content knowledge so that they are better equipped to positively impact student learning outcomes.

CAPs as an Instructional Modality

Content Acquisition Podcasts (CAPs) are a specific type of multimedia module undergirded by the instructional design principles outlined of CTML (Kennedy et al., 2011; Mayer, 2009; McNamara & Drew, 2019). CAPs are short, narrated, recorded presentations enhanced with images to help preservice and in-service teachers acquire specific content. The term CAP was first coined by Kennedy and colleagues (2011) to describe this specific kind of multimedia instruction in special education and teacher education. Adherence to specific instructional design principles are hallmarks of CAPs and distinguish them from other types of multimodal instruction (Kennedy et al., 2014; Kennedy et al., 2015). Specifically, CAPs are designed to address the three instructional goals of multimedia learning—reducing extraneous processing through focused content, managing essential processing by combining words and images, and fostering generative processing to support learner understanding (DeLeeuw & Mayer, 2008; Kennedy et al., 2014; Kennedy et al., 2015).

Each of these goals is addressed by specific instructional design principles (Mayer, 2009; Kennedy et al. 2015). For example, reducing extraneous processing can be accomplished through the coherence principle, which states that only information directly related to the specific content area is included in the CAP (Kennedy et al., 2014). Managing essential processing is achieved by combining spoken words, print, and images, also referred to as the modality and multimedia principles (Kennedy et al., 2014). Including opportunities for learners to check their

understanding and receive feedback helps to foster generative processing by supporting learners in making sense of the content (Kennedy et al., 2014). Table 1, adapted from Kennedy and colleagues (2014) and Zepp et al. (in preparation), shows the full alignment between the multimedia instructional goals, instructional design principles, and their application in a CAP.

In addition to their strong theoretical foundation, CAPs may help to address persistent problems in special education teacher preparation. Teacher preparation is challenged by having too much content to deliver with too little instructional time (Kennedy et al., 2011; Kennedy et al., 2012a). Special education teacher preparation is particularly overburdened as preservice teachers must comprehend multiple disability categories, evidence-based interventions in multiple areas, and the requisite knowledge to write legally defensible Individualized Education Programs (IEPs). The demands on special education personnel preparation continue to grow in response to technological advancements and increased rigor (Leko et al., 2015). Many commonly used instructional approaches in higher education are not aligned with theories of learning, resulting in constrained knowledge acquisition (Barr & Tagg, 1995; D'Avanzo, 2003; Handelsman et al., 2004; Kennedy et al., 2014).

Researchers suggest that CAPs address the limited instructional time in teacher preparation programs through more effective and efficient content acquisition (Kennedy et al., 2011; Kennedy et al., 2012a). By integrating technology carefully and centering cognitive load theory, CAPs can maximize learning in a shorter amount of time than assigned readings and some lecture formats (Kennedy et al., 2013). The alignment with cognitive load theory and principles of instructional design ensures preservice teachers acquire pedagogical content knowledge more thoroughly. Because this can be accomplished more efficiently than with other modalities, more content can be covered, and more time can be allotted to application activities

in teacher preparation coursework. For these reasons, CAPs may help to ensure that special education teachers leave their preparation programs with the necessary knowledge and skills to meet the increasing demands of the field (Leko et al., 2015; Zepp et al., in preparation).

Comparative Studies

Over the past 11 years, research teams have investigated CAPs on myriad topics with preservice and in-service teachers, as well as PK-12 students with disabilities. The most substantial area of focus has been increasing teacher candidates' pedagogical content knowledge and includes topics such as characteristics of disabilities (Allen, 2022; Kennedy et al., 2011; Kennedy et al., 2012a; Kennedy et al., 2014), inclusive physical education (McNamara et al., 2020; McNamara et al., 2021), positive behavioral interventions and supports (Firestone & Rodl, 2020; Kennedy & Thomas, 2012), evidence-based practices (Kennedy et al., 2012b), curriculum-based measures (Kennedy et al., 2016), behavior-specific praise (Miller & Uphold, 2021), and language and disability (McNamara et al., 2020). With two exceptions (Kennedy et al., 2012; Miller & Uphold, 2021), these studies utilized experimental designs to compare CAPs to traditional instructional approaches such as assigned readings and lectures. Results of the studies indicated that participants in the CAPs' conditions outperformed the comparison groups on knowledge and application measures with moderate to large effect size reported by several research teams (Kennedy et al., 2011; Kennedy et al., 2012a; Kennedy & Thomas, 2012; Kennedy et al., 2014; Kennedy et al., 2016).

CAPs and Reading Instruction

A significant amount of the research on CAPs specifically evaluated the impact of CAPs on preservice teachers' knowledge of reading instruction (Alves et al., 2018; Carlisle et al., 2016; Driver et al., 2014; Ely et al., 2014a; Ely et al., 2014b; Kennedy et al., 2013; Peeples et al.,

2019). Researchers utilized CAPs to enhance preservice teachers' knowledge in several areas of reading, including vocabulary (Alves et al., 2018; Ely et al., 2014a; Ely et al., 2014b; Peeples et al., 2019), phonological and phonemic awareness (Carlisle et al., 2016; Driver et al., 2014; Kennedy et al., 2013), and phonics (Carlisle et al., 2016). Phonological awareness is recognized as the foundation of reading and describes the ability to detect and manipulate the sound structures of oral language. The most linguistically complex phonological awareness skill is called phonemic awareness, which refers to the ability to detect and manipulate individual sounds in spoken words. Phonics is the process of using knowledge of letter-sound relationships to read and spell words.

Kennedy and colleagues (2013) conducted the first study investigating the impact of CAPs on preservice educators' knowledge of reading instruction. The research team utilized Clark's instructional practice framework (2009) and CTML (Mayer, 2009) to create a CAP on phonological awareness skills and instruction. After creating the CAP, researchers employed a two-group pre-posttest-maintenance design. Participants (N = 148) were randomly assigned to either the CAPs group or the comparison group with two stratification variables: education major and number of prior reading courses. Those in the comparison group read a practitioner-oriented article on phonological awareness and the intervention group watched a CAP developed to include the same content. The pre-posttest-maintenance probe included 26 items drawn from the *Survey of Language Constructs Related to Literacy Acquisition* (Joshi et al., 2009) and the *Teacher Knowledge Survey* (Moats & Foorman, 2003). Analysis showed no significant differences between the two groups at pretest; however, the CAPs group scored significantly higher on the posttest and maintenance probes. The findings of this study demonstrated the efficacy of CAPs for increasing preservice teachers' knowledge about reading instruction and

reiterated the need for this pedagogical content knowledge to effectively teach reading (Brownell et al., 2009; Carlisle et al., 2011).

Driver et al. (2014) employed a two-group pre-posttest-maintenance design to understand the impact of a CAP on the phonological awareness knowledge of participants (N = 103) enrolled in an introductory special education course. Some participants had previously completed coursework in reading, and as a result, the researchers randomly assigned participants with this as a stratification variable. At pretest, students who had prior learning about reading instruction scored significantly higher than those with no prior coursework in reading. The knowledge measure used for assessment included 14 multiple-choice questions adapted from the *Survey of Language Constructs* (Joshi et al., 2009) and the *Teacher Knowledge Survey* (Moats & Foorman, 2003), as well as seven application items. Application items asked participants to apply knowledge of phonological and phonemic awareness by identifying the number of phonemes in words and syllables, isolating phonemes, and identifying similar word endings. Researchers collected data for pre-posttest and maintenance over a five-week period with the pretest administered one week before intervention and the maintenance probe administered three weeks after intervention.

For the intervention, participants in the CAP group watched a researcher-created CAP on phonological awareness and those in the comparison group read a practitioner-oriented article on the same content. The CAP group scored significantly higher on the knowledge and application questions in the posttest and maintenance probes than the text-only comparison group. The results of this study contributed to the growing body of research on CAPs as an effective and efficient instructional modality in teacher preparation (Driver et al., 2014).

Expanding upon the previous two studies, Ely and colleagues (2014a) utilized CAPs to enhance preservice teachers' knowledge and skills for evidence-based vocabulary instruction. The researchers used a 19-item multiple choice test to measure changes in participants' knowledge. They also collected data on participants' ability to implement evidence-based instructional practices into a teaching performance. Participants (N = 49) were randomly assigned to either watch a video plus CAP or read an article on steps for delivering vocabulary instruction and sample scripts for teachers. Immediately after intervention, participants completed the posttest knowledge measure. To assess performance, the researchers asked participants to teach a vocabulary lesson using an assigned children's book and scored their performance with a fidelity checklist. On the posttest knowledge measure, participants in the CAPs group scored significantly higher than the text-only group. Those in the CAPs group also scored higher on the application measure by integrating more evidence-based instructional practices into their vocabulary lessons. The results of this study demonstrated the value of CAPs for increasing both content knowledge and the application of that knowledge.

In a similar study, Ely et al. (2014b) considered the impact of CAPs on preservice teachers' knowledge of effective vocabulary instruction using a two-group, pretest-posttest design. The researchers assigned participants (N = 101) to the video plus CAP group or the text-only group. As a knowledge measure, researchers created a pretest consisting of 19 multiple choice questions and administered it one week before intervention. The same knowledge measure was used for posttest immediately after intervention and maintenance three weeks after intervention. The video plus CAP group watched a demonstration of a researcher implementing effective vocabulary instruction with kindergarteners. They also viewed a CAP on effective vocabulary instruction. The text-only group read a practitioner-oriented article presenting the

same content as the CAP. At posttest and maintenance, the CAP group significantly outperformed the text only group. Findings from this study supported prior research on CAPs as an instructional tool to enhance preservice teachers' knowledge of reading.

To replicate and extend prior research on CAPs, Carlisle and colleagues (2016) examined the impact of a CAP on preservice special educators' knowledge of phonological awareness, phonemic awareness, and phonics. Participants (N = 52) were randomly assigned to watch a CAP on these topics or read an article on assessment and instruction of the same content. Researchers collected baseline assessment data during the fourth week of a course on language development for students with disabilities. Later in the course, participants completed a pretest and then the intervention or comparison conditions. The two groups were not significantly different at baseline, but the CAP group significantly outperformed the reading group on the knowledge and application measures. This study added to the existing research on CAPs by replicating findings on increasing preservice teachers' knowledge of phonological and phonemic awareness, as well as extending the research base to include phonics as an area of knowledge enhanced by CAPs.

Alves and colleagues (2018) utilized a two-group pretest-posttest design to investigate the impact of CAPs for students (CAP-S) creation on preservice teachers' knowledge of effective vocabulary instruction. Participants (N = 121) were enrolled in introductory special education courses at two universities. All participants began by completing a pretest and watching three CAPs on components of effective vocabulary instruction. The researchers then randomly assigned participants to one of two conditions: CAP-S creation or non-multimedia group. Those in the CAP-S creation group used in-class activities aligned with CTML (Mayer, 2009) to create a CAP teaching a multisyllabic vocabulary word. In contrast, the non-multimedia group created a traditional lesson plan to teach the same multisyllabic words. Each participant recorded

themselves delivering their designed instruction as part of an application measure. Finally, participants completed a posttest knowledge measure about effective vocabulary instruction. The knowledge measures used six open-ended questions and were scored with a rubric. The application measure was scored with a rubric based on components of effective vocabulary instruction. Results of the knowledge measure indicated that both groups gained a significant amount of knowledge regarding evidence-based vocabulary instruction after watching the series of CAPs. The CAP-S creation group also scored significantly higher than the non-multimedia group on the application measure. Social validity measures indicated that participants perceived CAP-S to be useful and effective.

Using a unique three-group pretest-posttest design, Peeples and colleagues (2019) randomly assigned participants (N = 200) to one of three conditions; one group viewed a CAP for Teachers with Embedded Video Modeling (CAP-TV), a second group received content through a recorded lecture, and a third group read a practitioner-oriented article. CAP-TVs extend traditional CAPs by adding a video model of knowledge application. In this specific study, participants watched a CAP about evidence-based vocabulary instruction which included a teacher modeling each vocabulary instruction practice. Researchers collected data on changes in preservice teachers' knowledge of evidence-based vocabulary instruction and their ability to apply that knowledge to teaching vocabulary. In addition to instruction, participants also received performance feedback on their skill application. The results of this study indicated all three groups increased their knowledge of evidence-based vocabulary instruction; however, the lecture condition generated the most significant change from pre- to posttest knowledge measure. Participants in the CAP-TV condition scored the highest on the application measure, indicating that this condition most effectively fostered generative processing.

Gaps in the Extant Literature on CAPs

Although robust, the extant literature on CAPs has focused on answering the question of whether CAPs work to enhance reading content knowledge in specific areas; however, preservice teachers' knowledge of reading fluency has not yet been addressed through CAPs. These studies utilized quantitative methodologies and reported results based on pre-posttest knowledge measures. Taken together, there is sufficient evidence to conclude CAPs are a more effective instructional modality in teacher preparation than assigned readings and some lectures (Zepp et al., in preparation). However, research has not yet investigated why CAPs work, for whom, or under what conditions, and only one study (Kennedy et al., 2016) considered participants' perceptions of cognitive load while watching a CAP.

Conclusion

This review of the literature highlighted the current dearth of teacher knowledge related to reading instruction, particularly reading fluency, and how the interrelationships between teacher knowledge and teacher quality may ultimately impact reading achievement for students with disabilities. Some current approaches to teacher education are not aligned with theories of learning, and therefore may have limited efficacy. This results in special education teachers leaving their preparation programs without the requisite knowledge and skills to support students with disabilities in achieving reading proficiency.

Cognitive load theory and CTML are helpful frameworks to bring teacher preparation into alignment with effective learning strategies. Building upon these theories allowed the researcher to design a high-quality CAP intervention and explore the individual and contextual factors influencing how people learn from CAPs. Specifically, these theories emphasize the role of generative processing in deep, meaningful learning. Generative processing includes the

learners' motivation and engagement, as well as their perceptions of the learning experience. Thus, these theories are central to answering the research question of this study.

Additionally, the literature base is clear that well-designed interventions to enhance teacher knowledge are successful (Hudson et al., 2021) and that teacher knowledge is linked to student reading achievement (Lane et al., 2009; Moats & Foorman, 2003; Park et al., 2019). CAPs are one example of a well-designed instructional modality with proven efficacy for increasing preservice teachers' content knowledge, yet little is known about learners' experiences with CAPs, or the role of individual factors on generative processing during CAPs. This study addressed this gap in the research by expanding understandings of how people learn from CAPs to create a more comprehensive picture of multimedia instructional modalities within teacher preparation coursework.

Chapter 3: Method

The current study built on the previous literature by utilizing a mixed methods research design to understand the role of engagement and motivation in learning from CAPs. Although the research base on CAPs as an instructional modality in teacher preparation is growing, the emphasis has remained on whether the intervention works to increase preservice teachers' pedagogical content knowledge for reading instruction (Alves et al., 2018; Carlisle et al., 2016; Driver et al., 2014; Ely et al., 2014a; Ely et al., 2014b; Kennedy et al., 2012; Kennedy et al., 2013; Kennedy et al., 2014; Peeples et al., 2019). The goal of the current study was to understand the individual factors that influence the efficacy of multimedia instruction on preservice special education teachers' knowledge of reading instruction, thus addressing a clear gap in the extant literature. The research question addressed by this study was: How do learner perceptions of their engagement and motivation while watching a CAP on reading fluency relate to differences in scores on a knowledge measure? Findings will help teacher educators understand how and why CAPs work as an instructional modality, as well as help to close the research-to-practice gap in teacher preparation by examining for whom CAPs are effective.

Toward this goal, this research was approached through a paradigm of pragmatism. Pragmatism "focuses on real life research problems and prioritizes the purpose of the study rather than the use of particular research designs" (Klinger & Boardman, 2011, p. 210). Rather than emphasizing one epistemology or methodology, pragmatism seeks to identify what works, for whom, and under what conditions by employing the worldviews and methods that best address the social problem of interest (Klinger & Boardman, 2011). Thus, this research draws on post-positivist and constructivist epistemologies and values the contributions of both quantitative and qualitative methods (Johnson & Onwuegbuzie, 2004). With postpositivist assumptions, this

study addresses the cause-and-effect relationship between an intervention and knowledge acquisition (Creswell & Plano Clark, 2018). This is reflected in the sequence of the research phases, the selected knowledge measure, and the statistical analysis. Reflecting constructivist traditions, this study also prioritizes the individual and subjective views of participants (Creswell & Plano Clark, 2018). Assumptions from the constructivist epistemology can be seen in the inclusion of multiple realities as illustrated by participants' perspectives, which are shaped by their personal experiences and social interactions. An important tenant of pragmatism is employing pluralistic worldviews, ontologies, and methodological approaches to understand "what works" in authentic contexts (Creswell & Plano Clark, 2018).

In alignment with the stated paradigm and research question, a mixed methods research design was employed. This chapter includes a description of the purpose for mixing and the mixed methods research design, settings and participants, intervention, measures, and procedures for both phases of data collection and analysis. Integrated analysis is also described in this chapter in alignment with the mixed methods research design and research question. Finally, an explanation of how this study meets quality dimensions for quantitative, qualitative, and mixed methods research is provided.

Mixed Method Purpose and Design

Mixed methods research is defined as the purposeful integration of quantitative and qualitative methodologies to answer specific research questions about real-world issues (Plano Clark & Ivankova, 2016). Given a paradigm of pragmatism and the goal of addressing a research gap in special education teacher preparation, mixed methods research designs are particularly well suited to answer the research question in this study (Johnson & Onwuegbuzie, 2004; Klinger & Boardman, 2011; Maxcy, 2003; Tashakkori & Teddlie, 2003). Specifically, an

explanatory sequential design was used, including an initial quantitative phase and a follow-up qualitative phase (Creswell & Plano Clark, 2018). Such a design provided valuable information by soliciting participant feedback, examining participant perspectives, explaining the quantitative outcomes, and making deeper connections between the intervention and the theoretical model (Klinger & Boardman, 2011). Employing a mixed methods research design serves three purposes: development, initiation, and complementarity (Corr et al., 2020; Greene, 2008). Aligning with development as a purpose for mixing, the initial quantitative phase was needed to identify participants and develop the interview protocol for the second qualitative phase (Corr et al., 2020). In addition, planned initiation was employed to test the hypothesized difference between education and non-education majors' perceived levels of motivation and engagement while learning from a CAP (Corr et al., 2020). Finally, this study was designed to understand the phenomena of learning from CAPs more deeply in alignment with complementarity. Thus, the qualitative data provided an expanded and more nuanced understanding of the quantitative data. Answering the research question required the integration of quantitative and qualitative methods at the points of sampling, data collection, and data analysis.

In addition to the use of an explanatory sequential design to answer the research question, a case-selection variant was applied to prioritize the second, qualitative strand. The initial quantitative strand served as the sampling strategy to identify the most suitable participants and develop interview protocols for the qualitative strand (Creswell & Plano Clark, 2018). The qualitative strand, focusing on participant perceptions of motivation and engagement, yielded critical insight into how and why teacher candidates learn from CAPs, thus providing a more complete picture of how multimedia instruction functions in teacher preparation (Creswell & Plano Clark, 2018; Klinger & Boardman, 2011).

Sampling Strategies

Integrating quantitative and qualitative data brings innovation and a unique perspective to the existing literature base on CAPs by explaining quantitative results with qualitative data. One point of integration in this study was sampling. Results from the quantitative phase were used to inform the sampling strategy in the qualitative phase, thus employing sequential mixed methods sampling (Teddlie & Yu, 2007). Students enrolled in two sections of a course designed to prepare future educators and members of society to better understand individuals with disabilities (N = 80) participated in the first, quantitative phase of the study. Convenience sampling was used to identify the two course sections for phase one based on accessibility, enrollment numbers, and availability for the timeframe of the study (Etikan et al., 2016). Demographic data was collected to ensure that the sample was representative of the national population of preservice special educators. Descriptions of participant demographics are provided in the next section.

