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EXPLORING THE ROLE OF THINKING STYLES IN ENHANCING KNOWLEDGE ACHIEVEMENT WITH DIGITAL VIDEO COURSEWARE

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ABSTRACT

This study explores the role of thinking styles; legislative, executive, and judicial, in enhancing knowledge achievement through digital video courseware (DVC). Drawing on Sternberg's Mental Self-Government (MSG) Theory and Mayer's segmenting principle, the research investigates the effectiveness of two instructional modes: learner-paced digital video courseware (DVC-LS) and system-paced digital video courseware (DVC-SS). The DVC was developed using Articulate Storyline 360, featuring interactive quizzes, embedded multimedia elements, and adaptive feedback. The platform tracked learner engagement through analytics such as time-on-task, navigation patterns, and quiz attempts. A sample of 180 undergraduate students from four universities participated in this quasi-experimental 2×3 factorial design study. Legislative thinkers, who thrive in innovative and self-directed environments, excelled in learner-paced settings. Conversely, executive thinkers, who prefer structured guidance, and judicial thinkers, adept at evaluating and analyzing, achieved better outcomes in system-paced formats. These findings underscore the importance of aligning instructional strategies with diverse cognitive preferences to maximize learning outcomes. By addressing the varied needs of learners, this study offers insights into the design of flexible and inclusive digital learning environments, with practical implications for instructional designers, educational technologists, and software developers.

Keywords: Thinking styles, Sternberg's Mental Self-Government (MSG) Theory, Digital Video Courseware, Knowledge Achievement, Learner-Paced Segment, System-Paced Segment

1. INTRODUCTION

The rapid advancement of technology in education demands innovative approaches to learning, particularly in skill-based disciplines such as digital video production. Digital competence and computational thinking (CT) are key components of 21st-century skills, requiring learners to engage with complex, multimedia-rich content (Juškevičiene & Dagiene, 2018; Wing, 2008). However, the effectiveness of digital learning environments often depends on aligning instructional design with learners' cognitive preferences (Huang et al., 2020).

Sternberg's Mental Self-Government (MSG) Theory categorizes thinking styles into three primary types; legislative, executive, and judicial, representing unique ways individuals approach problem-solving and decision-making (Grigorenko & Sternberg, 1997). Legislative thinkers prefer creative autonomy, executive thinkers thrive on structured guidance, and judicial thinkers excel in

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analytical and evaluative tasks. Understanding how these cognitive styles interact with instructional design can significantly impact knowledge acquisition and retention (Branković, 2019).

Mayer's segmenting principle, a core concept in multimedia learning, highlights the benefits of breaking instructional content into manageable segments. This approach minimizes cognitive overload and enhances learners' ability to process and retain information (Fyfield et al., 2019). By combining Sternberg's MSG Theory (Sternberg & Wagner, 1991) with Mayer's segmenting principle, this study investigates how thinking styles and instructional pacing modes; learner-paced (DVC-LS) and system-paced (DVC-SS); influence knowledge achievement in digital video learning environments.

The integration of multimedia principles, such as Mayer's segmenting principle, with cognitive theories like Sternberg's MSG Theory provides a robust framework for designing effective educational tools. Digital video learning environments, enriched with interactive features and visually engaging content, are increasingly being recognized as powerful platforms to promote active learning. These environments allow students to interact with content in ways that align with their cognitive preferences, fostering better engagement and deeper understanding. However, without careful alignment of instructional strategies with thinking styles, these tools may fail to achieve their intended outcomes, leading to frustration and reduced learning efficacy (Richard E. Mayer & Pilegard, 2014).

Moreover, digital video production as a learning activity offers unique opportunities to enhance both technical and cognitive skills. By engaging in tasks such as storyboarding, editing, and algorithmic thinking, students can apply theoretical concepts to practical scenarios, making the learning experience more meaningful. When instructional pacing is tailored to students' thinking styles, it not only improves knowledge acquisition but also cultivates essential skills such as problem-solving, critical thinking, and creativity. These skills are vital for equipping students to thrive in dynamic, technology-driven industries, further highlighting the need for research that bridges the gap between cognitive preferences and instructional design (Juškevičiene & Dagiene, 2018; Mohamed et al., 2021).

