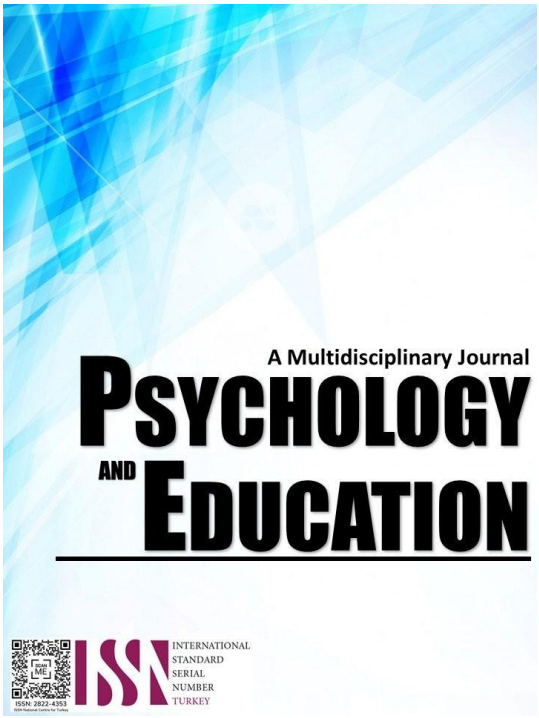
EXAMINING THE EFFECTS OF SOCIAL STUDIES INSTRUCTIONAL MATERIAL FORMAT ON COGNITIVE LOAD AMONG COLLEGE STUDENTS



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Research Article

Examining the Effects of Social Studies Instructional Material Format on Cognitive Load Among College Students

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Abstract

This study explored how different formats of social studies instructional materials - textual, visual, and interactive affect college students' cognitive load and engagement. It aimed to support teachers in creating learning environments that promote not only memorization but also meaningful understanding of historical and civic concepts. Using a quantitative comparative approach, 90 students were divided into three groups, each exposed to one type of instructional material. Data were collected through a carefully developed and validated instrument and analyzed using descriptive statistics and one-way ANOVA. The findings showed that visual materials attracted the highest levels of engagement but also resulted in increased cognitive load, suggesting that while these materials encourage deeper thinking, they also overwhelmed learners if not carefully designed. Interactive materials also improved engagement and cognitive processing, whereas textual materials led to the least engagement and cognitive demand. Statistically significant differences were found between textual and both visual and interactive formats. Overall, the study highlights the need for well-balanced instructional design that fosters student engagement without causing cognitive overload. It recommends combining different material formats to enhance learning effectiveness in social studies education.

Keywords: *Social Studies instructional materials, cognitive load, student engagement, visual learning materials, interactive Learning Materials*

Introduction

Social studies education is crucial to developing an understanding of history and current affairs, as well as active participation in civic life. To do so, students need to know that these learning strategies develop historical understanding that is integrated into problem-solving in society today. Despite the perceived value of social studies, students struggle to retain and apply the historical facts they have learned, particularly when using language-oriented learning approaches. Such sources, even though they are all encompassing, have the effect of cognitive load, which fails to allow students to systematically process and engage with the material. Noticing students' struggles with the chronology of events and historical facts, educators and other scholars start to explore the possible role of teaching materials in the issue.

In recent years, certain instructional formats have become the center of attention for several learning theories, especially in social studies education. It is reported that the use of multimedia elements, such as images, videos, and animations, enables students to overcome cognitive overload and better comprehend complex subjects and concepts. This is also the basis for active learning as emphasized by constructivist learning theories. When it comes to social studies, the combination of reading, viewing, and playing can make the subject of history not only easier to learn but also more insightful as well as students can relate historical events to modern society.

To bridge this gap, this study investigated the different formats of instructional materials utilized in the classroom and their effects on the cognitive load of text, images, and videos among college students. The study particularly targeted first-year IT students at the University of Science and Technology of the Southern Philippines - Jasaan and sought to establish how the factors of the three linear formats in instruction influence the students' understanding of social studies in detail. To provide an answer, this research proposed to explore the learner's experience as well as develop scenarios on how the art of material provides to create the learners' understanding and makes the now traditionally difficult process of social studies uncomplicated.

Adopting cognitive load theory (CLT), which stresses that poorly designed instructional material should not cause mental strain on learners, investigates which instructional formats do not overburden cognitive processes that are responsible for smooth learning. Comprehensive as appreciation of cognitive load theory is gaining momentum, limited focus has been placed on operationalizing the formats of instruction in the context of social studies and their impact on cognitive processing.