In the second, qualitative phase, a stratified purposive sampling strategy was used based on the results from the first, quantitative phase. Changes in the pre-posttest scores were used to create strata of the top and bottom third of education and non-education majors (Teddlie & Yu, 2007) and then a small number of education (n = 7) and non-education majors (n = 11) were interviewed in the qualitative phase (Teddlie & Yu, 2007). Although the sample for the qualitative strand was smaller than the quantitative strand to allow for in-depth, descriptive information about participants' experiences (Brantlinger et al., 2005), the sample was large enough to allow for saturation of information. This enabled the qualitative strand to explain significant and nonsignificant results from the quantitative strand, in alignment with explanatory sequential design (Creswell & Plano Clark, 2018). Table 2 was adapted from Creswell and Plano

Clark (2018) and provides a summary of the procedures for each phase of the study, along with the products created in each phase.

Table 2

Description of the Research Phases, Procedures, and Products

Phase	Procedure	Product
Quantitative Data Collection	• CAP on reading fluency • Pre-posttest knowledge measure (N = 80)	• Numeric data
Quantitative Data Analysis	• Data transformation and screening • Repeated measures *t*-test	• Descriptive statistics • Growth from pre- to posttest
Interview Protocol Development	• Purposefully select participants from the top and bottom third of education and non-education majors (N = 18) • Develop interview protocol	• Cases (N = 18) • Interview protocol
Qualitative Data Collection	• Individual in-depth interviews with 18 participants via Zoom • Semi-structured protocol using stimulated recall	• Interview transcripts
Qualitative Data Analysis	• Coding • Analytic memos • Thematic analysis • Credibility and trustworthiness (peer debriefing, member checks)	• Codes and themes • Similar and different themes and categories
Integration of Quantitative and Qualitative Results	• Summarize quantitative and qualitative results with emphasis on connections	• Joint data display • Discussion • Implications • Future research

By employing stratified purposive sampling based on quantitative results, the qualitative phase included perspectives of those who experienced success learning from a CAP as well as

those who did not. This valuable insight can inform the development of future CAPs in both research and practice. Teacher educators may benefit from the findings of this research as they design coursework for preservice teachers. In summation, this study makes important contributions to the field of teacher education by examining multiple facets of multimedia instruction, collecting robust social validity data, and more holistically evaluating the efficacy of CAPs as an instructional modality.

Settings and Participants

The primary setting of this study was a large, Midwestern flagship university. This study was situated within existing teacher preparation coursework, specifically two sections of a course designed to introduce preservice teachers and society members to special education and individuals with disabilities. This course was selected because it is a prerequisite for beginning the special education teacher education program, thus minimizing the chance that participants received prior instruction on reading fluency. Experimental control was established by using content that has not been covered in the course, and by using a course that is also a prerequisite for the reading methods course. The procedures were conducted during the usual course meeting times in the second to last week of the semester. Specifically, section one met on Monday from 2:25 to 5:25 PM and section two met on Tuesday from 4:30 to 7:30 PM. The usual classroom space in the school of education building served as the location for the initial quantitative phase of the study. Based on the results of the quantitative phase, selected participants were contacted by email for follow-up interviews between one and three weeks after the quantitative phase. Interviews were conducted via Zoom during the second qualitative phase.

This study was conducted in accordance with the University Institutional Review Board policies (see Appendix A). Potential participants were informed of the general study procedures

and time commitment at the start of the study. Students were also informed that they may be asked to participate in follow-up interviews about their experiences (see Appendix B). After obtaining consent, participants (N = 80) completed the phase one study procedures (described below), beginning with providing demographic information.

Of the 80 participants in the quantitative strand, 68 (85%) were female and 12 (15%) were male. The majority of participants identified as White (62, 77.5%) with seven (8.75%) identifying as Asian, seven (8.75%) identifying as Latinx or Hispanic, three (3.75%) identifying as two or more races, and one (1.25%) identifying as American Indian or Alaskan Native. Most (95%) reported speaking English as their primary language, with four (5%) participants reporting other primary spoken languages (i.e., Chinese, Malay, Mandarin, and Spanish). These data are reflective of national data on teacher demographics (National Center for Education Statistics, 2020). The sample included 56 (70%) non-education majors and 24 (30%) education majors, ranging in age from 18 to 49 with 88.75% of participants between 18 and 25 years old. At the time of the study, 26 (32.5%) were enrolled in their first year at the university, 26 (32.5%) were enrolled in their second year, 15 (18.75%) were enrolled in their third year, 11 (13.75%) were enrolled in their fourth year, and 3 (3.75%) were graduate students. Most (71.25%) had no prior instruction in reading methods, while 17 (21.25%) reported current or previous enrollment in one reading methods course and six (7.5%) reported current or previous enrollment in two reading methods courses. Table 3 displays participants' demographic information in the quantitative phase.

Table 3

Participant Demographics – Quantitative Phase

Participants	***n***	**% of sample**

Total participants	80	100.00%
Age		
18-25	71	88.75%
26-35	2	2.50%
36+	2	2.50%
Not specified	5	6.26%
Race/Ethnicity		
American Indian or Alaskan Native	1	1.25%
Asian	7	8.75%
Black or African American	0	0.00%
Latinx or Hispanic	7	8.75%
Native Hawaiian or Pacific Islander	0	0.00%
Two or more races	3	3.75%
White	62	77.5%
Other	0	0.00%
Gender		
Man	12	15.00%
Woman	68	85.00%
Non-binary/third gender	0	0.00%
Other	0	0.00%
Primary Spoken Language		
Chinese	1	1.25%
English	76	95.00%
Malay	1	1.25%
Mandarin	1	1.25%
Spanish	1	1.25%
University Enrollment Status		
First year	26	32.50%
Second year	26	32.50%
Third year	15	18.75%
Fourth year	11	13.75%
Graduate student	3	3.75%
Major		
Education	24	30.00%
Non-education	56	70.00%
Prior Reading Courses Taken		
Zero	57	71.25%
One	17	21.25%
Two or more	6	7.50%

For the qualitative strand, 18 participants were interviewed regarding their perceptions of engagement and motivation while watching the CAP on reading fluency. This sample consisted of four strata based on major and the difference between pre- and posttest scores. All participants in this sample spoke English as their primary language. The top third of education majors (n = 4, 22.22% of the sample) included three women and one man. Three identified as White and one identified as two or more races. They reported being in the first or second year of their undergraduate program and did not have any prior reading coursework. The top third of non-education majors (n = 6, 33.33% of the sample) included four women and two men. Three identified as White, two as Latinx or Hispanic, and one as Asian. Three were in their first year, two were in their second year, and one was in their fourth year, and they did not have any prior reading coursework.

The bottom third of education majors (n = 3, 16.67% of the sample) consisted of two women and one man. All three identified as White, with one in their first year of undergraduate study, one in their third year, and one was a graduate student pursuing teacher licensure. All three reported prior or current enrollment in a reading methods course. The bottom third of non-education majors (n = 5, 27.78% of sample) consisted of five White women. Three were in their second year of undergraduate study, one was in their first year, and one was in their fourth year. They reported no prior instruction in reading methods. The demographic details for participants in the qualitative phase are displayed in Table 4.

Table 4

Participant Demographics – Qualitative Phase

Participant	Age	Race/Ethnicity	Gender	Primary Spoken Language	University Enrollment Status	Prior Reading Courses
Top third education majors (4, 22.22% of sample)						
60	20	White	Man	English	2nd year	0
61	19	Two or more races	Woman	English	1st year	0
77	19	White	Woman	English	1st year	0
82	20	White	Woman	English	2nd year	0
Top third non-education majors (6, 33.33% of sample)						
6	19	White	Woman	English	1st year	0
12	19	Latinx or Hispanic	Man	English	1st year	0
18	19	White	Woman	English	1st year	0
30	22	Asian	Woman	English	4th year	0
47	20	Latinx or Hispanic	Man	English	2nd year	0
74	20	White	Woman	English	2nd year	0
Bottom third education majors (3, 16.67% of sample)						
35	18	White	Woman	English	1st year	1
70	49	White	Woman	English	Graduate	1
72	21	White	Man	English	3rd year	1
Bottom third non-education majors (5, 27.78% of sample)						
8	19	White	Woman	English	2nd year	0
21	19	White	Woman	English	1st year	0
45	20	White	Woman	English	2nd year	0
64	20	White	Woman	English	2nd year	0
76	22	White	Woman	English	4th year	0

Intervention

A 15-minute CAP on reading fluency was designed using content from *Put Reading First: The Research Building Blocks for Teaching Children to Read* (Armbruster et al., 2009) and the Teacher Knowledge of Reading Fluency Survey (Lane et al., 2009). The *Put Reading First* booklet provides a summary of the primary research findings related to phonemic awareness, phonics, fluency, vocabulary, and comprehension detailed in the NRP (2000). Creating the CAP involved writing a script with distinct sections for the definition of reading fluency, its importance, prerequisite skills for developing reading fluency, assessing reading fluency, and instructional strategies for teaching reading fluency (see Appendix C). Each section followed a consistent format beginning with a brief definition or explanation, a comparison between fluent and less fluent readers, and ended with a brief check for understanding using a multiple-choice question. Next, PowerPoint slides were created with visuals and text to complement the script. These were aligned with key instructional design principles for CAPs (Kennedy et al., 2014) and included directions for accessing closed captioning (see Appendix D). The CAP included essential features of focused content, minimal text, and images paired with audio narration (Kennedy et al., 2011). After the slides were finalized, they were uploaded to Voicethread, a virtual platform for recording narrated presentations, and the audio narration was recorded using the script.

To ensure quality alignment, a reading expert, holding a Master of Education degree with an emphasis on reading and a reading teacher license, reviewed the CAP using a checklist (see Appendix E) based on the content of *Put Reading First* (Armbruster et al., 2009). Four doctoral students in special education also reviewed the CAP using a rubric specifically designed to evaluate CAPs (Weiss et al., 2016, see Appendix F). Feedback from the reading expert and

CAPs review were used to revise the final CAP. Based on the feedback, the revisions reduced some extraneous text on slides, clarified images to match the narration, added clarifications about word recognition and the distinction between automaticity and fluency (see Appendix C sections in red), and suggested the narration use a more conversational tone. The finalized CAP was uploaded to Kaltura, an instructional video platform, where closed captioning was added. It was then embedded in a module in the Learning Management System (i.e., Canvas) for the selected course sections.

Measures

Reading Fluency Survey

For the pre-posttest knowledge measure, the Teacher Knowledge of Reading Fluency Survey and corresponding rubric developed by Lane and colleagues (2009) was used with permission from the first author (see Appendix G). The pre-posttest questions were formatted as open-response items and were designed to measure teachers' knowledge of reading fluency. The five questions on the survey were: (1) What is reading fluency? (2) Why is it important for children to develop reading fluency? (3) What knowledge and skills do children need to become fluent readers? (4) How can reading fluency be assessed? (5) What instructional methods could be used to develop reading fluency?

For each question, a score of zero, one, two, or three was possible using the rubric. Generally, a score of zero indicated no knowledge or insufficient detail to determine how much the participant knew. A score of one meant that the response included some correct information, but also some incorrect information. A score of two indicated an acceptable level of knowledge, although provided at a surface level. A score of three meant that the response showed thorough, expert-level knowledge with sufficient details. For example, in response to the question "Why is

it important for children to develop reading fluency?" a response that stated reading is important would be awarded zero points, as this answer is vague and lacks detail. A response that states reading fluency supports comprehension would be awarded one point because it is partially, but not fully, correct and does not include an explanation. A response that explains how reading accurately improves comprehension because each word is understood would be awarded two points because it is partially correct and includes sufficient detail. A response that explains how reading fluency supports a shift from decoding to comprehension because of accurate, automatic word recognition would be awarded three points because this response is complete, correct, and includes sufficient detail.

The researcher scored all participants' responses using the rubric and sample responses provided by Lane and colleagues (2009, see Appendix H). A second scorer was also trained to conduct a secondary scoring analysis for 30% of pre- and posttest assessments (n = 24). The second scorer was a doctoral candidate in special education who received training from the researcher. As part of the training, the second scorer was required to apply the rubric and achieve 95% reliability with sample responses before beginning the process. Results of the secondary scoring analysis indicated 95% inter-rater reliability.

Interview Protocol

Interviews are frequently used to understand the experiences and perceptions of learners, thus aligning with the research question (Savenye & Robinson, 2005). Additionally, interviews were a logical choice because engagement and motivation cannot be easily observed; therefore, data on these constructs needed to be collected through participant reporting. The format of the interviews was semi-structured to allow for follow-up and clarifying questions (Sediman, 1991).

Results from the quantitative phase were used to revise the questions for the interview protocol in the qualitative strand. Revisions included adding questions to understand the tools participants employed while watching the reading fluency CAP, as well as recall questions prior to rewatching the CAP. The five questions from the Teacher Knowledge of Reading Fluency Survey (Lane et al., 2009) were added so that they would be asked immediately prior to rewatching the CAP. This allowed for data to be gathered on how well the participants retained the content. Participant responses then informed additional follow-up questions and conversation after rewatching the CAP. After making these adjustments, the revised interview protocol was finalized to be used consistently across participants.

This finalized interview protocol consisted of questions framed around operationalized definitions of motivation and engagement, with intervention defined as watching the reading fluency CAP (see Appendix I). Because approximately two weeks elapsed between the quantitative and qualitative strands, a stimulated recall procedure was used to understand participants' in-the-moment thoughts and perceptions (Dempsey, 2010). The protocol specified that participants would rewatch the CAP using the same conditions they selected during the quantitative phase (e.g., video speed, closed captioning) to support their memory of the experience and to help them respond to questions about their perceptions of the intervention. This allowed for an exploration of the process of learning from CAPs, drawing from participants' experiences in the moment of learning, and helped uncover how and why participants learned from this instructional modality (Dempsey, 2010).

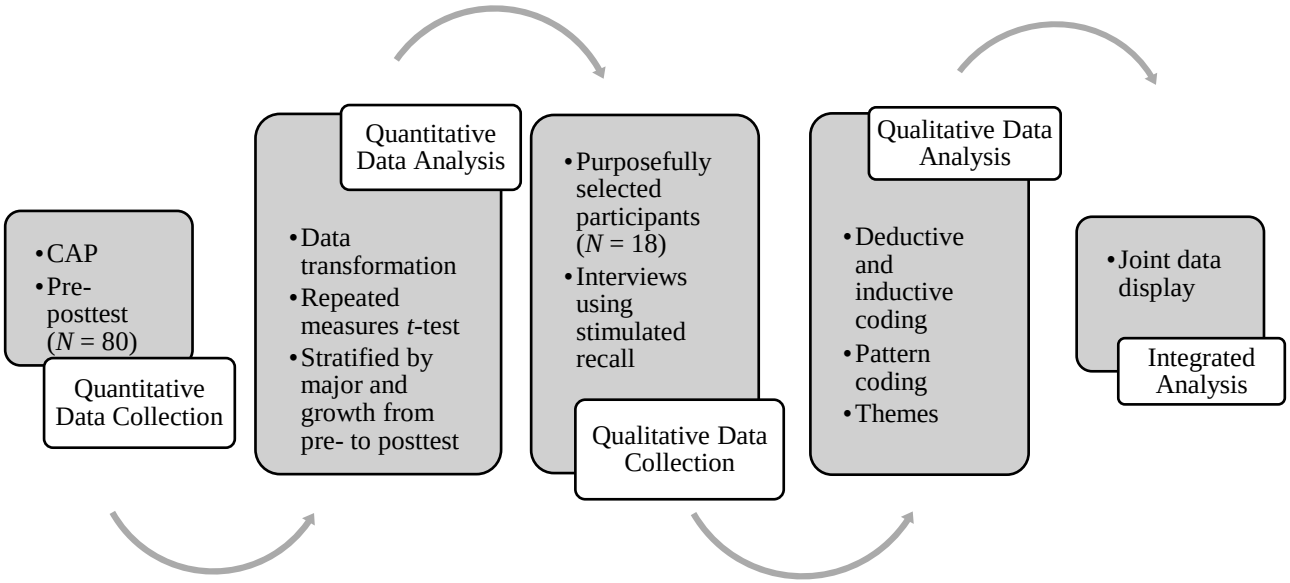
Phase 1 Procedures

In keeping with the explanatory sequential design, data were collected sequentially. The initial phase employed quantitative methods, which served to inform the sampling strategy for

the second phase of the study by identifying participants who had the most and least significant changes in scores from pre- to posttest. Figure 2 depicts the process of moving from the quantitative to qualitative phase and integrated analysis. This section details the procedures for quantitative data collection and analysis.

Figure 2

Research Phases and Procedures



Quantitative Data Collection

In the quantitative phase, participants accessed the study materials through a module on individual computers with headphones using the Learning Management System. The module included links to the study activities that participants could navigate through independently, thus allowing each participant to work at their own pace. Participants were instructed not to engage in other activities while accessing the study materials, such as visiting other websites, talking, or

writing. They were informed that they could take notes, but it was not required. Following these instructions, participants were invited to answer demographic questions and complete the pretest in Qualtrics. Pretest completion times ranged from 73 seconds to 19 minutes with the average completion time being four and a half minutes. After completing the pretest, participants watched the reading fluency CAP in the module. Finally, participants completed the posttest and were released from class. Posttest completion times ranged from 57 seconds to 16 minutes with the average completion time being four minutes and 45 seconds.

Two proctors oversaw the implementation of the study procedures in the quantitative phase. The researcher served as the first proctor, provided the study directions, and answered participants' questions. The second proctor was a trained assistant who used a checklist to ensure that the same procedures (e.g., reading the study directions, answering questions) were completed similarly for both sections of the course (see Appendix J). While participants watched the CAP, both proctors circulated to monitor participants. The proctors observed the extent to which participants completed the task as designed. This was defined as watching the CAP on a computer screen without opening other browser windows, using other computer applications, or talking to other participants. Based on the checklist, implementation fidelity was reported as 100%.

Quantitative Analysis

Following the quantitative data collection, participants' responses were scored in a data transformation process. Narrative responses to each question were awarded a numeric value based on the rubric developed by Lane and colleagues (2009). Fifteen total points were available for the pre- and posttest by adding scores from all five questions on each measure to calculate the final scores for each participant. This analysis process also identified the top and bottom third so

that stratified purposive sampling could be used in the qualitative phase. These data were further stratified using major as a variable, and the top and bottom third for both education and non-education majors were identified.

Data reduction was used to generate descriptive and summary statistics, which are displayed in Chapter 4. As data were from a single group of individuals and measured as changes from pre- to posttest within the group, a repeated measures *t*-test was used to compare the participants pre- and posttest scores on the knowledge measure and effect size was calculated using Cohen's *d* (Cohen, 1992). This analysis was selected to identify statistically significant differences between the pre- and posttest means. An independent samples *t*-test was also used to identify statistically significant differences between education and non-education majors at pre- and posttest.

Phase 2 Procedures

Qualitative Data Collection

Using the results of the quantitative phase, participants were identified for the qualitative strand through stratified purposive sampling. Ten days after the quantitative phase, participants from the top and bottom third of education and non-education majors (n = 60) were contacted via email and invited to participate in follow-up interviews. Nineteen selected participants agreed to be interviewed; however, one person did not attend their scheduled interview time.