2. LITERATURE REVIEW

2.1 Thinking Styles and Their Role in Learning

Thinking styles, as proposed by Sternberg (1988), are intrinsic preferences that govern how individuals approach cognitive tasks and make decisions. Legislative thinkers excel in tasks that require originality and self-direction, as they prefer to create and construct new ideas or plans. In contrast, executive thinkers thrive in environments with clear, structured guidelines, relying on predetermined frameworks to accomplish tasks effectively. Judicial thinkers, on the other hand, are evaluative in nature, preferring to analyze, critique, and assess the validity of existing ideas or systems.

Aligning instructional strategies with these cognitive styles can significantly enhance students' engagement and learning outcomes. For example, legislative thinkers benefit from project-based or exploratory learning environments that offer flexibility and freedom in decision-making. Executive thinkers respond well to structured, instructor-led approaches, where goals and processes are clearly outlined. Judicial thinkers thrive when provided with opportunities to assess and critique, as such tasks align with their analytical mindset (Brown, 2001).

Prior research highlights that mismatches between instructional design and thinking styles can hinder learning. For instance, legislative thinkers may feel constrained in rigidly structured environments, while executive thinkers may struggle in open-ended tasks without clear directions. Understanding these nuances is essential for designing adaptive learning environments that cater to diverse cognitive preferences, ultimately improving engagement, decision-making, and knowledge retention (Al-Thani et al., 2014; Baratè et al., 2017).

2.2 Segmenting Principle in Multimedia Learning

The segmenting principle, a core concept in Mayer's Cognitive Theory of Multimedia Learning, emphasizes the importance of dividing instructional materials into manageable segments to reduce cognitive overload and enhance learning efficiency. Learner-paced segments empower students to control the flow of information, allowing them to process content at their own pace. This approach fosters deeper cognitive engagement by giving students time to internalize information before moving on to subsequent sections (Mayer & Chandler, 2001).
System-paced segments, on the other hand, follow a predetermined sequence, offering consistency and structure. This method is particularly beneficial for learners who prefer guided instruction, as it ensures uniformity in the delivery of content. Studies have demonstrated that both learner-paced and system-paced approaches have unique advantages depending on the learners' cognitive styles and prior knowledge (Mayer, 2014).

Recent research has expanded the understanding of the segmenting principle by exploring its effects on various educational outcomes, including knowledge retention, transfer, and learner satisfaction. For example, Stiller et al. (2011) found that students with low working memory capacity benefited significantly from segmented instruction compared to continuous presentations. However, the interplay between segmenting methods and thinking styles remains an underexplored area, particularly in the context of multimedia learning environments such as digital video courseware.

2.3 Knowledge Achievement in Digital Learning

Knowledge achievement involves the ability to acquire, retain, and apply learned information in meaningful ways. In the context of digital learning, the integration of multimedia elements such as videos, animations, and interactive tools, has been shown to improve both cognitive and affective learning outcomes. When designed thoughtfully, digital video learning environments can facilitate active engagement, critical thinking, and knowledge retention (Castro-Alonso et al., 2021). Furthermore, according to Chaw and Tang (2023), greater proficiency in digital competence areas, excluding safety, has a positive effect on university students' learning performance, with the semester having no significant moderating influence.

The effectiveness of digital learning is influenced not only by the quality of the multimedia content but also by its alignment with learners' cognitive needs. For instance, studies have highlighted the importance of adaptive pacing and interactivity in addressing cognitive overload and fostering deeper learning (Huang et al., 2020). Furthermore, the integration of Mayer's segmenting principle into digital video courseware has proven to be particularly effective in enhancing knowledge acquisition, as it allows learners to process complex information in manageable chunks (Darejeh et al., 2022; Liu et al., 2022) .

Research on the interaction between thinking styles and digital learning environments is relatively limited but growing. Legislative thinkers, for example, may excel in environments that allow for creative exploration and self-paced learning, while executive thinkers may benefit more from structured, guided content. Judicial thinkers, with their analytical approach, may find value in digital learning tools that incorporate evaluative components, such as quizzes and reflective prompts. Understanding these interactions is crucial for optimizing the design of digital video courseware to maximize knowledge achievement across diverse learner profiles (Baratè et al., 2017; Juškevičiene & Dagiene, 2018).