This study went further to bridge that gap by evaluating textual, visual, and interactive learning materials and providing well-researched strategies to teachers on how to choose materials that will aid in achieving effective learning situations. Therefore, the research aimed to determine whether the methods of teaching social studies can effectively engage students in the subject matter, simplifying the learning process by removing cognitive barriers that negatively impact the learning experience.

As such, the study hoped to assist teachers in fostering an environment in the classroom that is inclusive, encouraging, and constructive. It is hoped that such a classroom will not only emphasize retention of content but also understanding of the historical and civic concepts being emphasized.

Finally, the findings and recommendations from this research may enhance teaching practices, enabling teachers to teach not just facts and dates, but also to preach the integration of history and its relevance to society.

Research Questions

The purpose of this study is to investigate how different formats of instructional materials (textual, visual, and interactive) affect college students' cognitive load and their ability to retain historical information or concepts.

This study aimed to answer the following questions:

1. What is the level of engagement of college students with the instructional material when grouped according to the following format:
   1.1. textual format;
   1.2. visual format; and
   1.3. interactive format?
2. What is the level of cognitive load experienced by learners when engaging with historical content, considering the following:
   2.1. intrinsic load;
   2.2. extraneous load; and
   2.3. germane load?
3. Is there a significant difference in the level of cognitive load of learners when grouped according to the type of instructional materials used?

Methodology

Research Design

A quantitative comparative design was adopted for this study to assess the effectiveness of different instructional material formats—textual, visual, and interactive on students' cognitive load.

Part II will consist of questions numbered 1-10 for textual formats, and 11-20 for visual formats, and questions numbers 21-30 are intended for interactive formats.

Part III will include questions, 31-35 are for Intrinsic Cognitive Load, 36-40 are for Extraneous Cognitive Load, and numbers 41-50 are for Germane's Cognitive Load questions.

It is only in recent years that attention has been paid to the importance of using various forms of educational materials text, illustration and interactive ones while working with students, especially concerning the study of history in a more comprehensive manner.

Textual formats anchor concepts rather than structure content and evidence indicates that well designed text with some exposition and likely needs context which is required within the interpretation of history (Mayer, 2017). Texts structured as narratives or those structured by summarizing key elements enable learners to form organized mental schemas and, in turn, improve the level achieved by the comprehension and retention of the information (Wiley & Voss, 2016).

Visual formats play a major role in reducing cognitive load by providing spatial representations of information, such as timelines, maps, and charts. Such images help learners to arrange and visualize the order of incidents, thus making it easier to remember and retrieve historical facts (Fleming et al., 2019; Schnotz & Bannert, 2019). Evidence seems to show that infographics or other picture representations are good tools for memory enhancement since they enable students to acquire information without straining their verbal working memory (Plass et al., 2020).

Interactive formats additionally promote learning through soliciting active participation by students. Quizzes, simulations, and even drag-and-drop activities make learners do more than just memorize information since they can manipulate it, get instant feedback, and learn through real experiences (Domagk et al., 2020; Pimmer & Mateescu, 2020). It has been shown through the use of interactive elements that both comprehension and retention can be improved in a large part due to applicability and active learning (Blasco-Arcas et al., 2016; De Vries, 2019). The use of these formats should also be considered as being essential in any instructional design so as to avoid cognitive overload, enhance attention, and improve the retention and recall of complex historical facts or events.

Conversely, research in the last decade has consistently advanced our understanding of cognitive load from instructional materials toward learning outcomes.

Intrinsic cognitive load, or the difficulty of the task in question, ought to be consistent with the schema of the learner to avoid saturation of intellect (Sweller et al., 2019). Learning process and its outcome, including comprehension and memory retrieval, should be presented in a way that does not overload the cognitive efforts of the learner (Chen et al., 2017).

Extraneous cognitive load can be defined as information overload due to the format or presentation of information materials. Elements that are diffused in the instructional design or methods distract learners from the focal point, thereby compromising the effectiveness

of the learning (Kalyuga, 2019; Leppink et al.,2017). Decreasing extraneous load is necessary to enable learners to engage with the content as opposed to the layout of the material being learnt.

Germane cognitive load pertains to the mental effort invested in processing, understanding, and integrating new information into existing knowledge structures. Effective instructional design enhances germane cognitive load by fostering deeper learning processes, such as critical thinking and problem-solving, which are essential for long-term retention and recall (van Merriënboer & Sweller, 2016; Rikers et al., 2020). Understanding these three types of cognitive load is particularly important when evaluating how different instructional material formats influence students' ability to recall historical dates and timelines, as each type of load plays a distinct role in the learning process.

Respondents

The respondents of this study were first-year college students enrolled in the Bachelor of Science in Information Technology (BSIT) program at the University of Science & Technology of Southern Philippines - Jasaan Campus. Participants were informed about the study through announcements made during general education classes. These announcements provided an overview of the study's goals, procedures, inclusion criteria, the voluntary nature of participation, and ethical considerations. Participants had the opportunity to ask questions and, if interested, complete consent forms during these sessions.