To obtain data on participants' experiences during multimedia instruction, interviews were conducted virtually and individually with the small, qualitative sample (n = 18) via Zoom, and the audio files were retained for mechanical transcription in Zoom. Participants were asked to answer the five questions from the Teacher Knowledge of Reading Fluency Survey (Lane et al., 2009) that they previously answered on the posttest. Additionally, participants were asked

about the conditions they employed to watch the CAP (e.g., video speed, closed captioning), features of the CAP design, and the strategies they used while viewing the CAP (e.g., notetaking, verbal rehearsal, pausing). After responding to these questions, participants rewatched the CAP with the interviewer before moving on to questions about engagement and motivation. Because a semi-structured protocol was used, participants' responses in the first half of the interview were used to guide conversations in the second half. For example, if a participant reported using closed captioning or notetaking strategies, they were asked to explore the ways in which this strategy contributed to their perceived level of engagement and motivation.

The primary focus of the interviews was to gather data on participants' reported levels of engagement and motivation. Motivation was defined as the extent to which the participants wanted to use the intervention. Indicators of motivation included rewatching portions of the CAP, ease of use, clarity or perceived usefulness of the information. Engagement was defined as the extent to which the participants felt stimulated by the intervention, and the ways in which the participants felt the intervention supported cognitive processing. Indicators of engagement included enjoying the intervention, finding the intervention interesting, and self-reported increases in confidence with the content following intervention.

Qualitative Data Analysis

Mechanically transcribed interviews were downloaded, reviewed along with the audio recordings, and corrected as needed. Then, the transcribed interviews were deductively coded in an initial descriptive coding process (Linneberg et al., 2019). A pre-established list of codes, or coding frame, included terms such as engagement, motivation, cognition, ways of learning, knowledge acquisition, and social validity constructs (Kramer, 2011; Linneberg et al., 2019). Such terms were derived from the theoretical frameworks as described in Chapter 1 and 2. Social

validity constructs were defined as participants' views on the acceptability of CAPs, the meaningfulness of the learning outcomes, and the importance of pedagogical content knowledge acquisition. These codes represent the conceptual framework of the extant literature and serve to understand the social validity of multimedia instruction in teacher preparation more thoroughly (Kramer, 2011; Linneberg et al., 2019). A second phase of pattern and categorization coding was then used to establish patterns in the interview data (Linneberg et al., 2019, see Appendix K). Analytic memos were produced throughout two cycles of coding the qualitative data to record reflections in the process (Linneberg et al., 2019). Then, immersive analysis was conducted with an emphasis on identifying thematic data aligned with theories of cognitive load and multimedia learning, as well as social validity (Kramer, 2011; Linneberg et al., 2019). In vivo codes were generated using an inductive coding approach during immersive analysis. Finally, pattern codes were grouped to identify the most salient themes from the qualitative data.

Researcher Positionality

Rather than attempting to limit bias, this study provides clear information about the researcher's positionality and personal values (Brantlinger et al., 2005). The researcher served as the interventionist and directly supervised the participants during the study as a doctoral candidate in special education at a large, Midwestern public university. The researcher's role is to interpret participants' viewpoints; therefore, all potential biases are noted (Trainor & Graue, 2014). The researcher is a monolingual (English), White, cis woman with a disability with 12 years of experience teaching students with disabilities and holds licenses as a special education teacher, reading teacher, and reading specialist. These identities and experiences shaped personal beliefs that value public education and high-quality reading instruction for students with disabilities.

Additionally, professional experiences and a doctoral course of study focused on teacher education contributed to a belief that many educators are well equipped to provide the high-quality reading instruction students with disabilities need. The researcher is also trained as a teaching assistant, teaching intern, and field supervisor for preservice special educators and has three years' experience in those roles. These identities helped to facilitate access to the participants and to interact with them, particularly because many of these identities are similar to participants' identities. The researcher began doctoral studies from a post-positivist paradigm, drawn from professional training and years in the field; however, this worldview came into question through coursework and reflection. Some of these questions revolved around the so-called research-to-practice gap and the need to identify what works in real-world application. Others centered on the importance of including student voice in instructional design. This shift reflects an embrace of a pragmatism paradigm, and the methodology of this study in the prioritization of the qualitative strand.

The researcher also shared their current position as a doctoral candidate during participant recruitment, which helped students understand why this research was conducted. Participants were also informed of the researcher's previous role as an educator in the second qualitative phase, which may have helped participants feel at ease reflecting on their own experiences as learners and increased their willingness to share their perspectives. Qualitative data were collected with minimal intrusion through interviews. Because beliefs and professional goals of improving content delivery in higher education were made clear, the researcher was able to gain participants' trust during the interviews. In addition, the qualitative data collection only began after the quantitative components of the study had concluded, and the same procedures were distributed across participants from all strata in the qualitative phase. This data collection

sequence was justified because reflection during the intervention could potentially influence the outcomes of the intervention. Further, the sequential data collection process, with qualitative data collected after the intervention, created a more complete picture of multimedia instruction in teacher preparation and potentially explains the results from the quantitative phase (Creswell & Plano Clark, 2018).

Finally, it is necessary to acknowledge that there is inherent interdependence between researcher, methods, and data, thus reflexivity is essential (Mauthner & Doucet, 2003). Toward that goal, a voice-centered relational method of qualitative data analysis was employed, during which, each interview transcript was read three times (Mauthner & Doucent, 2003). After each reading, memos were generated with immediate, emotional reactions and analytical interpretations. Peer debriefing with scholars in the field of special education teacher preparation was also employed to help process these memos through the lens of the researcher's personal beliefs as well as through the extant literature throughout the data analysis phase.

Trustworthiness and Credibility

Following data collection and analysis, level one and level two member checks were conducted via email (Brantlinger et al., 2005). Each participant was asked to review the transcripts from their interview for accuracy, and to provide feedback on the aggregate data from the qualitative strand. During data analysis, analytic memos were generated through each round of coding to document responses to the data and efforts to locate confirming and disconfirming evidence. These memos were compiled into an audit trail and reviewed throughout the qualitative data analysis process. Peer debriefing with other researchers in the field of teacher education was also utilized to support trustworthiness and credibility (Brantlinger et al., 2005). These conversations with tenured faculty who possess expertise in teacher education and teacher

knowledge for reading instruction supported efforts to find confirming and disconfirming evidence in the data, as well as to identify patterns in the data and recognize themes. Finally, peer debriefing also grounded this study in the extant literature by discussing connections between the preliminary results, prior research on CAPs, and teacher knowledge of reading fluency.

Integrated Analysis

Select quotes from participants were identified to highlight the significant and nonsignificant results in the quantitative phase (e.g., top and bottom strata for each major). Quotes that contained key terms, such as engagement, motivation, or cognition were coded as these concepts were identified and organized based on the participant's stratum. Other important quotes from participants were included to illustrate how they felt about the intervention and the value they perceived from it. Data integration was supported by a joint data display organized by groups based on the quantitative knowledge measure scores (Guetterman et al., 2015). This aligns with complementarity as one of the stated purposes for mixing by demonstrating relationships between these data, as the joint data display created during integrated analysis provides a more nuanced understanding of the quantitative results. This also clarifies the ways in which each type of data answers the research question and illustrates the ways in which the data build upon each other to create a more complete picture of CAPs as an instructional modality in teacher preparation (Creswell & Plano Clark, 2018).

Quality Dimensions

The quantitative strand of this mixed methods study aligns with the established quality indicators for evidence-based practice research, as thorough descriptions of the context, setting, participants, and intervention agent are provided (Cook et al., 2015). Descriptions of the

intervention procedures, along with processes for ensuring implementation fidelity were described, and descriptive statistics of participant demographics were provided with the results of the repeated measures *t*-test (Cook et al., 2015). The outcomes of this study are socially important, as established in the introduction, and described in the procedures. Additionally, the quantitative knowledge measure, an open-response survey on reading fluency and corresponding rubric (Lane et al., 2009) is detailed to describe the measurement of the dependent variable (Cook et al., 2015). The quantitative data analysis was appropriate to compare two means in a within subject design, and effect size was reported using Cohen's *d* (Cohen, 1992; Cook et al., 2015)

In alignment with quality indicators for qualitative research and the mixed methods research question, the qualitative strand utilized an interview study approach (Brantlinger et al., 2005). Interviews were most appropriate to answer the mixed methods research question because engagement and motivation cannot be easily observed, and interviews are typically used to elicit the perceptions of learners (Savenye & Robinson, 2005). Participants for the qualitative strand were selected using stratified purposive sampling from the quantitative sample and based on the quantitative results. The interview protocol is presented in Appendix C and was revised based on the results of the quantitative phase. Interviews were audio recorded and transcribed in full (Brantlinger et al., 2005).

The confidentiality of participants was maintained by assigning random numbers to participants after phase one data collection and maintaining their use throughout the study (Brantlinger et al., 2005). Secure files were kept in accordance with the procedures established by the university's IRB. Using deductive coding with pre-established codes was appropriate for the qualitative data analysis, given the established conceptual framework and the research

question (Linneberg et al., 2019). Additional inductive coding was suitable to identify unanticipated themes in the qualitative data. Select quotes from participant interviews are shared in the results and joint data display. These quotes highlight participant experiences during the intervention and their perceptions of the social validity of CAPs (Kramer, 2011; Leko, 2014). This study adds to the current literature on multimedia instruction in teacher preparation and has strong connections to similar studies (Brantlinger et al., 2005).

This study also meets mixed methods quality indicators as established by the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018). As detailed above, the study meets single method quality indicators for qualitative interview studies and quantitative non-randomized design. There was an adequate rationale for using explanatory sequential design because the purposes for mixing were development, initiation, and complementarity (Creswell & Plano Clark, 2018; Greene et al., 1989). The mixed methods research question addresses multiple facets of the phenomena of learning from enhanced podcasts in teacher preparation courses. Quantitative and qualitative data needed to be integrated to understand how and why the CAPs intervention works which aligns with the explanatory sequential design in mixed methods research (Creswell & Plano Clark, 2018). The quantitative and qualitative components were integrated effectively at the points of sampling, data collection, and data analysis to answer the mixed methods research question (Hong et al., 2018).

Chapter 4: Results

The purpose of this mixed methods study was to understand how learners' perceptions of their engagement and motivation while watching a CAP on reading fluency related to differences in scores on a knowledge measure. To answer the research question, data from the quantitative and qualitative strands was integrated during the analysis process. This integration supported the goal of identifying individual and contextual factors that have the potential to support enhanced learning in reading methods coursework within teacher preparation. This chapter includes patterns in these data that provide a more nuanced understanding of learning from CAPs.

This chapter begins with a presentation of descriptive statistics and analysis from the quantitative phase followed by integrated analysis of the quantitative and qualitative data. These data are organized by theme with individual factors (e.g., engagement and motivation) presented first and contextual factors (e.g., setting) presented second. Taken together, these results illustrate the role of engagement and motivation in learning from CAPs, as well as contextual factors that may be manipulated to maximize knowledge acquisition.

Descriptive Statistics

Descriptive statistics were generated to capture pre-posttest results. These data are displayed in Table 5. Pretest scores ranged from zero to eight out of 15 (M = 1.79, SD = 1.58). Variation in responses is explored in the integrated analysis section of this chapter, along with selected pre- and posttest responses and mean scores by question displayed in Table 7 and Table 8, respectively. Education majors had a higher average pretest score at 2.25 compared with 1.59 for non-education majors, with most participants (88.75%) scoring between zero and three. Three participants (3.75%) scored four on the pretest; two were non-education majors, one was an education major, and all three reported no prior reading methods coursework. An additional

three participants (3.75%) scored five on the pretest; two were non-education majors with no prior reading methods coursework and one was an education major who reported taking one reading methods course. Two participants (2.5%) scored above five on the pretest, both of whom were education majors who reported no prior reading methods coursework.

Posttest scores ranged from zero to 13 out of 15 (M = 9.00, SD = 2.53). Education majors had a slightly higher average posttest score at 9.04 compared with 8.98 for non-education majors, with most participants (88.75%) scoring between six and 12. Seven participants (8.75%) scored between zero and five; three of these participants were non-education majors and four were education majors, two of whom reported previous completion of two or more courses on reading methods. Two participants (2.5%) scored 13 on the posttest; both were non-education majors with no previous reading methods coursework who scored one on the pretest.

To inform sampling for the qualitative phase, differences between pre- and posttest scores for all participants were calculated. These data were also stratified by major to identify participants for the qualitative phase. Differences between pre- and posttest scores ranged from zero to 12 with an average change of 7.21 (SD = 2.45). Most changes in scores (77.5%) were between five and 10 points. Twelve participants' scores changed by less than four points; half were education majors and half were non-education majors. Six participants increased their score from pre- to posttest by more than 10 points; five of the six were non-education majors. The average change for education majors was 4.41 and the average change for non-education majors was 5.29.

Main Quantitative Results

A matched pairs *t*-test was conducted to compare reading fluency knowledge at pre- and posttest. This analysis tested the hypothesis that the pretest means (M = 1.79, SD = 1.58) and

posttest means (M = 9.00, SD = 2.53) were equal. The correlation between the two means was estimated at r = 0.35, indicating a moderate correlation and suggesting that a matched pair t-test was appropriate. Results of the matched pair t-test further indicated that there was a significant large difference between the pretest (M = 1.79, SD = 1.57) and the posttest (M = 9.0, SD = 2.53), $t(79) = 26.13$, $p < .01$. Thus, the null hypothesis was rejected because the means were not equal. The observed effect size was large (d = 2.92). Combined with the significant difference, this finding suggests that viewing the CAP was effective in increasing participants' knowledge of reading fluency.

Comparisons were also made by major using a matched pair t-test. For education majors, there was a significant difference between the pretest mean (M = 2.25, SD = 2.01) and the posttest mean (M = 9.04, SD = 3.32), $t(23) = 10.76$, $p < .01$. For non-education majors, there was a significant difference between the pretest mean (M = 1.59, SD = 1.33) and the posttest mean (M = 8.98, SD = 2.15), $t(55) = 25.68$, $p < .01$. The correlation between the two means was estimated at r = 0.30, indicating a moderate correlation. The correlation between the two means was estimated at r = 0.40. Similar to the analysis for all participants, the correlation coefficients indicate a moderate association between the variables and the observed effect sizes were large (d, education majors = 2.20 and d, non-education majors = 3.43).

Table 5

Matched Pairs t-test

		Pretest		Posttest					
	N	*Mean*	*SD*	*Mean*	*SD*	*df*	*t*	*p*	*Cohen's d*
All participants	80	1.79 (0-8)	1.58	9.00 (0-13)	2.53	79	26.13	<.01*	2.92
Education majors	24	2.25 (0-8)	2.01	9.04 (0-12)	3.32	23	10.76	<.01*	2.20

Non-education majors	56	1.59 (0-5)	1.33	8.98 (3-13)	2.15	55	25.68	<.01*	3.43

Note: Scores are out of 15 total points. * Significant at $p < 0.05$

An independent samples *t*-test was also conducted to compare the means of education and non-education majors at pre- and posttest. There was not a significant difference between pretest means of education ($M = 2.25$, $SD = 2.01$) and non-education majors ($M = 1.59$, $SD = 1.33$), $t(78) = 1.74$, $p = 0.087$. There was also not a significant difference between post-test means of education ($M = 9.04$, $SD = 3.32$) and non-education majors ($M = 8.98$, $SD = 2.15$), $t(31.56) = 0.08$, $p = .936$. These data are displayed in Table 6.

Table 6

Independent Samples t-test

		Education majors		Non-education majors					
	N	*Mean*	*SD*	*Mean*	*SD*	*df*	*t*	*p*	*Cohen's d*
Pretest	80	2.25	2.01	1.59	1.33	78	1.74	.087	0.42
Posttest	80	9.04	3.32	8.98	2.15	31.56	0.08	.936	0.02

Note: Scores are out of 15 points, Welch's *t*-test was used for posttest scores as equal variance was not assumed

Integrated Results

As detailed in Chapter 3, the results of the quantitative phase were used to inform the sampling for the qualitative phase. This process began with data transformation to convert narrative responses to numerical scores on the pre-posttest assessments. These data were then used to calculate total scores for both pre- and posttest, as well as the difference between them for each participant. Table 7 highlights selected participant responses and mean scores for each

pretest question aligned with scores on the rubric to illustrate the variation in responses on the pretest.

Table 7

Selected Pretest Responses Aligned with Rubric Scores

Question 1: What is reading fluency?				
0	1	2	3	
Ability to read	The ability to read cohesively without messing up.	Reading fluency is the ability to read with speed and accuracy.	The ability to read with speed, accuracy, and proper expression	$M = 0.58$
Question 2: Why is it important for children to develop reading fluency?				
0	1	2	3	
Children need to develop reading fluency because reading it everywhere. Reading is at the grocery store, jobs, street signs, etc.	So that they can understand written language.	--	--	$M = 0.11$
Question 3: What knowledge and skills do children need to become fluent readers?				
0	1	2	3	
Children need a supportive network of individuals, both personal (parents, family, guardians, etc.) and professional (teachers, coaches, etc.) They need opportunity to learn these skills.	Knowledge of letters and sounds to be able to read.	Basic knowledge of morphology, phonology, and syntax as well as problem-solving skills.	They need to know how to be able to understand phonology and how to bring together phonemes to sound out words and later on, blend together. Once students are able to master these parts of pre reading skills, they ideally should be able to read with a brisk	$M = 0.60$

			pace, decode, and comprehend the meaning of text.	
Question 4: How can reading fluency be assessed?				
0	1	2	3	
Have individuals read a text and ask follow-up questions about comprehension	A student reads a paragraph and is recorded how many times they mess up, but I believe there should be alternative ways.	Reading fluency can be assessed using the DIEBELS 8 oral reading fluency subtest.	--	*M* = 0.20
Question 5: What instructional methods could be used to develop reading fluency?				
0	1	2	3	
Storytime, drawing images from text, etc.	Learning the alphabet, numbers, learning the sounds of letters, the rules of reading, then starting with basic words.	One method would be teaching vocabulary words so there is pre-knowledge of word meanings. Another instructional method would be practice reading and re-reading a variety of different materials.	--	*M* = 0.15

Note: No responses to Question 2 earned a score of 2 or 3. No responses to Questions 4 or 5 earned a score of 3.

Similarly, Table 8 displays selected participants responses and means for each posttest question aligned with scores on the rubric. Table 8 highlights the average score on each question of the pre-posttest knowledge measure, and the average gains made by all participants. Taken together, Tables 7, 8, and 9 represent how participant responses to the knowledge measure changed qualitatively from pre- to posttest.