2.4 Gaps in Current Research

While existing studies provide valuable insights into the effects of thinking styles, segmenting principles, and digital video learning on educational outcomes, the intersection of these factors remains underexplored. Specifically, there is limited empirical evidence on how instructional pacing modes interact with cognitive preferences to influence knowledge achievement in multimedia learning environments. Additionally, the role of external factors, such as cultural and technological influences, in shaping these interactions warrants further investigation.
This study seeks to address these gaps by examining the combined effects of thinking styles and instructional pacing on knowledge achievement in digital video courseware. By integrating Sternberg's MSG Theory with Mayer's segmenting principle, the research aims to provide actionable insights for designing adaptive learning environments that cater to diverse cognitive needs.

3. METHODOLOGY

3.1 Research Design

This study utilized a quasi-experimental 2×3 factorial design to explore the interaction between two key variables: instructional pacing modes (learner-paced and system-paced) and thinking styles (legislative, executive, and judicial). The design was chosen to investigate how different pacing modes influence students' knowledge achievement based on their thinking styles. The two factors; pacing and thinking style; were examined simultaneously to determine if there were significant differences in knowledge achievement as a result of their interaction.

The factorial design was appropriate for examining the combined effects of these independent variables and allowed for the analysis of both main effects (the impact of each factor independently) and interaction effects (how the factors work together to affect outcomes). The two pacing modes (DVC-LS and DVC-SS) were chosen based on Mayer's segmenting principle, which suggests that instructional material should be delivered in manageable parts to enhance cognitive processing. The inclusion of thinking styles as an independent variable allowed for a more nuanced investigation into how learners' cognitive preferences affect their ability to engage with and retain information in digital video learning environments.

3.2 Participants

The participants in this study were 180 undergraduate students enrolled in digital video production courses at four universities, representing a diverse pool of learners from different academic backgrounds. Participants were selected using a stratified random sampling method to ensure a representative sample from each university. This helped control any potential biases related to institutional differences in teaching methods or course content.The participants were

categorized into thinking styles using the *Thinking Styles Inventory* (TSI) developed by Sternberg and Wagner (1991). The TSI is a well-established tool designed to assess the cognitive preferences of individuals, categorizing them into legislative, executive, or judicial thinking styles based on their approach to problem-solving, decision-making, and information processing. Equal representation of each thinking style was ensured through a balanced grouping of participants, which was crucial for comparing the effects of different instructional pacing modes across the three thinking styles. This balanced grouping helped to control any potential confounding variables related to the distribution of thinking styles among the participants.
The average age of the participants was 21 years, with a gender distribution of 50% male and 50% female. All participants were in their second or third year of undergraduate study, with previous exposure to multimedia and video production techniques, ensuring they had a foundational understanding of the course material before participating in the study.

3.3 Instruments

To measure knowledge achievement, two primary instruments were used: Pre- and Post-Tests. The pre-test was administered before the intervention to assess participants' baseline knowledge of digital video production concepts. This knowledge included camera techniques, editing principles, storyboarding, and other foundational concepts in digital video production. The pre-test consisted of both multiple-choice questions (MCQs) and short-answer questions, allowing for an assessment of both rote knowledge and deeper conceptual understanding. The post-test, administered after the courseware intervention, was identical to the pre-test and was used to measure the knowledge gained by participants made during the intervention. The results of the pre- and post-tests were compared to evaluate the effectiveness of the digital video courseware in enhancing participants' knowledge.

The test items were developed by subject-matter experts in digital video production to ensure they accurately reflected the key concepts covered in the courseware. Both the pre- and post-tests were validated through expert reviews, ensuring content validity. The tests were also piloted with a small sample of students before the main study to check for reliability and clarity.

3.3.1 Digital Video Courseware

The courseware was developed using Articulate Storyline 360 as the primary authoring tool, with HTML5 export to ensure compatibility across devices and browsers. It was hosted as offline web courseware, which allowed for centralized access, progress tracking, and learner management. Interactive elements included branching scenarios, drag-and-drop activities, and embedded self-check quizzes. Adaptive feedback mechanisms were integrated to guide learners based on their performance in quizzes. Learning analytics captured within the LMS included time spent per module, navigation sequence, frequency of revisits, and quiz attempt data. The interface was designed with a clean, minimalistic layout adhering to WCAG accessibility standards, ensuring usability for diverse learner profiles. Usability testing was conducted with a pilot group of 20 students prior to the main study, leading to refinements in navigation flow, font readability, and interaction pacing. The digital video courseware was the primary intervention used in this study. Two versions of the courseware were developed:

- DVC-LS (Learner-Paced Courseware): This version of the courseware allowed students to control their learning pace through interactive elements. Students could pause, skip, or replay sections of the instructional material, providing them with autonomy over how

quickly they progressed through the content. The learner-paced courseware was designed to cater to students who prefer to engage with material at their own pace, reflecting the needs of legislative thinkers who thrive in flexible, self-directed learning environments.

- DVC-SS (System-Paced Courseware): This version of the courseware followed a predefined sequence of content with no student control over the pacing. The instructor set the progression of the courseware, and students moved through the material in a structured manner, with transitions between sections occurring automatically. This system-paced courseware was designed for executive thinkers, who tend to perform better when provided with clear, structured guidance. The system-paced mode also aligned with judicial thinkers' preference for evaluative tasks, as it provided opportunities for analysis and reflection after each segment.

Both versions of the courseware were built using a combination of text, video, animations, and interactive quizzes to ensure engagement and to reinforce the key concepts of digital video production. Each courseware was designed to cover similar content, ensuring that the primary variable in the study was the pacing of the instructional material.

3.4 Procedure

The study was conducted in three phases: pre-test, intervention (courseware usage), and post-test.

- Phase 1: Pre-Test

Before engaging with the digital video courseware, participants completed a pre-test to measure their baseline knowledge. The pre-test was administered in a controlled classroom environment to ensure consistency in the administration process. The test was designed to assess participants' understanding of digital video concepts, including camera operation, shot composition, and editing techniques.

- Phase 2: Intervention (Courseware Usage)

Participants were randomly assigned to one of six groups based on their thinking style (legislative, executive, judicial) and the type of courseware (learner-paced or system-paced). Each group was asked to use the courseware for a period of one hour, during which they would complete the instructional modules. In the learner-paced group, participants were encouraged to explore the courseware at their own pace, with the ability to pause, rewind, and revisit sections of the content. In the system-paced group, participants followed the instructor-guided flow of the courseware, progressing through each segment at a fixed pace.

Throughout the intervention, participants were encouraged to actively engage with the content and take notes on the material. In both courseware modes, interactive quizzes were embedded at the end of each segment to reinforce learning and provide immediate feedback.

- Phase 3: Post-Test

After completing the courseware intervention, participants took a post-test identical to the pre-test to assess the knowledge gained during the intervention. The post-test was administered under similar conditions to the pre-test, ensuring consistency. Knowledge achievement was measured by comparing pre-test and post-test scores, allowing for an analysis of the impact of the instructional modes and thinking styles on knowledge gains.

3.5 Data Analysis

The data from the pre- and post-tests were analyzed using Analysis of Covariance (ANCOVA) to assess the main and interaction effects of instructional pacing (DVC-LS vs. DVC-SS) and thinking styles (legislative, executive, judicial) on knowledge achievement. ANCOVA was chosen because it

allows for the examination of differences between groups while controlling for the effects of pre-test performance, ensuring that any observed differences in post-test scores were due to the intervention rather than pre-existing knowledge differences.

The ANCOVA model included the pre-test scores as a covariate, the instructional mode (DVC-LS vs. DVC-SS) and thinking style (legislative, executive, judicial) as the independent variables, and the post-test scores as the dependent variable. This statistical approach enabled the researchers to assess the effect of the instructional pacing modes on knowledge achievement, as well as the potential interaction between thinking styles and instructional modes.

In addition to ANCOVA, descriptive statistics (mean, standard deviation) were calculated to provide an overview of the participants' performance across different groups. Post-hoc pairwise comparisons were conducted to explore significant differences between the groups in more detail.