Table 8

Selected Posttest Responses Aligned with Rubric Scores

Question 1: What is reading fluency?				
0	1	2	3	
Reading fluency is the ability for a child to be able to understand, comprehend, and speak on what they have read.	Reading fluency is the pace and comprehension of how well a student understands the reading material.	Reading fluency is a combination of reader's comprehension, automaticity, and prosody while reading.	Reading fluency is the ability to read with appropriate rate, expression, and accuracy.	*M* = 2.69
Question 2: Why is it important for children to develop reading fluency?				
0	1	2	3	
It is important for them because it helps develop critical learning skills.	So that they can understand what they are reading and read to others well.	It's important because it bridges the gap between word recognition and reading comprehension.	Fluency acts as the bridge between word recognition and reading comprehension, propelling children to read to learn and comprehend greater concepts outside of simply decoding words.	*M* = 1.68
Question 3: What knowledge and skills do children need to become fluent readers?				
0	1	2	3	
The ability to practice.	Reading fluency comes before comprehension but after decoding.	Readers need to be able to decode words from text through using orthographic and phonological knowledge.	Reading fluency builds of other language skills like oral language, phonemic awareness, and decoding. Students then need proper ability to read accurately, at a appropriate rate, and expression.	*M* = 1.14
Question 4: How can reading fluency be assessed?				
0	1	2	3	
Through assigned readings	Through a test in which students are asked to read a passage aloud and	Children should use Dibels, which looks at accuracy and rate with a	It can be assessed through DIBELS-8 which is the oral reading fluency	*M* = 1.75

	scored on how many words they correctly pronounce.	story that is given. They read a story out loud and then assessed how well they are reading the story (ex: no errors).	subtest and listening to readers' expressions.	
Question 5: What instructional methods could be used to develop reading fluency?				
0	1	2	3	
Ask questions about what they have read.	Reading out loud.	modeling, rereading, and feedback.	Instructional methods that could be used to develop reading fluency is modeling fluent reading (or listening and practicing with fluent readers), rereading, practicing reading out loud, monitoring and feedback, having it be timed. This is shown through reading short passages or short plays.	*M* = 1.67

Table 9

Average Pre- and Posttest Score by Question

	Question 1	Question 2	Question 3	Question 4	Question 5
Pretest	*M* = 0.11	*M* = 0.11	*M* = 0.60	*M* = 0.20	*M* = 0.15
Posttest	*M* = 2.69	*M* = 1.68	*M* = 1.14	*M* = 1.75	*M* = 1.67
Difference	2.58	1.57	.54	1.30	1.52

After scoring and determining the difference between pre- and posttest scores, all participants from the quantitative phase ($N = 80$) were separated by major (education, $n = 24$; non-education, $n = 56$). Then, each major was stratified by the top third, middle third, and

bottom third based on the change from pre- to posttest. Participants from the top and bottom third for each major were contacted via email to participate in a follow-up interview. Eighteen participants completed interviews, and these data were combined with the quantitative results to produce the integrated results.

The integrated results are organized around the most salient themes: engagement, motivation, and contextual factors, and secondary themes are included within each primary theme. Within engagement, secondary themes include specific strategy use, activation of schema, and relationships between engagement and elements of instructional design. Under motivation, secondary themes include relevance of the content, desire to learn, and length of the class session. Secondary themes within contextual factors include setting and the impact of COVID-19 on perceptions of multimedia instruction. Table 9 provides a joint data display with participants' quotes regarding their engagement organized by strata and Table 12 shows a joint data display with participants quotes' regarding their motivation organized by strata, as these were the most salient themes and best align with the research question.

Engagement

Patterns in the data displayed in Table 10 suggest differences between how participants from the top strata engaged with the CAP compared with those in the bottom strata. These differences appeared to be consistent regardless of major, apart from differences between activating schema and perceived prior knowledge. Those in the top third stratum were more likely to identify specific strategies used while watching the CAP to maximize their learning. They were also more likely to explain how they attached the new information to existing knowledge. Finally, those in the top strata were less likely to report having prior knowledge of

reading fluency. These differences in engagement may reflect differences in generative processing, supporting the role of cognitive load theory in learning from multimedia modalities.

Table 10

Engagement Quotes from Participants from the Top and Bottom Third on Pre-Posttest

Engagement Extent to which participants felt stimulated by the CAP or felt that it supported cognitive processing	
Top third *Education majors*	"Most of my professors, or whatever, just give text articles and say, 'Read this.' And I find if it's something I'm interested in, I'll sit down and actually read it and take meaningful notes and highlight, but even this was something I'm interested in I probably would have still just kind of highlighted quick points, skimmed my way through and been done. The CAP is much more engaging." "I would say, like a nine. I thought it was like pretty engaging I liked the fact that there was kind of like some diagrams like you had the ones like the bridge between like decoding and comprehension kind of like helps you visualize that." "I'd be more engaged with the video if it had a setup like your video that had like you know, like you are talking about a topic, maybe a definition first and then it asks you, 'hey what's the definition?' in the video. I mean yeah that'll actually be more engaging and it might help me like understand the content more." "I'll be a more effective learner with the videos, the CAP videos, because it's more fun to look at." "I liked those images and how they were like very visible to see some of the differences, and I also liked the questions that are embedded in the CAP, and I feel like reading a lot of times, like you, just like kind of read to read, whereas I feel like the CAP is kind of it helps you like outline the important points, a little bit better than just reading a long text would."
Top third *Non-education majors*	"It wasn't necessarily pertained to what I do, so yeah, I'd say it did affect [my motivation and engagement]."

	"The engagement was more like me wanting to do well than me being interested in the actual content."
	"Watching videos can be very passive, so that they need to maybe before they watch the video, think about a strategy that's going to keep them engaged and alert throughout the video. For me, that strategy is watching it at 1.5 speed and then kind of that keeps me on my toes, and then quizzing myself throughout."
	"You need to figure out a strategy before you start that's going to help you stay engaged and alert throughout the video."
	"The modality made it easy to engage in so when it's easier to engage, I'd say I engage in it more."
	"I'd say a CAP [instead of an assigned reading] because it's more engaging. Like it asks you questions, too. Like it gives you those learning checks. Reading doesn't necessarily provide that."
	"Like when you're saying like I'm going to define what reading fluency is like just having those bold letters, like the definition is good because it like it keeps you engaged."
Bottom third *Education majors*	"The CAP was very informative so long as you're engaged and not really worrying about the rest of the room."
	"I would choose the CAP just because...I just can't stand sitting there and reading chapters of books. I just, I end up skimming and getting bored of it, but with the CAP, I feel like since it's moving from different point to point to point...I feel like I could easily stay engaged."
	"It makes you work cognitively but it keeps you engaged."
Bottom third *Non-education majors*	"Like a medium high because I did kind of pause and take some of those notes and like when it did ask us like the recap questions. I did actually pause the video and like mark what I thought they are like mentally note what I thought the answer was before checking it, so I would say, maybe not the highest level of engagement, but not the lowest either."

> "I think I was pretty engaged, I think, by hearing the text and having the closed captions on seeing the words and then also seeing like the pictures and words that you provided, too."
>
> "It kept me like looking at the screen and it kept me interested to learn, and I think also like taking the pretest, knowing the questions and then knowing I had to answer them again at the end it kept me engaged because I wanted to learn how to answer those questions."
>
> "Giving a visual with the audio is always engaging for me. If it was if it was just audio, it would be hard for me to you know stay focused and remember what I've heard."

Specific Strategy Use. Participants who identified specific strategies they used while watching the CAP were more likely to score in the top third for their major. Examples of specific strategy use included note taking, pausing, and verbal rehearsal to answer the check for understanding questions. Each participant in the top third of education majors, and all but one participant in the top third of non-education majors, reported taking notes while watching the CAP. Some participants took notes throughout the CAP, but most took notes during the check for understanding questions, which are specifically designed to foster generative processing.

For example, Participant 6 (top third, non-education) explained, "I wrote down like how like it was a bridge between like decoding and comprehension, like I said before. Like I wrote down like the question that you asked like when we had a pause and then I wrote down my answer if it was right. But if it was wrong, I'd write down the correct answer." Participant 47 (top third, non-education) used the same strategy, "I would like to take that little like question quiz and then I would basically write the answer like so and so is this." As Participant 82 (top third, education) explained, these notes could be referenced during the posttest to help answer the questions. They shared, "I took notes. I like just little quick speaking notes on each of like the

main bullet points that were being pointed out, and then I referenced those when I took the posttest quiz." Thus, notetaking appeared to be an important tool to enhance learning from the CAP.

Participant 12 (top third, non-education) did not take notes, but reported pausing the CAP because "I learn at my own rate, and sometimes, I would just like to stop and like process what I just took in before I just continue and then my brain is just overflowed and then I'm not even gonna understand anything." Like notetaking, pausing allowed time for participants to process their learning. It also allowed the learner to feel in control of their learning experience and to process information at a comfortable rate. In a similar approach, Participant 30 (top third, non-education) reported verbally rehearsing responses to the check for understanding questions. They stated,

> "When I was actually watching the video, I would pause the video after like an important sentence or an important like concept. After they mentioned specific parts to reading fluency, I think I paused and kind of quizzed myself and was like, 'Okay, what were the three things just mentioned?' before I kept going just to make sure I was engaged because I feel like sometimes watching videos can be very passive…. I was kind of quizzing myself throughout and pausing the video after each major like, after each major piece of information that was given."

By pausing and verbally practicing their response to the check for understanding questions, it seems that Participant 30 was able to retain the information more thoroughly. This aligns with the goal of fostering generative processing, the instructional purpose that undergirds the use of checks for understanding in CAPs.

In contrast, participants in the bottom third reported vague or limited strategy use, with some indicating no use of strategies to promote learning. For example, Participant 8 (bottom third, non-education) shared, "I didn't necessarily use any strategies." They then clarified their approach by stating that they "definitely just gleaned [the information] and just learned that, oh

this might be important." Similarly, when asked about strategy use, Participant 21 (bottom third, non-education) shared, "I obviously was looking at the closed captions. I was listening…I really listened to this." Participant 72 (bottom third, education) noted, "I kind of just like try to keep those [pretest questions] in the back of my mind and it's like I was watching the video, if like, something registered or clicked with one of the questions, I would just kind of like try to remember it for the posttest." Listening alone or relying solely on memory did not seem to be a successful strategy while watching the CAP. Based on the differences between pre- and posttest scores, it appears that engaging with the CAP through a specific strategy was a more effective approach to acquiring knowledge about reading fluency.

Closed Captioning. Closed captioning was one specific strategy used by most participants (77.8%), with many indicating specifically that it supported their engagement and learning. Of those who did not use closed captioning, only one scored in the top third for their major. When asked about their choice to use closed captioning, some participants reported that it supported their engagement with video-based instruction. Participant 77 (top third, education) shared, "It's easier for me to like follow along and really understand what they're saying. I feel like I kind of miss things sometimes if I don't have closed captions or it's not like fully ingrained in my head like I just feel like I understand it better, when I can read what's going on, while I watch it." Similarly, Participant 21 (bottom third, non-education) stated, "I feel like I understand it better when I'm reading and listening and watching." Participant 70 (bottom third, education) did not use closed captioning but indicated that they would if asked to complete this same task again.

Reading the captions while listening to the audio appeared to provide dual input which, according to the participants, decreased their overall cognitive load. This strategy is different

from those discussed in the previous section because it is unique to multimedia learning; pausing, notetaking, and verbal rehearsal could all be employed while reading a text. It also requires self-monitoring of comprehension and the cognitive flexibility necessary to monitor dual input successfully. For these reasons, as well as because of the overall need for accessible learning materials, the findings about closed captioning are particularly interesting.

Video Speed. Like closed captioning, participants reported using the video speed as a specific strategy to support their engagement while watching the CAP. Eight participants (44%) reported watching the CAP using 1.5 speed, eight (44%) reported using 1.0 speed, and two participants (12%) reported watching the CAP on 2.0 speed. Both participants who used 2.0 speed scored in top third—one was an education major, and the other was a non-education major. Some participants suggested that increasing the video speed was a specific strategy that enhanced their engagement while watching. Participant 30 (top third, non-education) shared, "For me, when I watched things at 1.0 speed, I tuned out too much versus 1.5. I was kind of like, 'Oh, they're talking fast. I need to pay attention.'" For Participant 60 (top third, education), watching on double speed was paired with frequent pausing to take notes, a strategy learned during pandemic-related online learning— "I'm a university student and I went through online school my first year so all the videos are all on double speed, so I just had it on double speed and then I was pausing it whenever I needed to write something down."

Others reported that they increase the speed simply for efficiency purposes, although some noted that this had potential drawbacks. Participant 70 (bottom third, education) reported increasing the video speed "because it was going to be 12 minutes or so, I remember, and I needed it to be like half of that." Participant 18 (top third, non-education) said, "With a video, I can put on like two times speed and just like listen to it really quickly. I might not retain the

information as well, but like I will get it out of the way faster." These data suggest that increasing video speed may support learner engagement, thereby allowing for greater knowledge acquisition from multimedia instruction. Table 11 provides details regarding video speed and closed captioning use for each stratum.

Table 11

Video Conditions Reported by Participants

Strata	Participant	Video Speed	Closed Captioning
Top third *Education majors*	60	2.0	No
	77	1.5	Yes
	61	1.0	Yes
	82	1.0	Yes
Top third *Non-education majors*	47	1.5	Yes
	30	1.5	Yes
	6	1.0	Yes
	12	1.0	Yes
	74	1.0	Yes
	18	2.0	Yes
Bottom third *Education majors*	35	1.0	Yes
	70	1.5	No
	72	1.5	Yes
Bottom third *Non-education majors*	8	1.5	No
	21	1.5	Yes
	64	1.5	No
	45	1.0	Yes
	76	1.0	Yes

Activation of Schema. Activating schema is a specific strategy that helps learners attach new information to existing information which promotes generative processing. Several participants in the top third stratum explained how they activated schema by remembering their

own experiences with learning to read while watching the CAP. For example, Participant 82 (top third, education) reported personal experience with reading fluency assessment by sharing “I remember being like ‘Oh, I remember doing this as a child. Oh, this is clicking this is making sense. That's what we were doing.’ I remember taking those little DIBELS tests and things like that. So I think the fact that, like I could relate [helped me].” Participant 74 also recalled being assessed for reading fluency: “I remember doing stuff about reading fluency and comprehension. Like tests for that stuff but a really long time ago, so this was like kind of like a refresher.”

Similarly, Participant 18 (top third, non-education) explained, “When I was reading or watching it, I thought like a lot about like, ‘Oh, how did I learn to read? Or what were like the main things that they like really wanted me to do well on?’” Participant 12 (top third, non-education) shared their personal difficulties with reading and how the terms presented in the CAP connected with their own experience as a reader. They stated, “If I'm struggling, now I know like the struggles that I don't do when I'm reading, there's a word for them. Not just an idea.” These specific personal connections appear to have supported learning, perhaps because participants were able to attach the new information about reading fluency to an existing memory, thus integrating it into their mental structure.

Two participants in the bottom third of non-education majors also reported activating schema as a strategy to support their learning, but with less specificity. Participant 76 (bottom third, non-education) explained how they answered the pre-posttest questions by saying, “I related them all to myself because I feel like I'm able to remember things better that way.” Similarly, Participant 21 (bottom third, non-education) reported, “I tried kind of hard to remember what everything was from when I did it in like elementary school.” Participants in the bottom third of education majors did not report using activation of schema as a strategy to

support their learning. Given this contrast between strata, it appears that activating schema by connecting new information with specific memories may enhance the amount of knowledge gained from watching a CAP.

Perceptions of Prior Knowledge and Experience. In contrast to activating schema, participants' perceptions of their existing knowledge appeared to negatively impact new knowledge acquisition. All three participants in the bottom third education majors' stratum reported prior or concurrent enrollment in a reading methods course, which was different from the participants in the other strata, as none of them had any prior coursework in reading. It is important to note that the participants in the bottom third of education and non-education majors had higher pretest scores and thus less room for improvement, thereby placing them in the bottom strata. The average pretest score for participants in the top third were 1.50 (education majors) and 1.00 (non-education majors), while those in the bottom were 3.00 (education majors) and 3.40 (non-education majors). In addition to having different pretest scores and thus different amounts of growth possible, those in the bottom strata had lower posttest scores than those in the top third strata. Table 12 displays pre- and posttest scores for all participants included in the qualitative phase to provide more context around this theme.

Table 12

Pre-Posttest Results for Qualitative Phase Participants

Strata	Participant	Pretest Score	Posttest Score	Growth
	60	0	12	12
Top third	61	1	11	10
Education majors	77	3	11	8
	82	2	12	10
Stratum *M*		**1.50**	**11.50**	**10.00**
Top third				
Non-education	6	1	12	11
majors	12	0	9	9

	18	2	11	9
	30	2	11	9
	47	0	10	10
	74	1	10	9
Stratum *M*		**1.00**	**10.50**	**9.50**
	35	2	5	3
Bottom third	70	6	11	5
Education majors	72	1	7	6
Stratum *M*		**3.00**	**7.67**	**4.67**
Bottom third *Non-education majors*	8	5	11	6
	21	5	11	6
	45	4	10	6
	64	2	8	6
	76	1	8	7
Stratum *M*		**3.40**	**9.60**	**6.20**

One of the participants in the bottom third of education majors, Participant 70, had the highest pretest score of all participants, scoring six out of 15 on the pretest. Their posttest score was 11 out of 15, placing them in the bottom third for difference between pre- and posttest score. Two participants in the bottom third of non-education majors, Participants 21 and 45, also had pretest scores more than one standard deviation above the mean. Although limited by the relatively small sample size, these findings suggest that perceptions of prior knowledge may limit the acquisition of new information from CAPs.

This suggestion is further supported by qualitative data from interviews with the participants. Participant 70 specifically stated, “Some of it was knowledge I kind of had” because of personal experiences as a parent of children with dyslexia. They noted that they did not already possess extensive knowledge of reading fluency, but that “it was at least familiar terminology;” however, this personal connection and familiarity did not translate to deeper

learning. When asked to recall answers to the posttest questions during the interview, Participant 70 demonstrated minimal change from their pretest responses. For example, they continued to emphasize the role of comprehension in reading fluency rather than how fluency supports comprehension. Another possible explanation for this is the video conditions employed by this participant—double speed with no closed captioning. They reported needing to move more quickly through the study procedures because of limited time; however, it is also possible that their perceived level of prior knowledge contributed to this decision.

Similarly, Participant 21 (bottom third, non-education) scored more than one standard deviation above the mean on the pretest but did not demonstrate significantly more learning at posttest. Participants 8 and 76 (bottom third, non-education) also reported familiarity with reading fluency during the follow-up interviews that was not reflective of their performance on the knowledge measure. Participant 8 stated, “I haven't necessarily learned all of that information in other classes before, but I have learned like bits and pieces about literacy” and Participant 76 indicated that they already knew, “Like the term reading fluency. Like I think I know what it means, but I wouldn't say that I would like off the top of my head like know the exact definition before watching it.” Considering the role of prior knowledge is important, particularly as it appears to have played a negative role in learning from a CAP on reading fluency. This suggests that participants who feel they already know the information may engage differently with the CAP, which is further supported by the limited strategy use of participants in the bottom third stratum.

Relationships Between Engagement and Elements of Instructional Design. Some participants made explicit connections between CAPs design elements and their perceptions of engagement and motivation. Participant 47 summarized it well by explaining how the CAP

differed from other multimedia learning because of adherence to specific design principles. They shared that this influenced their level of engagement by explaining, “I thought it was really engaging because it had a lot of moving parts to it, as opposed to a lot of other online instruction, where it's kind of just slides with audio, but there were kind of from what I remember, I don't know if this is wrong, but like transitions and like just a lot of other information that was given in an audio format but like kind of displayed in a visual format.” This was in contrast to other multimedia learning experiences, which they described as, “Just a bunch of text that was basically being read aloud.”

Instructional design principles that foster generative processing (i.e., personalization, voice, and image principles, generative activity principle) appeared to be especially important for participants’ engagement. When asked about the most important components of the CAP, Participant 45 (top third, non-education) listed, “Those little quizzes, the like multimedia presentation to it, of hearing a person's voice, too,” as particularly important in their engagement. These components directly connect to specific instructional design principles designed to foster generative processing and distinguish CAPs from other types of multimedia instruction. This draws an important connection to the theoretical framework of this study, as the goal of multimedia instruction is to foster generative processing to support enhanced knowledge acquisition.