4.0 RESULTS

4.1 Interaction Effects

The ANCOVA results revealed significant interaction effects between thinking styles and instructional pacing on knowledge achievement, with an F-value of $F(2, 173) = 8.21$, $p < .01$. This means that the relationship between the two independent variables; thinking styles (legislative, executive, judicial) and instructional pacing (learner-paced, system-paced), had a statistically significant impact on students' achievement. The p-value of less than 0.01 indicates a strong likelihood that the observed differences in post-test scores were not due to random chances, but rather the result of the interaction between these two factors. Additionally, analysis of learner interaction data from the LMS showed that legislative thinkers in the learner-paced group spent on average 18% more time on content pages and revisited modules 1.6 times more frequently than executive thinkers. In contrast, executive thinkers in the system-paced group had higher completion rates on first attempts and fewer navigation deviations. Judicial thinkers exhibited more balanced navigation patterns but engaged more with embedded discussion prompts, suggesting a preference for reflective and evaluative interactions.

This finding suggests that students' thinking styles influence how effectively they engage with and learn from different instructional pacing modes. In other words, the type of pacing used in the digital video courseware (whether learner-paced or system-paced) has varying effects depending on whether students are legislative, executive, or judicial thinkers. This underscores the importance of matching instructional design with cognitive preferences to optimize learning outcomes.

4.2 Legislative Thinkers

Legislative thinkers exhibited the highest knowledge gains in the DVC-LS group (learner-paced courseware), with a mean score of $M = 85.6$, and a standard deviation of $SD = 6.3$. Legislative thinkers, as defined by Sternberg's theory, are characterized by their preference for autonomy, creativity, and self-directed decision-making. They thrive in environments that provide them with the freedom to control their learning process, which aligns well with the learner-paced courseware design.

The learner-paced courseware allowed these students to set their own pace, decide when to move on to the next section, and revisit previous content as needed. This autonomy in the learning process is particularly suited to legislative thinkers, as it taps into their preference for self-guided exploration and creative problem-solving. By being able to control the flow of information, legislative thinkers were able to engage more deeply with the material, which fostered better retention and a stronger understanding of digital video production concepts.

The high mean score of 85.6 suggests that legislative thinkers were able to achieve a high level of knowledge, benefiting from the learner-paced structure, which enabled them to spend more time on areas they found particularly engaging or challenging. The relatively low standard deviation (6.3) indicates that most legislative thinkers in the group showed similar levels of performance, suggesting that the learner-paced environment was generally effective for this thinking style.

4.3 Executive Thinkers

Executive thinkers, who prefer structured environments with clear guidelines and instructions, performed significantly better in the DVC-SS group (system-paced courseware), with a mean score of M = 80.2 and a standard deviation of SD = 7.5. Executive thinkers thrive in environments where the instructional process is predefined and systematic, as they tend to prefer working within established frameworks and following explicit directions. The system-paced courseware, which was designed with fixed content flow and segment transitions guided by the instructor, suited their cognitive style.

In this courseware mode, executive thinkers could focus on learning the material step-by-step, without needing to make decisions about when to move forward or revisit content. The structured pacing helped these students remain on task and follow the material in a sequential manner, which is in line with their preference for guided learning. The higher mean score of 80.2 reflects the effectiveness of system-paced instruction for executive thinkers, indicating that they benefited from having the pace and structure dictated for them. The relatively higher standard deviation (7.5) suggests some variability in performance within this group, which may be due to individual differences within the executive thinking style itself, such as variations in how each student applies structured learning.

4.4 Judicial Thinkers

Judicial thinkers, known for their analytical and evaluative approaches, showed moderate performance across both instructional modes, but slightly favored the DVC-SS group with a mean score of M = 78.9 and a standard deviation of SD = 6.8. Judicial thinkers are adept at evaluating existing ideas, analyzing patterns, and making judgments based on critical assessments. While they benefit from structured, evaluative tasks, they also require flexibility to engage in deep reflection and analysis.

In the DVC-SS (system-paced) environment, judicial thinkers had predefined segments and opportunities to evaluate their learning after each section, which aligned well with their cognitive preferences for assessment and critique. However, their performance in the DVC-LS group (learner-paced courseware) was not significantly worse, suggesting that they also adapted to environments that allow for some autonomy, though they slightly preferred the structured evaluation aspects of the system-paced environment. The mean score of 78.9 in the DVC-SS group reflects their ability to apply analytical skills to the content presented in a fixed sequence. However,

their preference for evaluative opportunities may explain why they performed better in the system-paced environment, where content was presented in a logical and evaluative sequence.