Images and visuals in the CAP may have been especially important for supporting perceived engagement and enhanced learning. First, images enhanced the visual appeal of the CAP, as Participant 82 (top third, education) noted. Second, images played an important role in engagement. For example, Participant 77 (top third, education) stated, “I thought it was like pretty engaging. I liked the fact that there was kind of like some diagrams like you had the ones

like the bridge between like decoding and comprehension kind of like helps you visualize that." Similarly, Participant 45 (bottom third, non-education) found the images engaging and helpful in retaining information. They stated, "giving a visual with the audio is always engaging for me. If it was…if it was just audio, it would be hard for me to you know stay focused and remember what I've heard." This pairing of audio and visual inputs is also representative of the Temporal Contiguity Principle, which helps learners to manage essential processing. Participant 61 also felt that images contributed to their learning by stating, "With like textbooks it's like a bunch of text on one page versus like CAPs slides with like less words and like more like the pictures and stuff like that which is easier to comprehend just like for me." The dual input of audio and images appears to reduce overall cognitive load by managing essential processing in alignment with the theoretical framework of CAPs.

In addition to noting the role of all images in their experience with the CAP, some participants identified specific images that were particularly memorable and connected to their learning. Participant 18 (top third, non-education) shared, "I particularly really liked your like ladder picture, where it like had like the arrows facing towards each other and you explained like this is where you should be like in kindergarten or first grade, and this is where you should be in college, and I thought that was like really easy to understand." Likewise, Participant 77 specifically recalled, "I thought it was like pretty engaging. I liked the fact that there was kind of like some diagrams, like you had the ones like the bridge between like decoding and comprehension—kind of like helps you visualize that." These two specific images directly connected with two posttest questions. The ladder picture described Chall's stages of reading development (1996) and provided details to answer the third question "What knowledge and skills do children need to become fluent readers?" The bridge picture explained how reading

fluency served to connect decoding and comprehension, which explained the answer to the second question, “Why is it important for children to develop reading fluency?” By remembering these specific images, participants were better able to respond to the posttest questions correctly, thus increasing their posttest score to place them in the top third for their major.

Checks for understanding throughout the CAP also helped promote engagement, especially when compared with other common instructional modalities in higher education. Participant 47 (top third, non-education) explained that the CAP differed from assigned readings in courses “Because it's more engaging. Like it asks you questions, too. Like it gives you those learning checks. Reading doesn't necessarily provide that.” Participant 18 (top third, non-education) also found the checks for understanding helpful. They shared, “There's like little like a multiple-choice portion of the video...and I mean I would answer those by myself first before writing like before just skipping to like the answer, and then, once I got it, I'd write down the answer.” Likewise, Participant 82 (top third, education) felt their engagement was “pretty high considering I took notes. I was very focused and engaged in making sure I was writing down what was going on and understanding and like able to answer the questions at each stop. I would stop and like think it through and answer the question, so I would say, definitely engaged with it.” The checks for understanding supported their engagement, but also facilitated their use of notetaking as a specific strategy. They further explained this by saying, “The little bullet points that like each of like right before you would kind of summarize what that little section was talking about, and then it would go to the question. I would write down those like little quick summary bullet points.” Participants who meaningfully engaged with the checks for understanding by pausing, engaging in verbal rehearsal, and taking notes appeared to learn more

from watching the CAP than those who merely watched this portion of the CAP without engaging in specific strategy use.

Motivation

Unlike engagement, participants' perceptions of their motivation did not appear to correspond to differences between either education and non-education majors, nor were there as clear differences between those who made the most and least gains from pre- to posttest. Those in the top third of non-education majors expressed relatively low levels of motivation to learn about reading fluency. Specifically, Participants 18 and 47 (top third, non-education) reported that their motivation was lower because the content was not in alignment with their areas of interest and future career goals. Some participants in the top third of education majors noted the importance of the content for their future careers; however, the relevance of the content did not appear to be the primary factor in participants' motivation to learn. For example, Participant 61 (top third, education) noted the content was, "Pretty valuable, especially because, like my future career, I want to be an elementary school teacher," yet reported their motivation as "Like five-six [out of 10] because it was toward the end of the day, and I was tired, and I was kind of not as motivated." Participant 77 (top third, education) shared similar perceptions of motivation while watching the CAP, sharing, "It was at the end of class and that class is a long class. And it's a later time of day, so I think a lot of people were kind of just doing it to like get it done." Thus, perceiving the content to be valuable and applicable did not necessarily increase participants' motivation to learn from the CAP.

Instead, several participants who expressed higher levels of motivation described themselves as eager to learn and succeed academically. For example, Participant 82 (top third, education) shared, "I'm just a student who's always been motivated, and learning's fun and

interesting, and I really identify with who I am as a student and learning so I've always just been quite motivated to learn more and be interested in things and ask questions." Similarly, Participant 47 (top third, non-education) explained that their motivation was primarily to succeed on the posttest and Participant 30 (top third, non-education) described the leading factor in their motivation as the desire to, "Do well in school." Participant 82 (top third, education) also expressed this sentiment by stating, "I'm motivated to like do well, even though it doesn't mean anything for my grade or anything but doing well, and like make sure I'm learning and understanding."

In addition to internal factors that motivated participants, contextual factors also influenced participants' perceived levels of motivation across all strata. Several participants felt their motivation was negatively impacted by the length of the class session that served for the study procedures. The course sessions were each three hours in length with one section scheduled for 2:25 to 5:25 PM and the other scheduled for 4:30 to 7:30 PM. The study procedures were conducted during the last hour of each class session, which may have influenced participants' motivation to complete the tasks. Participant 61 (top third, education) explained, "The lecture is like really long; it's like a three-hour long lecture so like...I think it's just hard [to feel motivated]." Participant 74 (top third, non-education) echoed this sentiment, as did Participant 64 (bottom third, non-education) who stated, "It was three hours so…it definitely impacted like my attention span." Likewise, Participant 35 (bottom third, education) noted that it was "a long day of class" which contributed to "mental fatigue." Non-education majors reported that three-hour lectures were uncommon outside of the school of education, and participants from both majors felt that the course session was too long to remain motivated throughout. As a result, the timing of the study procedures and the length of the course session appear to have

played an unanticipated role in decreased motivation for many participants. A joint data display in Table 13 includes participant quotes illustrative of perceived motivation, organized by strata.

Table 13

Motivation Quotes from Participants from the Top and Bottom Third on Pre-Posttest

Motivation Extent to which participants wanted to use the CAP	
Top third *Education majors*	"I'd say the motivation be about the same, I mean depending on the topic like, if it's going to be like, if the topic was about like playing a musical instrument, like I play trumpet in the band so like that would be something that interests me." "I think I would learn the information probably about equally from both because I'd be like motivated like the motivation, so I think I would still be like eager to learn it...so I think that it'd be like the same for both [a CAP or a traditional lecture]." "Yes, I mean I obviously I would complete both [a reading and CAP]. I would be motivated to get my work done for both, but I think, also the little tests that come in and like I'm a very like gotta do well on my test so paying attention I'm motivated to like do well, even though it doesn't mean anything for my grade or anything but do well, and like make sure I'm learning and understanding versus when I read like a long text, especially I just kind of my motivation is just to quickly skim through this and get done versus like truly understanding and being motivated to absorb the content." "I would say, like if you're passionate about something, then that increases your motivation to learn about it or if it's like related to your line of work which reading is so like that's definitely like a part of like communication disorders and stuff, so I feel like for someone who has like no connection to reading, no interest in like working with kids, then their motivation is probably gonna be a lot lower."
Top third *Non-education majors*	"It wasn't like something that I actually cared about. I just cared about like what the actual answer was."

	"[I would rate my motivation as] Like a three out of five because I like to learn, but reading stuff is not necessarily my interest." "I also like to learn about different things." "Out of 10, I will give it a 6 just because I've had a rocky relationship with, I guess the realm of English language and reading myself. I was in ESL before and just all the testing that I had to do, reading never felt like, 'Oh, let's become fluent.' It felt like, 'Oh, I have to do this to prove that I'm literate in English.'" "Learning is important to me." "If it's something that like I'm learning and I can potentially be using in the future, I think that I'm more interested in it."
Bottom third *Education majors*	"I think because I already thought I knew what reading fluency is [it impacted my motivation]." "I was actually really motivated and curious to see the different ways, like the benchmarks of how that works and stuff." "For the most part, I'm really determined to learn everything I can and just because I know something doesn't mean I still don't have something else I could learn about that, so I mean, I'm motivated." "I don't think it's a motivation piece because I'm obviously motivated to get the information, regardless of how it's going to be presented."
Bottom third *Non-education majors*	"Some of my motivations…are just to get the good grade and not to fully understand." "I'm motivated by like, if I have a project to do if I have an exam like I'm gonna, you know, focus on learning that material well so that I can do well in an assessment." "I think that one was just hard, because it was three hours so, especially if it was like a harder day at work or didn't get as much sleep or something I would be like pretty yet like tired and like fatigued by like the end the class, so it probably, well it definitely impacted like my attention span or like maybe how much like easier, it would have been to like

	really focus versus at the end of a long day just becomes more of a challenge.”

Contextual Factors

In addition to their perceptions of their engagement and motivation, each participant provided information about how they interacted with the CAP during the study procedures. Some participants shared contextual factors that they perceive to influence their learning, such as distractions in the setting and the lingering impact of COVID-related virtual learning on their opinions about multimedia instructional modalities.

Setting. For some participants, setting played a noticeable role in their learning experience. Participant 72 (bottom third, education) reported feelings of anxiety due to factors in the setting, which ultimately changed how they interacted with the CAP. They shared, “It made me like anxious to see like people finishing before me a lot sooner than me. I thought I was like maybe doing it wrong or I was like watching it too slow. That's kind of why I sped it up to like 1.5 because everyone was sort of finishing before me so it's kind of intimidating.” Similarly, Participant 70 (bottom third, education) reported feeling distracted due to the setting. They explained, “The learning piece, I would do much better if I was not distracted by other people and I was just watching a video at home.”

While some participants reported distractions in the setting that could have influenced their learning, many noted their perception that multimedia learning modalities were associated with home-based learning, despite the in-person setting of the study. Multiple participants (top third, non-education Participants 6 and 74; bottom third, non-education Participant 21; bottom third, education Participant 72) referred to learning from multimedia instruction as happening “in my own bed” and thus less motivating and engaging. This may be because of virtual learning

experiences as a result of the COVID-19 pandemic, which could play an on-going role in students' perceptions of multimedia instructional modalities.

Impact of COVID on Perceptions of Multimedia Modalities. Several participants mentioned COVID-related virtual learning as a factor that influenced their perceptions of multimedia learning modalities. For some, virtual learning during the pandemic helped them to learn strategies that ultimately resulted in more efficient learning experiences. Participant 60 (top third, education) explained, "Probably since the pandemic started, I would lean more towards videos than I would actually reading because before they would kind of take the same amount of time, you know, watching videos and doing the readings for any given class, but now it's just like these videos are way more efficient, and I can watch them at whatever speed I want and I get the same amount of information." Participant 35 (bottom third, education) felt that the pandemic helped them learn how to navigate "the online world" better. A few participants even indicated that they now prefer multimedia learning over traditional in-person learning. Participant 12 (top third, non-education) reported how their feelings about multimedia instruction changed through the pandemic by saying, "In the beginning, I was like I'm not even getting an education for real. I'm just here doing what I have to do to pass, but now it's so funny because now, I want all my classes to be virtual because I learned so much better that way." In summation, Participant 45 (bottom third, non-education) explained how the pandemic influenced perceptions of multimedia instruction by saying, "I think I know what good virtual instruction looks like and what virtual instruction that doesn't really work for me looks like."

Other participants reported fatigue with multimedia learning modalities or associated them with negative learning experiences. For example, Participant 70 (bottom third, education) described their feelings about multimedia learning by saying, "After a while, it just gets kind

of...it kind of burns you out," indicating that multimedia instruction should supplement traditional, in-person learning. Others, like Participant 21 (bottom third, non-education), associated multimedia instruction with isolation and learning from their bed. They shared, "[during virtual instruction] I was in my bed and being at home, even doing homework at like in college. I like don't do homework in my bed because I feel like I just don't have any motivation to do it and I won't be engaged into it." Participant 64 (bottom third, non-education) felt similarly. They explained, "At first, I did like videos, and I was like 'I think this is a great thing we're doing' and like to continue with classes and stuff, but I do think I got burned out on it very quickly." Thus, there appears to be a lingering impact of COVID-related virtual learning on college students' opinions about multimedia instructional modalities. While some found greater appreciation for the efficiency and convenience of multimedia instruction, others felt burned out and eager to return to traditional, in-person learning experiences.

Conclusion

The results of this mixed methods study indicate that learners' perceptions of their engagement while watching a CAP on reading fluency appear to differ between those scoring in the top third and those scoring in the bottom third regardless of their major. Participants who scored in the top third strata were more likely to report more meaningful engagement through specific strategy use and activation of schema. Participants in the bottom third strata reported higher perceived levels of prior knowledge, although this was not consistently reflected in their scores on the pre-and posttest knowledge measure. Additionally, specific instructional design elements that foster generative processing seemed to play a role in learner engagement. Unlike engagement, perceived motivation appeared to be consistent across participants regardless of scores on the knowledge measure. Although individual factors were the focus of this study,

contextual factors also influenced participants' experiences with the CAP, with the setting and the lingering impact of COVID-19 all playing a role in knowledge acquisition.

Chapter 5: Discussion

The purpose of this study was to explore the role of engagement and motivation in relation to students' learning from a reading fluency CAP. A mixed methods explanatory sequential research design was employed to answer the research question, and data integration occurred at the points of sampling, data collection, and data analysis. Specifically, the initial quantitative phase informed the selection of participants for the qualitative phase, and both quantitative and qualitative data were integrated during data collection and analysis. Analyses focused on participants' perceived levels of engagement and motivation while watching the CAP in connection with their level of growth from pre- to posttest, but also included contextual factors (i.e., setting) that played a role in their perceptions of the learning experience.

This chapter includes a summary of the findings to explore the influence of engagement and motivation during a CAP on participants' learning, beginning with the quantitative results and then the qualitative and integrated results. To provide implications for research and practice, these findings are positioned within the extant literature on both CAPs and teacher knowledge about reading instruction. Finally, the limitations of this study and directions for future research are noted.

Quantitative Findings

Overall, the results of the quantitative phase indicated that the CAP was effective at increasing participants' knowledge related to reading fluency. Results obtained through a matched pair *t*-test indicated there were statistically significant differences between pre- and posttest means for all participants, as well as for education and non-education majors individually, and large effect sizes were noted. However, item analysis reveals that gains were not consistent across questions.

Specifically, participants made the largest gains on Question 1: What is reading fluency? Smaller, more consistent gains were noted for Question 2: Why is reading fluency important?, Question 4: How can reading fluency be assessed?, and Question 5: What instructional methods could be used to develop reading fluency? The smallest gains were made on Question 3: What knowledge and skills do children need to become fluent readers? Higher scores on Questions 1, 4, and 5 reflect the more concrete nature of the answers, as responding to these three questions successfully can be completed using recall, and without any contextualized knowledge of the mechanisms involved in reading. In contrast, Question 3 cannot be effectively answered without a nuanced understanding of language and reading development. This item analysis highlights important considerations about what type of content is best suited for delivery via this modality, as the CAP was not equally effective for all kinds of questions and types of content knowledge. This finding suggests that the CAP did not prepare individuals to answer questions about more abstract concepts as thoroughly, perhaps because they required a more contextualized understanding of reading processes.

Mayer's Cognitive Theory of Multimedia Learning (CTML, 2009) posits that CAPs support learners in acquiring more complex content knowledge by reducing extraneous processing, managing essential processing, and fostering generative processing. Absent from this theoretical framework are considerations of what content is most suitable for independent learning activities rather than instructor-facilitated experiences, as well as contextualized versus decontextualized learning. Previous studies of CAPs have primarily compared their efficacy with other types of independent learning (e.g., reading an assigned text), not interactive learning experiences (Alves et al., 2017; Carlisle et al., 2016; Driver et al., 2014; Ely et al., 2014a; Ely et

al., 2014b; Kennedy et al., 2013; Peeples et al., 2019). These studies also did not report item analysis to explore differing gains made with various types of content.

Additionally, other studies using CAPs specifically to impact knowledge of reading constructs focused on phonological and phonemic awareness, and vocabulary. These constructs require differing levels of contextual knowledge, with vocabulary being the aspect of reading most familiar to the average person. Consequently, the most frequent area of reading addressed through CAPs has been vocabulary (Alves et al., 2017; Ely et al., 2014a; Ely et al., 2014b; Peeples et al., 2019). Although many people outside of education are unfamiliar with phonological and phonemic awareness, these areas of reading are less conceptually complex than reading fluency, as they are beginning reading skills rather than bridging processes.

The findings of the current study suggest that while CAPs may work to increase knowledge acquisition more effectively than other independent learning activities, the knowledge gains reflect more recall rather than deeper, contextualized learning. Furthermore, the inconsistent scores between questions on the pre-posttest measure indicate that not all content was learned equally well, and therefore, some types of content may not be as suited for delivery through multimedia instruction.

Qualitative Findings

Through integrated analysis, the findings of the qualitative strand of this study suggest that engagement during CAPs varied widely and was closely connected to the level of learning attained from the CAP. Participants who reported the highest levels of engagement made the largest gains from pre- to posttest. In contrast, motivation did not appear to be variable across participants from different strata or closely related to the amount of content knowledge gained

from the CAP. A summary of the findings related to engagement are presented first, followed by those reflecting motivation to contextualize the implications for future research and practice.

Engagement

Engagement was closely tied to learning outcomes, and specific factors were identified within engagement that contributed to increased knowledge gains. Participants from the top third of their major reported using specific strategies for independently learning activities such as notetaking, pausing, and verbal rehearsal. Several also noted manipulating the video conditions (e.g., speed, closed captioning) to maximize their level of engagement, as well as using strategies and video settings to create a more active learning experience. Participants from the bottom third of their major did not report using specific strategies while watching the CAP, and instead described a passive learning experience.

In addition to differing levels of perceived engagement, participants from the top third of their major were more likely to report activating schema while they watched the reading fluency CAP. They engaged in this process by recalling their own experiences with learning to read and remembering reading fluency assessments they were administered as PK-12 students. By identifying as a learner and relating the content to their past experiences, they were able to retain more specific and detailed information from the CAP. This finding aligns with cognitive load theory (Sweller, 1988) and suggests an important way to scaffold schema activation to maximize content acquisition.

It is important to note the contrast between successfully activating schema and assuming prior knowledge from experiences in the field. The former appeared to positively influence learning, while the latter appeared to negatively influence learning. This was highlighted in the integrated analysis of data from participants in the bottom third of education majors. These

individuals reported prior instruction in reading methods, and in two instances, personal and professional experiences with reading instruction where they were not the learner (e.g., parent, experiences working with children). It may be that their assumed level of prior knowledge of reading fluency resulted in feeling less need to engage with the CAP, and thereby reduced the amount of knowledge they were able to gain from viewing it.

Engagement also appeared to be influenced by specific design features from CTML (2009) and elements of Universal Design for Learning (UDL). Participants contrasted the CAP with other multimedia experiences and noted that the design felt more intentional and high-quality. This aligns with the goals of the instructional design principles outlined in CTML. Specifically, personalization and images principles appeared to be important for supporting engagement, as several participants noted that the images and visual representations of information were particularly memorable and easy to understand.

The redundancy principle from CTML (2009) also played a role in students' engagement, as they reported liking minimal text on each slide. When considered alongside participants' use of closed captioning, this is simultaneously an area of tension with the theoretical framework. CTML's redundancy principle recommends only including a few, carefully selected words on the screen for learners to read as a means of reducing extraneous processing. In this study, most participants reported turning on closed captioning and reading the captions while listening to the audio at the same time. Several participants identified this as a specific engagement strategy, and explained that it contributed to their level of learning from the CAP. This was corroborated with their growth on the pre-posttest knowledge measure. Potentially, the dual input of audio and text resulted in more content acquisition. Another possibility is that this phenomenon extends the temporal contiguity principle, which occurs when stimuli are presented simultaneously and

results in developing a stronger association. As will be discussed later in this chapter, this is an area for future research, particularly given important considerations about access for all learners.

Altogether, the integrated results related to learners' perceived levels of engagement provide important information for the use of CAPs as pedagogy in teacher education. Maximizing engagement appears to allow for greater content acquisition, and teacher educators can scaffold engagement to facilitate this. Specific strategy use, video conditions, and differentiating between activating schema and perceptions of prior knowledge all seem to be important factors in engagement. These can be scaffolded by explicitly teaching and modeling strategy use, setting clear expectations about video conditions (e.g., caution against watching on 2.0 speed, recommend using closed captioning), and helping students avoid assuming that their prior knowledge is sufficient. In short, it appears that engagement is more malleable than motivation, and that without specific prompting to link motivation and engagement, lower levels of engagement are most closely associated with lower levels of content acquisition.

Motivation

In contrast with previous research that suggested features of multimedia instruction (e.g., graphics, challenging scenarios) support motivation and thereby foster generative processing (Mayer, 2014), motivation did not appear to influence learning from a reading fluency CAP. Participants shared that their perceived levels of motivation were low-average to average, and there did not appear to be a difference in motivation between education and non-education majors. Thus, no clear pattern emerged regarding the influence of motivation on learning. Instead, motivation appeared to be more accurately described as an intrinsic "feature" of individuals rather than a response to instruction. For example, some participants in the top third of non-education majors identified as eager to learn and succeed in any academic content,

regardless of the modality or relevance of the content. This contrasts with CTML's (Mayer, 2009, 2014) assertion that people may be more motivated to learn from multimedia modalities and is also significant given that the content was directly applicable to education majors' future careers.

In part, the reason for the dissonance between the theoretical framework and the findings of this study could be attributed to the lingering impact of COVID-19 related school closures on learner perceptions of multimedia instruction. CTML (Mayer, 2009) and prior research on CAPs were conceptualized when technology-based instruction was relatively novel, which in turn could have contributed to higher levels of perceived motivation. In the current study, multiple participants across strata reported feeling "burned out" by technology-based instruction after an entire academic year of exclusively virtual, multimedia teaching and learning. Some participants reported negative associations with technology-based learning due to the isolation they experienced during the height of the pandemic and described multimedia instruction as "in bed learning". The majority of participants indicated a strong desire to return to in-person, interactive learning experiences, and perceived multimedia instruction as more passive and not a replacement for discussion-based and hands-on learning experiences.

Despite overall decreased interest in multimedia instructional modalities, COVID-19 related virtual learning may have improved the quality of such teaching and learning opportunities. Technology developed rapidly during the pandemic to respond to the need for virtual instruction, resulting in more advanced tools. For example, live transcription became available on several platforms that previously did not offer such access features. Although none identified as hard of hearing or Deaf, nearly all participants in the qualitative phase reported

using closed captioning, and some explained that this preference developed over the course of the pandemic.

In addition to technological advancements, students became more adept at navigating technology-based instruction, thus participants reported increased fluency with multimedia instruction. Specifically, they were able to develop strategies for more efficient and effective learning such as pairing increased video speed with closed captioning. The combined impact of COVID-19 on virtual learning appears to be one of decreased motivation and increased engagement. Consequently, students seem amendable to using multimedia instruction as a replacement for other passive activities to gain information (e.g., reading), while returning to in-person, active learning as a means of building knowledge and skills.

Implications for Practice

The findings of this study provide substantial implications for practice in teacher education and add to the existing literature on CAPs in important ways. First, the results may help instructors select content most suitable for delivery through CAPs. Secondly, the integrated findings of this study highlight how teacher educators can maximize student engagement to result in higher levels of content acquisition. These suggestions can be applied to many types of independent learning and complements previous research on CAPs. Teacher educators can confidently integrate CAPs into their pedagogy, knowing that they have been evaluated with multiple reading constructs and found to be effective. Additionally, the qualitative findings of this study bring new information about learners' perceptions of and experiences with CAPs. It is particularly important that educators consider how to navigate learning post-COVID school closures.

Teacher educators need to consider what types of content are most suitable for delivery through independent or passive learning experiences, and how active and passive learning experiences complement each other. As the item analysis from the quantitative data revealed, participants did not learn all types of information equally well. Concrete concepts appeared to represent the strongest gains, as evident by higher scores on questions that could be answered through simple recall. More abstract concepts and those that required a more contextualized understanding of reading process appeared to be more difficult to learn thoroughly through the CAP. Thus, instructors need to carefully select the content most suitable for passive learning tasks and plan active learning opportunities that allow students to deepen their knowledge of the subject matter. Given participants perceptions of CAPs compared to independent reading, CAPs may be a valuable replacement for assigned reading in teacher preparation courses. With concrete concepts learned through a CAP, students could then participate in more interactive, hands-on learning facilitated by an instructor during in-person sessions. Although further research into this approach is needed, this may be a promising practice for increasing pre-service teachers' knowledge and skills related to reading fluency and other reading constructs.

In addition to considerations of content, teacher educators also need to consider how to scaffold independent learning experiences to promote student engagement. As the results of this study illustrate, engagement is closely related to improved learning outcomes regardless of learner motivation. This is an important implication for practice because, although motivation appears to be individual and unresponsive to varying modalities, engagement can be scaffolded. Teacher educators can improve the quality of student engagement by explicitly teaching specific strategies for independent learning tasks and providing active learning experiences to deepen understandings gained from passive learning activities.

Several engagement strategies can be applied to CAPs and other independent learning tasks. For example, modeling notetaking and pausing to check for understanding may benefit students while learning from CAPs and assigned readings. Notetaking can be even further scaffolded with guiding prompts or guided notes. Setting clear expectations can also be applied to multiple types of independent learning. Unique to CAPs, teacher educators can emphasize the importance of using verbal rehearsal during the embedded checks for understanding. In alignment with CTML (2009), this component of CAPs is designed to foster generative processing, and participants who actively engaged with the checks were more likely to score in the top third for their major. Another unique scaffold for CAPs is to provide clear expectations about use of video conditions. Participants who used 1.0 or 1.5 video speed and close captioning simultaneously reported higher levels of engagement and were more likely to make large gains from pre- to posttest.

Finally, the integrated findings reveal the potential risk in relying on self-reporting to ascertain prior knowledge. Participants in the bottom third of education majors overestimated what they already knew about reading fluency, which appeared to negatively influence their engagement. In turn, this resulted in smaller gains from pre- to posttest and the lowest overall posttest scores of the four strata. These data reinforce prior findings that indicate a gap between teachers' perceived and actual knowledge of reading constructs (Cunningham et al., 2004; Podhajski et al., 2009; Washburn et al., 2011). Given this well documented phenomenon, it may be more effective to assess what students actually know about reading constructs rather than relying on their self-assessment. This process should include discussion and collaboration with learners so that they have accurate understandings of their current knowledge toward the goal of prompting higher levels of engagement.

Implications for Research

In addition to these implications for practice, the findings of this study also have significant implications for teacher education research. First, the results of this study demonstrate the value of using mixed methods to investigate teaching and learning in teacher preparation programs. Specifically, mixed methods research designs support more nuanced understandings of phenomena in teacher education and allow for pre-service teachers' voices to be included in guiding instructional decisions. Additionally, mixed methods research designs can evaluate the efficacy of instructional approaches in post-secondary education. For example, future research could employ mixed methods to explore the efficacy of assigned reading in teacher preparation coursework, as this practice does not appear to be effective or engaging for learners. Such a study could investigate the potential role of technology and multimedia instructional modalities in post-secondary education, particularly to supplement or replace assigned readings. Findings from research in this area could lead to improvements in teacher preparation and address gaps in teacher knowledge related to reading instruction. In turn, this could improve the quality of reading instruction for all PK-12 students, and particularly, students with disabilities.

Secondly, further research is needed to understand the relationships between learners' engagement and motivation and multimedia instruction, particularly to expand the conceptual framework based on technological advancements (e.g., closed captioning, new technology) and the impact of COVID-19 related school closures on perceptions of virtual learning techniques. The findings of this study revealed tensions with the cognitive load theory and CTML related to learner motivation and specific instructional design elements. Specifically, the theoretical framework suggests that motivation plays a significant role in learning, and that multimedia instruction yields higher rates of motivation; however, the findings of this study do not align with

this assertion. To examine this issue further, a two-group comparison design could be used in future investigations to explore the role instructional modality plays in learner motivation, particularly as it relates to types of independent learning tasks (e.g., CAPs, assigned reading).

Additional research could also delve into the influence of specific design features on learner engagement, as well as how to maximize engagement by explicitly teaching and scaffolding strategies for multimedia learning. An exploration of the continued impact of COVID-19 on postsecondary students' perceptions of various instructional modalities could also contribute to the field. Examining this specifically within the context of teacher preparation is critical for ensuring that educators are well-prepared to meet the needs of students whose learning may also have been negatively impacted by COVID-19. Replication of this study would shed additional light on the interactions between learner engagement and motivation, as well as further explore how these constructs influence content acquisition. The findings of such studies could lead to extensions of CTML and expansions of cognitive load theory.

Finally, this study should also be replicated within a reading methods course, rather than a course designed to introduce education and non-education majors to special education and provide an overview of individuals with disabilities. As the quantitative findings suggest, not all content was learned equally well from the CAP. Future research could investigate contextualized learning situated within comprehensive instruction about reading processes. A two-group comparison design could be used in such a study, and could compare the efficacy of viewing a CAP to reading an assigned article or the impact of embedding video modeling within a reading fluency CAP. An investigation of this type could expand understandings of how people learn from CAPs, and specifically address ways to build preservice teachers' knowledge about the progression of reading development, effective assessment, and evidence-based instructional

practices. By situating a reading fluency CAP within a reading methods course, participants may view the content as more relevant, and therefore, report higher perceived levels of motivation, which could potentially influence learning outcomes.

Limitations

Although these findings contribute to the field by expanding notions of how and why CAPs work, this study was limited by several factors. First, the pre-posttest results were stratified by change from pre- to posttest to inform sampling for the qualitative phase. This meant that participants with relatively high pretest scores were less likely to be in the top third for their major because there was less room for them to improve. Stratification by highest posttest score rather than by change from pre- to posttest would have resulted in some changes within the various strata, and subsequently influenced the integrated analysis. Specifically, Participant 70 (bottom third, education) and Participants 8 and 21 (bottom third, non-education) would have been in the top third if stratified by posttest score rather than difference between pre- and posttest score.

Second, the qualitative phase of this study contained a relatively small number of participants (n = 18), particularly for the bottom third of education majors (n = 3). Additionally, participant motivation may have been influenced by the content selected for the CAP, as well as the declared majors of participants in the quantitative phase. Specifically, the quantitative phase included a larger percentage of non-education majors (n = 56) than education majors (n = 24), and non-education majors in the qualitative phase reported that the content did not appear relevant for their future careers. Future studies could focus on education majors at various points in their preparation programs to better understand how other knowledge experiences (e.g., field experiences) may highlight the importance of reading fluency and increase motivation.

Timing may also have played an unanticipated role in the results of this study. Quantitative data collection occurred during the second to last week of the semester and was situated in the last hour of a three-hour lecture. During follow-up interviews, some participants noted this as a factor that decreased their motivation to learn, and it is possible that this contributed to their performance on the pre-posttest knowledge measure. Because follow-up interviews were only conducted with a small number of participants, it is unclear if this was a significant factor in the results of this study.

Finally, the results of this study are limited by the researcher, despite efforts to reduce this as a factor. Participants may have wanted to please the researcher, particularly as they were aware that the researcher created the reading fluency CAP and that this study was conducted as part of a dissertation. It is also possible that the researcher's positionality influenced participants' responses to the interview questions, or that those who agreed to participate in the follow-up interviews had a more positive experience with the CAP. These risks are inherent in qualitative data collection; however, they must be acknowledged for their potential impact on the findings of this study.

Conclusion

The purpose of this mixed methods study was to create a more nuanced understanding of CAPs as a potential solution to the persistent problem in education—namely that educators are not adequately equipped with the knowledge and skills needed to teach all students to read. Previous research on CAPs demonstrated that this instructional modality is more effective than other types of independent learning in teacher preparation, and that specific reading constructs (i.e., phonological and phonemic awareness, vocabulary) could be taught using CAPs, yet little was understood why and for whom CAPs work as a mechanism for content acquisition. To

address this gap in the literature, this study was guided by the following research question: How do learner perceptions of their engagement and motivation while watching a CAP on reading fluency relate to differences in scores on a knowledge measure?

Findings from this study highlight the varying role of engagement in learning from CAPs, with active engagement appearing to influence learning regardless of reported levels of motivation. While motivation seemed to be more of an intrinsic "feature" of an individual instead of being related to instructional modalities or even the relevance of content, engagement via specific strategy use and activation of schema played a role in increased knowledge acquisition. These results reflect some tension with the theoretical and conceptual underpinnings of CAPs, particularly the suggestion that motivation may not play as significant of a role in learning and that modality may not be as motivating as previously thought.

However, this tension reveals exciting directions for future research, and offers useful implications for practice. Specifically, the findings of this study highlight the critical role that engagement plays in learning, and thus, provides clear suggestions for teacher educators when using CAPs in their pedagogy. Explicitly teaching and scaffolding strategy use may foster more generative processing, thus improving overall learning outcomes. In this way, the findings of this study may help to extend the conceptual framework of CTML (Mayer, 2009) and lead to sustained improvements in teacher preparation, particularly in the aftermath of the COVID-19 pandemic.

By providing a more theoretically grounded instructional modality than traditional approaches, CAPs have served as an effective learning tool within teacher preparation. This study strengthens the rationale for integrating CAPs into teacher education pedagogy because it evaluated the effectiveness of a CAP on learning about reading fluency and collected data

directly from participants about their learning experience. Participants' voices highlighted ways in which teacher educators can scaffold engagement to maximize student learning. Additionally, the findings presented here emphasize the need to select suitable content for independent learning tasks such as CAPs, as well as the importance of pairing independent learning tasks with interactive, relational opportunities to apply knowledge and skills.

By more effectively delivering additional pedagogical content knowledge for reading during teacher preparation, CAPs have the potential to help educators be better prepared to deliver reading instruction. Grounded in the research showing a correlation between teacher knowledge and student reading achievement, the result of improved teacher knowledge for reading instruction will be increased reading proficiency for students, including students with disabilities. Thus, teacher educators can potentially impact change for PK-12 students by utilizing multimedia instructional modalities paired with scaffolding for engagement and explicit instruction.

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Appendix A: Institutional Review Board Approval

Minimal Risk Research IRB
3/21/2022

Submission ID number:	2022-0328
Title:	Preservice Teachers' Engagement and Motivation During Content Acquisition Podcasts
Principal Investigator:	Melinda Leko
Point-of-contact:	Lauren Zepp
IRB Staff Reviewer:	Steph Wilson

The MRR IRB conducted a review of the above referenced initial application. The study was determined to meet the criteria for exempt human subjects in accordance with the following category(ies) as defined under 45 CFR 46:

(1) Educational settings

NOTE: If the research under this exemption application becomes subject to FDA regulations, the exemption status no longer applies.

You have identified the following financial sources to support the research activities in this IRB application:

None.

If this information is incorrect, please submit a change to modify your application as appropriate.

To access the materials the IRB reviewed and accepted as part of the exemption determination, please log in to your ARROW account and view the documents tab in the submission's workspace.

Although the human subjects research described in the ARROW application referenced above was determined to meet the federal criteria for exemption and thus does not require continuing review, please be aware of your responsibilities related to the conduct of the research and when additional IRB review is required. Prior to starting research activities, please review the Investigator Responsibilities for Exempt Human Subjects Research guidance (https://kb.wisc.edu/hsirbs/78821) which includes a description of the types of changes that must be submitted to ensure the research continues to comply with the conditions of the exemption and/or category(ies) of exemption.

Appendix B: Consent Form

University of Wisconsin - Madison
Research Participant Information and Consent Form

Study Title: Preservice Teachers' Engagement and Motivation During Content Acquisition Podcasts
Principal Investigator: Melinda Leko (Phone: (608) 263-5751) (Email: leko@wisc.edu)
Student Researcher: Lauren Zepp (Phone: 608-635-5030) (Email: lzepp@wisc.edu)

Description of the research
You are invited to participate in a research study about the role that engagement and motivation plays in learning from a type of multimedia module called Content Acquisition Podcasts (CAPs).
You have been asked to participate because you are enrolled in RPSE 300 for Spring 2022.
The purpose of the research is to understand how people learn from CAPs.
This study will include UW-Madison students enrolled in RPSE 300 for Spring 2022.
This research was conducted during regular class hours and in the classroom for course meetings.

What will my participation involve?
If you decide to participate in this research, you was asked if data from your in-class work (e.g., pre- and posttest data from watching the CAP) and your demographic information (e.g., age, gender, race, major) can be included in the study. You will also be asked if a member of the research team may contact you for a one-hour, audio-recorded follow-up interview. If selected for a follow-up interview, you may skip questions during the interview.

Recording information
The audio-recordings was used by members of the research team to transcribe interviews and was destroyed upon transcription.

Are there any risks to me?
There is a risk of a confidentiality breach. Participants may become fatigued or frustrated due to the length of the study.

Are there any benefits to me?
We don't expect any direct benefits to you from participation in this study.

Will I be compensated for my participation?
If you are selected to participate in the follow-up interview portion of this study and complete the one-hour interview, you will receive a $25 e-gift card.
If you do not complete this study, you will not receive payment.

How will my confidentiality be protected?
This study is confidential. Neither your name or any other identifiable information was published.

Only approved personnel will have access to the data. Your name was replaced with a participant number to ensure confidentiality. Data was stored securely according to campus policy. The course instructor is not a member of the research team and will not be aware of which students participate in the study.
If you participate in this study, we would like to be able to quote you directly without using your name. If you agree to allow us to quote you in publications, please initial the statement at the bottom of this form.

Whom should I contact if I have questions?
You may ask any questions about the research at any time. If you have questions, concerns, or complaints, or think that participating in the research has hurt you, talk to the research team or contact the Principal Investigator Melinda Leko at (608) 263-5751.

If you have any questions about your rights as a research participant or have complaints about the research study or study team, call the confidential research compliance line at 1-833-652-2506. Staff will work with you to address concerns about research participation and assist in resolving problems.

Your participation is completely voluntary. If you decide not to participate or to withdraw from the study, you may do so at any time.

Your signature indicates that you have read this consent form, had an opportunity to ask any questions about your participation in this research and voluntarily consent to participate. You will receive a copy of this form for your records.

Name of the Participant (please print): _____

Signature: _____

Date: _____ Email (for follow-up interview): _____

_____ I give my permission to be quoted directly in publications without my name.

Appendix C: Reading Fluency CAP Script

1. Welcome to my video introduction to reading fluency. This video was written and produced by Lauren B. Zepp at the University of Wisconsin-Madison.

2. Closed captioning is available through Kaltura. Please click on the CC at the bottom right and select English to view captions. At the end of each section, you will be asked to pause the video to check your understanding and then unpause the video to go to the next slide for the correct answer. Please click the pause and play icon at the bottom left to pause and unpause the video.

3. The purpose of this video is to introduce you to reading fluency. Reading fluency is one of five critical literacy skills identified by the National Reading Panel.