The standard deviation (6.8) for judicial thinkers is moderate, indicating that there was some variability in how these students performed in both pacing modes. Some judicial thinkers may have been more comfortable in the learner-paced environment, where they could take more time to evaluate the material, while others performed better in the system-paced environment, where the evaluation process was more structured and embedded into the instructional flow.

5. DISCUSSION

The results from the ANCOVA analysis demonstrate the critical role of aligning instructional pacing with students' thinking styles. The significant interaction effect between thinking styles and instructional pacing suggests that different pacing modes; learner-paced and system-paced; affect students' learning outcomes in distinct ways based on their cognitive preferences.
Legislative Thinkers benefit most from learner-paced environments, as these environments offer the autonomy they crave, allowing them to engage more deeply and creatively with the content. This is consistent with research suggesting that legislative thinkers excel in situations that provide freedom to explore and make decisions (Sternberg, 1988).

Executive Thinkers, on the other hand, perform better in structured, system-paced environments, which provide clear guidelines and consistent pacing. Their preference for task-oriented learning within well-defined frameworks (Brown, 2001) makes the system-paced environment an ideal match for them.

Judicial Thinkers show more variability in performance but slightly favor system-paced environments. Their preference for evaluation and analysis was better supported in the structured pacing of the DVC-SS group, although they were still capable of engaging with the learner-paced courseware, highlighting their adaptability to different types of instructional design.

These findings highlight the importance of personalized instructional design. Tailoring educational materials to accommodate diverse thinking styles can enhance knowledge retention, foster deeper engagement, and improve overall learning outcomes. By integrating the principles of learner-paced and system-paced designs with an understanding of students' cognitive preferences, educators can create more effective learning environments that cater to the needs of all students. In the context of modern educational technology, these results suggest that integrating adaptive learning systems, interactive video tools such as H5P, and analytics dashboards can further personalize instruction. For example, adaptive sequencing could automatically adjust pacing mode recommendations based on learner interaction data, while learning analytics dashboards could provide instructors with real-time insights into learner engagement and performance trends.

These findings underscore the importance of cognitive alignment in instructional design, which refers to the process of matching instructional strategies with the cognitive preferences and strengths of learners. The idea is that when students are placed in learning environments that align with their natural thinking styles, they are more likely to be motivated, engaged, and successful in achieving learning goals. Cognitive alignment is not just about ensuring content is appropriate, but also about adjusting the pace, structure, and nature of the learning experience to best support how students think, process information, and make decisions.

5.1 Legislative Thinkers and Autonomy in Learner-Paced Environments

The study's results suggest that legislative thinkers perform significantly better in learner-paced environments (DVC-LS), where they have control over the flow of information. Legislative thinkers are characterized by their preference for creative exploration and decision-making. They tend to excel in environments that allow them the flexibility to decide how and when to engage with the content. This preference for autonomy in learning is consistent with the findings of Brown (2001), who emphasized that intrinsic motivation; the drive to engage in an activity for the inherent satisfaction of learning; is often triggered by environments that allow learners to exercise choice and control over their actions.

In learner-paced settings, legislative thinkers are free to explore content in their own time and order, which leads to greater cognitive engagement and deeper learning. The ability to pause, revisit sections, or skip over material that is already familiar supports their need to control their learning process, which fosters deeper cognitive engagement. This autonomy allows them to take ownership of their learning, which in turn enhances knowledge retention. Essentially, providing legislative thinkers with control over their learning environment taps into their inherent strengths, enabling them to process and internalize content more effectively.

5.2 Executive and Judicial Thinkers in Structured Environments

In contrast, executive and judicial thinkers benefit more from structured learning environments like the system-paced courseware (DVC-SS). These two thinking styles thrive in environments where clear objectives are set, and the steps to achieve them are explicitly outlined. Executive thinkers, who favor clarity and structure, perform best when the learning process is systematic and predictable. They tend to focus on tasks that involve following well-defined procedures and responding to clear instructions. This is why they excel in a system-paced setting where the content follows a pre-determined sequence, and transitions between learning segments occur automatically. This structure helps them stay on task and reduces the cognitive load associated with decision-making about the next steps in their learning process.

Judicial thinkers, while also benefiting from structure, have an added preference for evaluative opportunities; the ability to analyze, critique, and assess information. In a system-paced environment, they have the chance to evaluate the material after each segment, which aligns well with their analytical cognitive style. This evaluative process helps judicial thinkers process information at a deeper level, leading to better understanding and retention. The combination of clear guidelines and evaluative tasks in a system-paced environment therefore supports their need for both structure and critical reflection.

5.3 The Role of Segmenting Principles

One of the significant insights from this study is the value of segmenting principles in instructional design. Segmenting, as outlined by Mayer's principles of multimedia learning, involves breaking instructional content into smaller, digestible segments. This approach is particularly effective in reducing cognitive overload, which can occur when learners are overwhelmed by too much information at once. Segmenting not only makes learning more manageable but also enhances knowledge retention by allowing learners to process each segment more thoroughly before moving on to the next.

In the context of this study, the segmenting principle is especially important for supporting learners with different cognitive preferences. For legislative thinkers, who prefer autonomy and exploration, segmenting allows them to control how they interact with the content, giving them the freedom to pause and reflect when necessary. For executive and judicial thinkers, who benefit from more structured environments, segmenting helps create a natural progression through the material, ensuring that information is presented in clear, manageable steps. This approach minimizes cognitive overloads for all learners, regardless of their thinking style, by aligning with their preferred modes of processing information.

5.4 Implications for Educational Practice

The findings from this study make an important contribution to the growing body of research on multimedia learning and thinking styles by highlighting the interaction between thinking styles and instructional design. Specifically, the study reinforces the idea that instructional pacing and structure should not be a one-size-fits-all approach. Rather, educators must consider the cognitive diversity of their students when designing digital learning environments.
By addressing the unique cognitive needs of learners; whether they are legislative, executive, or judicial thinkers; educators can design more inclusive and effective learning experiences. For instance, differentiated instruction can be employed to create digital learning environments that offer flexible pacing, clear guidelines, and opportunities for critical evaluation, thus supporting diverse learning preferences. This personalized approach can enhance both student motivation and achievement, as learners are more likely to engage deeply with material that aligns with their cognitive strengths.

Furthermore, the findings suggest that adaptive learning systems; which can adjust content pacing and structure based on students' preferences and performance; may be an effective way to tailor learning experiences. By integrating such systems, educators can provide more customized, responsive learning experiences that help each student achieve their full potential.

6.0 CONCLUSION

Overall, the study emphasizes the critical role of cognitive alignment in instructional design, demonstrating that instructional modes must be adapted to meet the cognitive needs of learners. By providing environments that foster autonomy for legislative thinkers, structure for executive thinkers, and evaluative opportunities for judicial thinkers, educators can create more engaging and effective learning environments. These findings contribute to the broader field of educational psychology by highlighting the need for thoughtful, individualized learning experiences that promote deeper engagement, intrinsic motivation, and long-term retention. In turn, this approach can prepare students for the complex, dynamic learning environments they will encounter in their academic and professional lives. Moreover, this study demonstrates the critical role of thinking styles in influencing knowledge achievement within digital video courseware environments. It confirms that students' cognitive preferences; legislative, executive, or judicial; significantly shape their learning outcomes when interacting with different types of instructional pacing. The results highlight those legislative thinkers, who prefer autonomy and self-direction, perform best in learner-paced settings (DVC-LS). These environments allow legislative thinkers to control the flow of content, engage in creative exploration, and deepen their understanding by revisiting material as needed. On the other hand, executive thinkers, who thrive on structure and clear instructions, excel in system-paced environments (DVC-SS), where content follows a predefined, instructor-controlled sequence. This structured approach aligns with their preference for following clear

guidelines and completing tasks within a set framework. Judicial thinkers, who prefer evaluating and critically analyzing content, show more moderate performance in both environments but tend to favor system-paced environments, where they can engage in evaluative processes after each instructional segment.

These findings support the idea that instructional design should not adopt a one-size-fits-all approach. Instead, it should consider the diverse cognitive needs of learners to ensure optimal learning experiences and achievement.

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