4. This video will cover the definition and importance of reading fluency, the knowledge and skills required for fluent reading, methods to assess reading fluency, and instructional strategies to develop reading fluency. At the end of each section, you will be asked to pause the video to check your understanding.

5. Part 1: Defining Reading Fluency

6. Fluency is the ability to read text with accuracy, automaticity, and prosody. Another way to say this is that fluency is the ability to read accurately, quickly, and with proper expression.

7. Fluency has three components: accuracy, automaticity, and prosody. Accuracy is the ability to read words correctly and with few errors. Automaticity is the ability to rapidly and automatically recognize words. Prosody is the ability to read aloud with appropriate intonation and expression. Each component is critical for fluent reading: reading fast or accurately is not the same as reading with fluency.

8. Fluent readers group words quickly into meaningful chunks and recognize familiar words effortlessly. Their oral reading sounds natural, as though they are speaking. Less fluent readers need to read more slowly and word-by-word because their word recognition is not effortless. Their oral reading sounds choppy and labored.

9. Let's check your understanding of the definition of reading fluency. Fluency is… (A) reading as fast as possible. (B) reading without any mistakes. (C) reading quickly, accurately, and with expression. Or (D) reading as fast as possible and without any mistakes. Pause the video here to check your understanding. When you are ready, unpause the video to check your answer on the next slide.

10. The correct answer is C. Fluency has three components: reading quickly, accurately, and with expression.

11. Part 2: The Importance of Reading Fluency

12. Fluency is essential because it serves as a bridge between word recognition and reading comprehension. Being able to read text does not necessarily mean comprehension occurred. Developing fluency helps readers move from decoding text word-by-word to smooth, effortless reading. This shift frees the reader from having to focus on individual word recognition and allows them to shift their focus to reading comprehension.

    Thus, fluent readers make more connections when reading and are more likely to understand what they read. Fluent readers also are able to read more text in the same amount of time as less fluent readers, meaning that they have more opportunities to learn from written text. Reading fluency also builds readers confidence. For these reasons, fluent reading is correlated with improved reading comprehension.

13. As an important bridge between word recognition and reading comprehension, fluency is included in the Wisconsin state English-Language arts standards as a reading foundational skill. Fluency is addressed in the standards for grades Kindergarten through 5th grade, with developmental alignment at each grade level. As an example, the 5th grade standard calls for students to read grade-level texts orally with accuracy, appropriate rate, and expression to support comprehension.

14. Fluency is important because it allows readers to make connections from text and focus on comprehending what they read. Less fluent readers need to focus on decoding each word, and thus can't focus on understanding what they read.

15. Let's check your understanding of the importance of reading fluency. Fluency is important because…(A) fluent readers can read more text. (B) fluent readers make more connections from what they read. (C) fluent readers can focus on comprehending, rather than decoding, or (D) all of the above. Pause the video here to check your understanding. When you are ready, unpause the video to check your answer on the next slide.

16. The correct answer is D. All of the above. Fluency is important because fluent readers can read more text in a set amount of time, make more connections from what they read, and focus on reading comprehension rather than decoding each word.

17. Part 3: Knowledge and Skills for Reading Fluency

18. Reading development begins with oral language and pre-reading skills in early childhood and continues through the advanced skills of construction and reconstruction as adult readers. Fluency develops beginning in stage 2, which typically occurs in 1st and 2nd grade. As this model shows, children first develop pre-reading skills and then learn initial reading or decoding skills. After decoding is relatively solid, children develop increasing fluency with reading familiar words and phrases. This stage of confirmation and fluency is so critical because it supports the next stage of reading for learning. Fluent readers are able to make the shift from learning to read to reading to learn that often begins in 3rd grade. This means that fluent readers can focus on understanding what they read, rather

than on decoding.

19. Fluency development relies on other foundational reading skills. Oral language skills like an extensive oral vocabulary and phonemic awareness, are prerequisites for reading fluency. Readers also need secure decoding and word recognition skills before fluency begins to develop. Once fluency skills are established, readers are more prepared for reading comprehension and making meaning from written text.

20. More fluent readers are able to decode and recognize words with automaticity. That means they can read quickly and effortlessly because their oral language and decoding skills are strong. These strong skills allow them to focus on understanding the words they read. Less fluent readers may struggle to decode or recognize familiar words. They hesitate and may misunderstand the words they read. This results in slower reading and more difficulty comprehending text.

21. Let's check your understanding of the knowledge and skills needed for reading fluency. Fluency develops…(A) before decoding and comprehension. (B) after decoding and before comprehension. (C) after comprehension and before decoding. (D) independent of other reading skills. Pause the video here to check your understanding. When you are ready, unpause the video to check your answer on the next slide.

22. The correct answer is B. Fluency develops after decoding skills are secure and before reading comprehension because it helps readers move from focusing on word recognition to understanding written text.

23. Part 4: Assessing Reading Fluency

24. The Dynamic Indicators of Basic Early Literacy Skills-8th Edition (DIBELS-8) are quick ways to assess foundational literacy skills, including reading fluency.

25. The Oral Reading Fluency subtest of DIBELS-8 assesses accuracy and rate with a connected text. A benchmark probe for the middle of 4th grade is shown here. With this subtest, the examiner provides the student with a passage and asks the student to read the passage aloud for one minute. Words omitted, substituted, or hesitations of more than 3 seconds are scored as errors. The final score is the number words read correctly and self-corrected in one minute. The results of these assessments are compared to benchmark goals at each grade level and are used as one measure to identify students who may require additional support.

26. More fluent readers read more words in the same amount of time as less fluent readers. They also read more words correctly than less fluent readers, and their reading sounds smooth and expressive. Their oral reading sounds natural, as though they are speaking, because they have developed prosody. Less fluent readers read fewer words and make more errors. Their oral reading may sound choppy or robotic because they have not yet developed prosody.

27. Let's check your understanding of assessing reading fluency. Fluency can be assessed by…(A) using DIBELS and listening for prosody. (B) Having a child retell a story. (C) Listening for accuracy and rate. (D) Asking questions about the story. Pause the video here to check your understanding. When you are ready, unpause the video to check your answer on the next slide.

28. The correct answer is A. Fluency can be assessed using quick tools like DIBELS to measure rate and accuracy. Prosody can be assessed by listening to the reader's intonation and expression as they orally read the passage.

29. Part 5: Instructional Strategies for Reading Fluency

30. Fluency can be learned by listening to models of fluent reading, practicing reading and rereading the same passage, and receiving feedback from a fluent reader. Modeling fluent reading involves reading aloud to children accurately as well as using appropriate rate and expression. Readers also need opportunities to practice reading and rereading passages aloud to develop their fluency skills. Teachers should monitor this rereading and provide feedback on the three components of fluency: accurate, automaticity, and prosody.

31. Repeated reading is an instructional strategy for fluency with a strong research base. In this approach, students are provided with a short text of 50 to 200 words at their independent reading level. An independent reading level can be read with 95% accuracy. That means no more than 1 in 20 words should be difficult for the student to read. To begin repeated reading, first, the teacher models fluent oral reading while the students follow along in the text. Next, the students practice reading and rereading the same text. Rereading can be accomplished through reading one-on-one with an adult, choral reading, audio-assisted reading, or partner reading. After each oral reading of the passage, the teacher provides feedback and guidance. Often, fluency activities are time for one minute and the words correct per minute is calculated by subtracting any errors from the total words read. Another meaningful approach to fluency practice is Readers' theater in which students practice and perform a play. The scripts are read and reread in preparation for the performance and appropriate expression can be practiced.

32. More fluent readers hear models of fluent reading, read and reread texts aloud, and receive feedback. Less fluent readers often hear less models of fluent reading, more frequently read silently, and receive less monitoring and feedback.

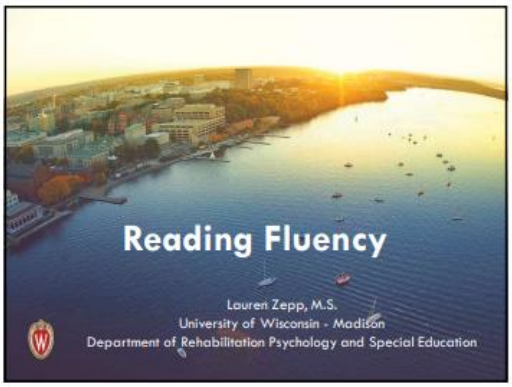
33. Let's check your understanding of teaching reading fluency. Fluency is taught by…(A) independent, silent reading of choice books. (B) focusing on other skills and allowing it to develop on its own. © modeling, rereading, and feedback. (D) all of the above. Pause the video here to check your understanding. When you are ready, unpause the video to check your answer on the next slide.

34. The correct answer is C. Fluency is taught by modeling fluent reading, providing opportunities for oral reading and rereading of the same passages, and providing

feedback to readers.

35. In conclusion, fluency is the ability to read quickly, accurately, and with proper expression. Fluency is essential because it serves as a bridge between decoding and reading comprehension, allowing readers to make meaning from written language. Fluent readers often feel more confident about reading and are more likely to practice this essential skill regularly. Thank you for watching this video on reading fluency!

Appendix D: Reading Fluency CAP Slides



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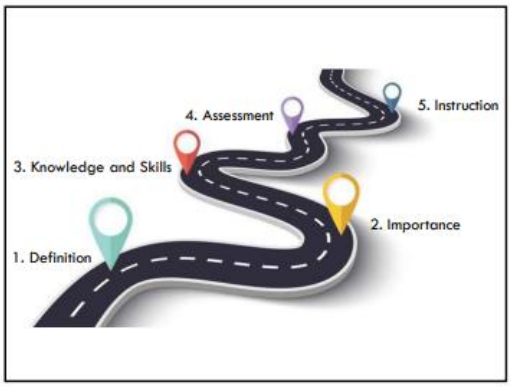

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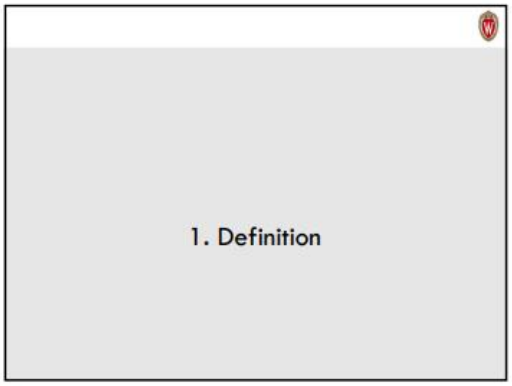

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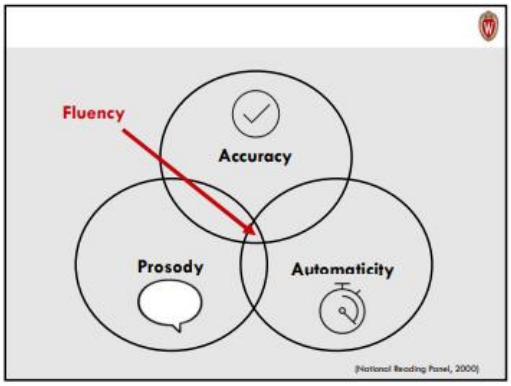

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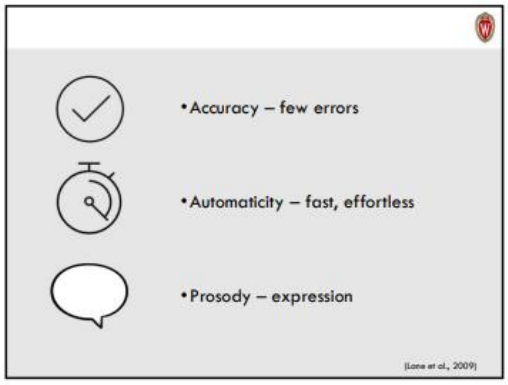
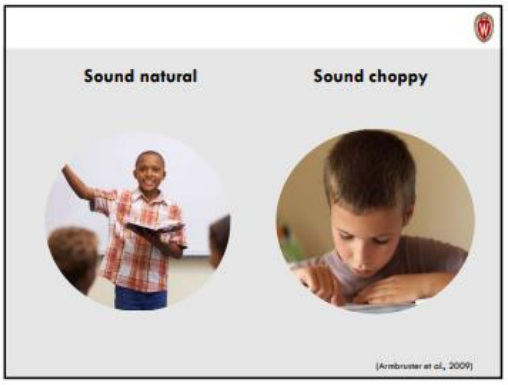
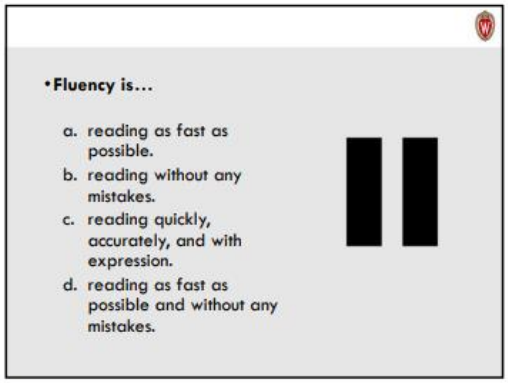

•Accuracy – few errors
•Automaticity – fast, effortless
•Prosody – expression
(Lane et al., 2009)

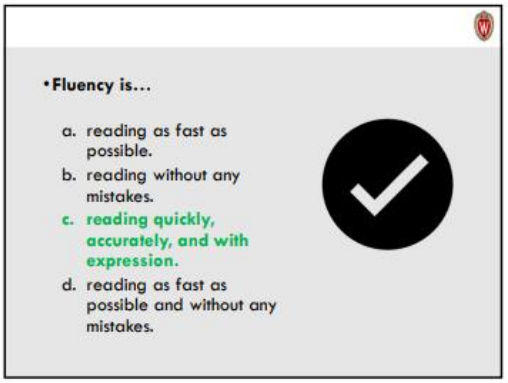
7


Sound natural
Sound choppy
(Armbruster et al., 2009)

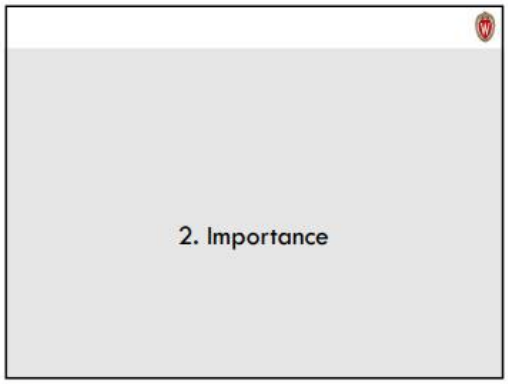
8


•Fluency is…
a. reading as fast as possible.
b. reading without any mistakes.
c. reading quickly, accurately, and with expression.
d. reading as fast as possible and without any mistakes.

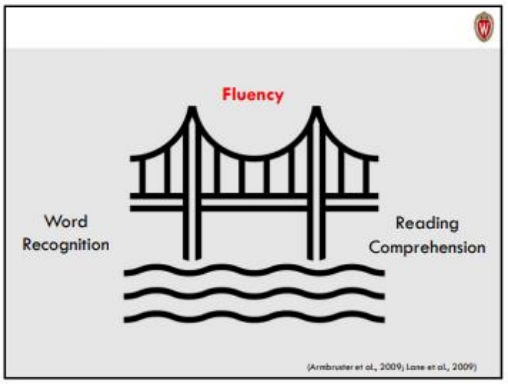
9


•Fluency is…
a. reading as fast as possible.
b. reading without any mistakes.
c. reading quickly, accurately, and with expression.
d. reading as fast as possible and without any mistakes.

10

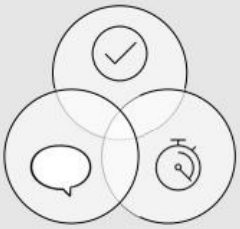

2. Importance

11


Fluency
Word Recognition
Reading Comprehension
(Armbruster et al., 2009; Lane et al., 2009)

12

- Read orally with
  - **accuracy,**
  - appropriate **rate,**
  - **expression**



(Wisconsin Standards for English Language Arts, 2020)

13

Comprehending **Decoding**

(Armbruster et al., 2009)

14

- **Fluency is important because…**
  a. fluent readers can read more text.
  b. fluent readers make more connections from what they read.
  c. fluent readers can focus on comprehension, rather than decoding.
  d. all of the above

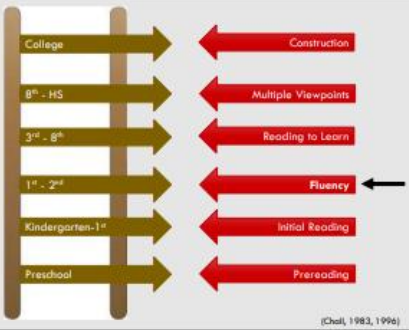
15

- **Fluency is important because…**
  a. fluent readers can read more text.
  b. fluent readers make more connections from what they read.
  c. fluent readers can focus on comprehension, rather than decoding.
  d. all of the above

16

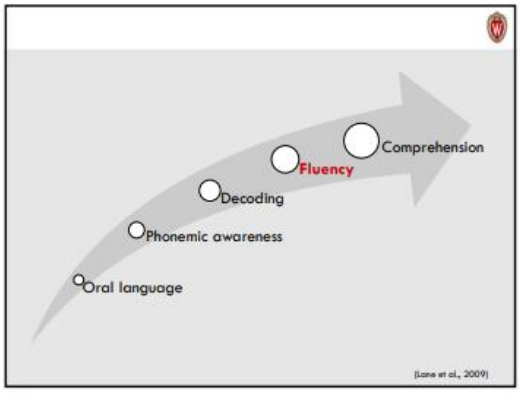
3. Knowledge and Skills

17



(Chall, 1983, 1996)

18



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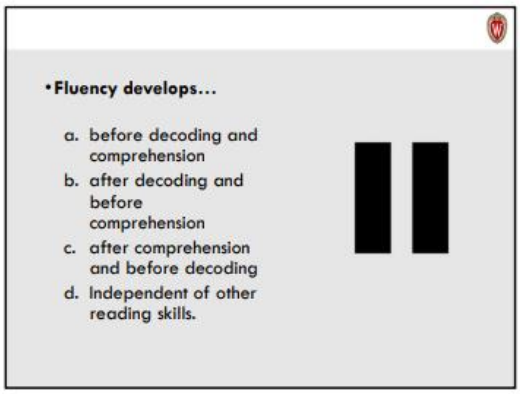

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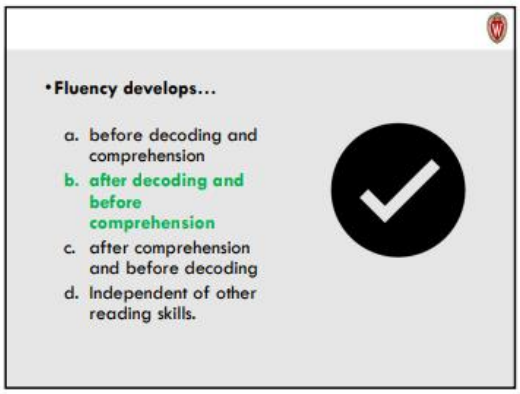

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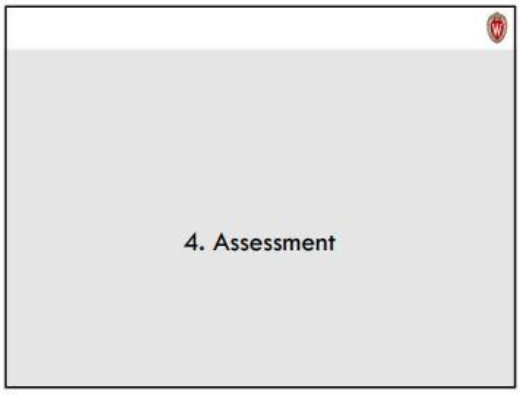

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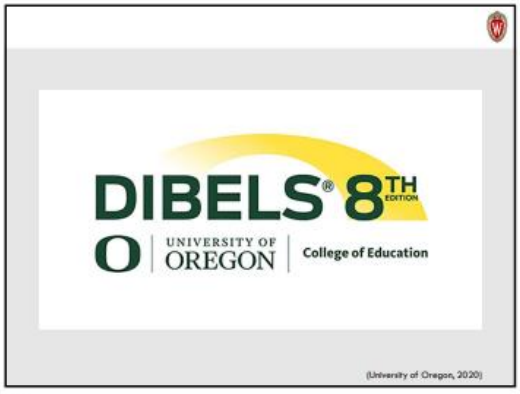


24

DIBELS-8
Oral Reading
Fluency

- Accuracy
- Rate

Honesty

My mom always tells me that honesty is the best policy. I wasn't quite (14)
sure what she meant by that until I found some money the other day. (28)
I was walking home from school when I saw a bag in the street. I (43)
could tell that something was in it, but I wasn't sure what. I walked over to (59)
the bag, picked it up, and then walked back to the sidewalk. It was heavy (74)
and lumpy. I opened it up and in it was stacks of money. (87)
I had never seen so much money before! I was baffled because I didn't (101)
know where it came from. I wanted to go to the store and spend it. I thought (118)
about the things I could buy with all this money. (128)
I stuffed it in my book bag and ran home. I wasn't sure if I should tell (145)
my mom or hide it in my room and spend a little at a time so no one would (164)
notice. I thought about what my mom always says about being honest. What (177)
if someone stole this money and the cops are looking for it? (189)
So, I went into the family room and told my mom about my recent (203)
discovery. Then I showed her the bag of money. We drove to the police (217)
station and turned it in. They said that the money was stolen and that I did (233)
the right thing. (236)
Three days later the police contacted my mom and told her to bring (249)
me to the police station to collect the reward money. It was a lot less money (265)
than had been in the bag, but I felt good about what I'd done and I was happy (283)
to be able to spend it without feeling guilty. (292)

Total words read _____ Total errors _____ Total words correct _____

(University of Oregon, 2020)

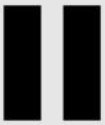
25

Quick & accurate **Slow & inaccurate**

(Armbruster et al., 2009)

26

- **Fluency can be assessed by…**
  a. Using DIBELS and listening for prosody
  b. Having a child retell a story
  c. Listening for accuracy and rate
  d. Asking questions about the story



27

- **Fluency can be assessed by…**
  a. **Using DIBELS and listening for prosody**
  b. Having a child retell a story
  c. Listening for accuracy and rate
  d. Asking questions about the story

28

5. Instruction

29

- Model fluent reading

- Practice reading and rereading

- Monitoring and feedback

(Armbruster et al., 2009)

30

- Rereading short passages
- Timed
- Practice aloud

(Armbruster et al., 2009)

31

Reread aloud **Read silently**

(Armbruster et al., 2009)

32

- **Fluency is taught by…**
  a. independent, silent reading of choice books
  b. focusing on other skills and allowing it to develop on its own
  c. modeling, rereading, and feedback
  d. all of the above

33

- **Fluency is taught by…**
  a. independent, silent reading of choice books
  b. focusing on other skills and allowing it to develop on its own
  c. **modeling, rereading, and feedback**
  d. all of the above

34

35

Appendix E: Reading Fluency Content Checklist

Put Reading First **(Armbruster et al., 2009) Content**	**Included (yes/no)**	**Comments**
Definition of reading fluency that includes three components is provided (p.19)		
Importance of reading fluency as a bridge between word recognition and comprehension is explained (p.19)		
More fluent reading is described (e.g., smooth, expressive oral reading; focus attention on making meaning and connections; focus on comprehension) (p.19)		
Less fluent reading is described (e.g., slow, choppy, labored oral reading; focus on decoding and word recognition; little attention left for comprehension) (p. 19)		
Relationship between fluency and other areas of reading is explained (p. 19)		
Automatic word recognition alone is not sufficient, and that reading connected text is necessary to develop fluency. (p. 20)		
Clear distinction between automaticity and fluency is provided (p. 21)		
Scientifically based fluency instruction (e.g., repeated reading) is described (p. 21)		
Repeated reading is described and includes key components (e.g., monitoring repeated oral reading and rereading of short passages of text at independent reading level paired with feedback) (p. 22)		
Independent reading level is accurately described as reader specific and a text that can be read with 95% accuracy (p. 23)		
Strategies for repeated oral reading practice are included (e.g., student-adult, partner reading, audio assisted reading, readers' theater) (p. 25)		
Procedures for assessing reading fluency using time oral readings are included (p. 27)		

The importance of monitoring reading fluency to inform instruction and identify students who may need additional support is highlighted (p. 27).		

Appendix F: Caps Instructional Design Rubric

Statement	Standard Not Met	Standard Partially Met	Standard Met
	1	2	3
Irrelevant or extraneous information was excluded (Coherence principle)	Includes excess or irrelevant content	Some irrelevant content	3 - No irrelevant content
Explicit cues were provided that signal the beginning of major headings (Signaling principle)	Lacks explicit cue	Some cues provided	Explicit cues provided
Short phrases on screen along with spoken words and pictures (Redundancy principle)	Extensive text on slides	Occasional redundant text	Short phrases on slides
Text and pictures presented in close proximity (Spatial contiguity principle)	Word and pictures not near each other	Some content not closely aligned	Words and pictures near each other
Pictures and text correspond to audio narration (Temporal contiguity principle)	Audio and text misalignment	Some misalignment	Alignment between audio, text, and pictures
Spoken words and pictures preferred to pictures and text alone (Modality principle)	Does not use audio/visuals		Uses audio/visuals
Multimedia presentation divided into short bursts (Segmenting principle)	Excessive lengths; no explicit breaks	Contains explicit breaks but is excessively long	Contains explicit breaks and is acceptable in length
Advance organizer reviews key concepts prior to instruction (Pretraining principle)	No advance organizer or hierarchy of content	Limited use of pretraining strategies	Advance organizer and order of content provided
Pictures and spoken words preferred to words alone (Multimedia principle)	Not multimedia (only contains words)	Inconsistently multimedia (some pictures and spoken words)	Combined use of spoken words, text, and pictures
Personalized tone of narration (Personalization principle)	Not personalized; formal tone	Tone is sometimes personalized,	Personalized, casual tone used throughout

		sometimes formal	
Conversational style of narration (Voice principle)	Formal narration	Some formal, some conversational tone	Conversational tone used throughout
Images are nonabstract and clearly represent the content (Image principle)	Images are vague and/or blurry	Most images are clear	Images are clear and represent the content

Note. Rubric adapted from Weiss and colleagues (2016)

Appendix G: Teacher Knowledge of Reading Fluency Survey

Created by Lane and colleagues (2009) and used with permission from the first author

Knowledge Measure Questions

- What is reading fluency?
- Why is it important for children to develop reading fluency?
- What knowledge and skills do children need to become fluent readers?
- How can reading fluency be assessed?
- What instructional methods could be used to develop reading fluency?

Scoring Rubric for Teacher Knowledge of Reading Fluency Survey

0	1	2	3
General meaning of assigned ratings			
Shows no knowledge or provide insufficient detail to tell how much they know.	Shows little knowledge and some information may be incorrect.	Shows some or acceptable level of knowledge – knowledge at a surface level.	Shows excellent, expert level knowledge – knowledge at a deep, detailed level.
Scoring rubric for question 1: what is reading fluency?			
No answer or incorrect answer.	Response relates to one area of reading fluency (accuracy, automaticity, and prosody). Response relates to more than one area, but only one area is explained correctly.	Response relates to two areas of reading fluency (accuracy, automaticity, and prosody). Respond relates to more than two areas, but only one area is explained correctly or completely.	Includes all three areas in definition. Response is accurate and complete.
Scoring rubric for question 2: why is it important for children to develop reading fluency?			
Specific indicators:			
Indicates reading fluency is important. Vague and general. Lacks details.	Indicates reading fluency is important for comprehension but does not provide any details.	Indicates reading fluency is important for comprehension. Provides additional details, but not how or why fluency	Indicates reading fluency is important for comprehension. Provides additional details and explains how or why fluency

		affects comprehension.	affects comprehension (e.g., says readers will devote less attention to decoding).
Scoring rubric for question 3: what knowledge and skills do children need to become fluent readers?			
Specific indicators:			
Answer incorrect. Vague and general. Doesn't answer the questions. Focuses on what teachers do, not what students need to learn.	Indicates just one area with no additional details.	Provides more areas, but either at the word level or language level. Lacks sufficient detail.	Provides sufficient areas to cover both the word and language levels. Complete and correct answer.
Scoring rubric for question 4: how can reading fluency be assessed?			
Specific indicators:			
Answer incorrect Vague and general. Doesn't answer the question – doesn't tell how to assess or tells about instruction.	Indicates just one area with no additional details.	Indicates two areas or just DIBELS with no detail about specific subtests or procedures. Lacks sufficient detail.	Indicates multiple methods that address the three areas of fluency. Provides names of specific assessments with sufficient detail.
Scoring rubric for question 5: what instructional methods could be used to develop reading fluency?			
Specific indicators:			
0 research-based methods mentioned. Methods mentioned do not address reading fluency.	1 – 2 research-based methods mentioned. Methods only address one component of reading fluency.	More than one research-based method mentioned and addresses more than one component (accuracy, automaticity, prosody).	Three or more research-based methods are mentioned, and methods address all components of fluency accuracy, automaticity, prosody).

Appendix H: Sample Responses from Teacher Knowledge of Reading Fluency Survey

Created by Lane and colleagues (2009) and used with permission from the first author

0	1	2	3
General meaning of assigned ratings			
Scoring rubric for question 1: what is reading fluency?			
A program designed to enhance five components of learning how to read.	So that when asked to read, can read a text and decode the words.	The ability to read with expression and at an appropriate rate.	Reading accurately at a comfortable rate and using intonation and expression to lead to comprehension.
Scoring rubric for question 2: why is it important for children to develop reading fluency?			
To prepare students for success.	Research has found that fluency directly affects reading comprehension.	There is a high correlation between fluency and comprehension. If students are fluent, they can focus on comprehension instead of thinking about decoding.	The main reason is how much fluency is connected to comprehension. If a child reads words incorrectly or slowly, he is unlikely to understand. Reading accurately and smoothly with expression makes comprehension easier and makes reading more enjoyable.
Scoring rubric for question 3: what knowledge and skills do children need to become fluent readers?			
A love of reading.	Decoding skills.	Children need to be able to sound out words correctly. Without good decoding skills, they will never be fluent readers. They also need to know their sight words.	To become fluent readers, children need a solid foundation in phonemic awareness, alphabet knowledge, and decoding skills. They need to be automatic with their skills, and they need to be able to read text without hesitations. They also need to be able to understand the words they read so

			they can figure out other words quickly.
Scoring rubric for question 4: how can reading fluency be assessed?			
FCAT	One-minute timings.	One-minute readings (for speed), listening for prosody.	DIBELS is a quick way to assess rate and accurate. You can also use running records to figure out which words need work Also you can listen to how a child sounds when they read. Does it sound smooth? Do they read with expression?
Scoring rubric for question 5: what instructional methods could be used to develop reading fluency?			
Centers, computers, games, etc.	Rereading text.	Timed readings, rereading familiar text, practicing sight words.	A teacher should model fluent reading so that students can understand the concept of being fluent and how a fluent reader sounds. Having the students do time re-readings will build accuracy and improve rate and confidence.

Appendix I: Semi-Structured Interview Protocol

Researcher: Lauren Zepp		
Research Questions: My primary research question is: How do learner perceptions of their engagement and motivation while watching a CAP on reading fluency relate to differences in scores on a knowledge measure?		
Interviewee Name:	**Date:**	**Location:**
Prompts		**Timing/Priorities**
Introduction: Hello and thank you so much for being here today! My name is Lauren Zepp (she/her) and I am a doctoral candidate in Special Education at the University of Wisconsin-Madison. My research focuses on understanding teacher preparation. This specific study explores preservice teachers' experiences with a type of multimedia learning called Content Acquisition Podcasts (CAPs). I have asked you to participate because I am interested in hearing your experiences with the CAP you watched on reading fluency. I hope to use this information to help other instructors make decisions about how to deliver content in teacher preparation courses. What questions do you have about my research or this interview? Can you please tell me your name and pronouns? [pause for response]. Thank you! Is it okay with you if I record our conversation today? [pause for response]		~ 3 minutes
Core Prompt 1 – Specific CAP experiences and learning 1. What is your major? 2. Based on what you saw in the CAP, tell me: a. What is reading fluency? b. Why is it important for children to develop reading fluency? c. What knowledge and skills do children need to become fluent readers? d. How can reading fluency be assessed? e. What instructional methods could be used to develop reading fluency? 3. Tell me about the Content Acquisition Podcast (CAP) that you watched. a. How did you complete the steps of the module (e.g., concurrent, sequential)?		~ 8 minutes (2 per question) ***** *****

b. What speed did you watch the video on (e.g., 1.0, 1.5, 2.0)? c. Did you watch with the closed captioning on? d. What was it like to watch that CAP? e. What words would you use to describe your experience viewing that CAP? f. What did you learn from that CAP? 4. What strategies did you use while you watched the CAP and/or to answer the posttest questions (e.g., notetaking, verbal rehearsal, closed captioning)?	
Core Prompt 2 - Stimulated recall 1. As you rewatch the CAP, think about your experience watching it for the first time. *[Rewatch CAP]* a. How would you rate your level of motivation to learn about reading fluency? b. What factors influence your motivation to learn? c. How would you describe your level of engagement while you watched the CAP? d. What factors influence your engagement with instruction? e. What does an ideal instructional experience look like for you? f. If you took notes, what did you write down? 2. How valuable is the information you learned from watching this CAP? Will you use this information? How?	~23 minutes (15 for CAP, 4 per question) ***** *****
Core Prompt 3 – Comparison to other ways of learning 1. If your instructor gave you the choice between watching a CAP and reading a text (e.g., a chapter in a textbook or an article), which would you choose to do and why? a. How would you decide? b. Would you be more motivated to watch a CAP or read an article? c. How would you engage differently in them? d. Do you think you would learn the information better one way or the other? Does that matter or is it more about your engagement? 2. If your instructor gave you the choice between watching a CAP and attending an in-person lecture for	~12 minutes (3 per question) *****

the same amount of time, which would you choose to do and why? a. How would you decide? b. Would you be more motivated to watch a CAP or attend a lecture? c. How would you engage differently in them? d. Do you think you would learn the information better one way or the other? Does that matter or is it more about your engagement? e. How do you think your opinions about this difference has changed through the pandemic?	*
Core Prompt 4 – General best-features/best practice 1. Sorting task: I am going to provide you with a set of cards with elements of CAP design on them that other pre-service teachers have told me are important components. Please rank these from least to most important, enjoyable, or valuable to you in your learning (most valuable on top, if creating a stack or least to most – left to right). a. Accessible again later b. Less cognitively demanding/less active intellectual effort c. Not boring d. Short in duration e. Ability to be paused 2. Why did you rank these items in this way? 3. Suppose you were going to help someone design a CAP. What would you tell them is the most important thing to keep in mind? 4. If someone was taking this class after you, what advice would you have for how to engage with the CAP?	~ 12 minutes (3 per question)

Note. * Indicates essential questions.

Appendix J: Recruitment Script and Implementation Fidelity Checklist

University of Wisconsin - Madison
Research Participant Recruitment Script

Preservice Teachers' Engagement and Motivation During Content Acquisition Podcasts

Hello, my name is Lauren Zepp, and my pronouns are she/her. I am a doctoral student in the Department of Rehabilitation Psychology and Special Education at UW-Madison. I am conducting a study *for my dissertation* on the role that engagement and motivation plays in learning from a type of multimedia module called Content Acquisition Podcasts (CAPs).

Participation in this research includes providing demographic information, taking a 5-question pre-test on reading instruction, watching a CAP about reading instruction, and completing a 5-question post-test on the same content. This will take approximately 45-60 minutes of class time.

If you agree to be contacted for a follow-up interview about your experience watching the CAP, you may be selected to participate in a one-hour follow-up interview. If you complete the follow-up interview, you will receive a $25 e-gift certificate. If you have any questions about this research, I can be reached at lzepp@wisc.edu.

Please read the consent form carefully. If you agree to allow your data to be used in this study, please complete the back portion with your name and signature. Including your email address will allow us to contact you for a follow-up interview. As part of RPSE 300, you are required to complete the in-class activities tonight; however, your participation in this study by allowing us to include your data is completely voluntary. When you finish signing the consent form, please pass them to the end of the row so they can be collected.

[Collect signed consent forms]

Directions for Participants

Your responses to the survey questions will be confidential and will not impact your grade in this course; however, please provide your name on the surveys so that we can contact you for the follow-up interview. Your name will be replaced with a number after data collection to protect your anonymity.

You will need a laptop or tablet and headphones to access the study materials. If you need a pair of headphones, please raise your hand and we will provide you with a new, sealed pair for your use. On your course Canvas page, you will see a module labeled "Engagement and Motivation Study." The module contains three parts. Please complete each step in its entirety before moving on the next step.

First, please use the link provided to complete the demographic questions and pre-test. Submit the pre-test before viewing the video.

After you complete the pre-test, please watch the CAP in Canvas using your device and headphones. You may take notes if you wish, but please refrain from engaging in any other activities while you watch the video.

Finally, please complete the 5-item post-test using the link. As a reminder, there are 3 steps in the module. Please be sure to complete each step fully before moving on to the next step.

When you have completed the post-test survey, you may leave. Please leave quickly so that you do not disturb others. Thank you again for your participation!

Checklist

- [x] The primary proctor read from the script to recruit participants for the study.
- [x] The primary proctor read from the script to explain the directions to participants.
- [x] Two proctors circulated throughout the room and monitored participants.
- [x] Participants did not engage in other activities during the study (e.g., talking, watching videos).
- [x] The primary proctor answered participants' questions consistently OR no participants asked questions.

Appendix G: Codes Used During Data Analysis

Deductive Codes	Inductive Codes
Engagement Specific strategy use Closed captioning Video speed Notetaking Pausing Check for understanding Self-monitor Activate schema *Motivation* Personal Values/Ethics Time of class Length of course session *Overall Recall of Answers* Definition of reading fluency Importance of reading fluency Prerequisite skills for reading fluency Assessment of reading fluency Instruction on reading fluency *CAPs versus assigned reading* *CAPs versus in-person lecture* *Instructional Design Principles* Coherence principle Signaling principle Redundancy principle Spatial contiguity principle Temporal contiguity principle Segmenting principle Modality principle Multimedia principle Pre-training principle Guided discovery principle Personalization principle Voice principle Embodiment principle Immersion principle	*Schema* Prior knowledge Personal experiences *Engagement* Connection between strategies and engagement Relationships *Motivation* Relevance for the future Efficiency *Impact of COVID* *Place and space* *Personal feelings about reading* *Cognitive load of reading* *Cognitive load of CAPs*

Generative activity principle *Rank of CAPs Design Elements* Accessible again later Less cognitively demanding Not boring Short in duration Ability to be paused	
Pattern Codes	
Cognitive load COVID Efficiency Engagement Length of course session Moderate recall Motivation Relationships Schema Setting Strategy use Strong recall Video conditions Weak recall	