The participants were selected due to the inclusion of social studies in their curriculum, which aligns with the study's objective of examining the effects of instructional material formats on cognitive load in the context of social studies education.

A purposive sampling method was used to select participants who have not previously been exposed to the specific instructional materials being tested. Purposive sampling ensured the selection of participants based on specific criteria relevant to the research objectives. According to Douglas (2022), purposive sampling is effective for selecting participants based on defined criteria, such as prior exposure to instructional materials, ensuring credible and trustworthy explanations of the phenomenon being studied. Similarly, Wang (2024) highlights that purposive sampling allows for targeted selection of participants, such as those unexposed to the "Social Studies Instructional Material, Textual-Visual-Interactive Format," thereby enhancing the relevance and applicability of the research findings.

A total of 90 students were chosen to participate, with 30 students assigned to each of the three instructional material formats: textual, visual, and interactive. This sample size is supported by Strunk and Mwavita (2020), who emphasize that a group size of 30 participants is often considered adequate for achieving statistical significance in educational studies. Furthermore, Fraenkel, Wallen, and Hyun (2019) note that this sample size is consistent with established standards for educational research.

Instrument

The research instruments used in this study were researcher-made and were developed specifically to meet the objectives of the study. The study aimed to determine the effects of Social Studies instructional materials in textual, visual, and interactive formats on students' engagement and cognitive load.

The survey questionnaire was researcher-made and served to measure variables such as student engagement and cognitive load across different instructional material formats. It was developed concerning the study's conceptual framework and for the particular context of the research to make it fit and pertinent.

Engagement Measurement. The survey includes items designed to determine students' levels of engagement with each instructional material format. A 5-point Likert scale was used, where responses range from "Strongly Agree" (5) to "Strongly Disagree" (1) to precisely quantify engagement levels.

Cognitive Load Assessment. To assess the three dimensions of cognitive load - Intrinsic Load, Extraneous Load, and Germane Load - specific scales were developed. These dimensions refer to the total mental effort needed for processing instructional materials and the extent to which the materials support constructive learning. A 5-point Likert scale was used, with responses ranging from "Strongly Agree" (5) to "Strongly Disagree" (1).

Instructional Materials. The instructional materials used in this study were researcher-made to ensure consistency in content across all formats. The only variation was the mode of delivery textual, visual, or interactive allowing for a valid comparison of their effects on student engagement and cognitive load.

By incorporating these scoring procedures, the study ensures an objective and systematic analysis of engagement and cognitive load across instructional material formats.

Procedure

The data gathering process for this study was meticulously designed to align with ethical standards and the research protocol, ensuring the rights and privacy of participants while maintaining the integrity of the data collected. The study examines the effects of different instructional material formats (textual, visual, and interactive) on student engagement and cognitive load in Social Studies. The methodology adheres to the recommendations of the Ethics Review Board and institutional requirements.

Before initiating data collection, necessary permissions were obtained from the Dean of the School of Graduate Studies, the Unit Head of General Education, and the Campus Director of the University of Science & Technology of Southern Philippines - Jasaan Campus. These approvals demonstrated transparency regarding the study's objectives, methodology, and ethical safeguards.

Participants in this study were first-year college students enrolled in the Bachelor of Science in Information Technology department at the University of Science & Technology of Southern Philippines - Jasaan Campus. Inclusion criteria required that participants be currently taking or have recently completed a general Social Studies course and provide informed consent before participation. Students who did not provide consent or chose to withdraw at any stage were excluded from the study without any academic consequences. Additionally, students with learning disabilities or conditions that could affect their ability to engage with the instructional materials or surveys were not included.

Recruitment was conducted through general education Social Studies classes. The researcher made announcements inviting students to attend an orientation session where the study's objectives, procedures, and ethical safeguards were explained. Participants were provided with consent forms and given sufficient time to review the materials and ask questions before deciding to participate. This recruitment approach ensured voluntary participation and transparency.

The research instruments were first tested in a pilot study involving 30 students who were not part of the main study. This pilot test was to determine ambiguous survey items, check the reliability of the instruments and adjust the items to make them consistent with the study objectives. The results showed that the instruments were internally consistent and only some minor changes, for example, restating some of the items and the instructions, were made to increase the clarity of the instruments. This step helped to avoid some possible errors during the main data collection and made the instruments valid and reliable.

The participants for the main study were recruited in a way that ensured that participants gave informed consent and took part voluntarily. The consent form explained the purpose of the study, the time it would take (approximately 10-15 minutes) to fill the questionnaire, and guaranteed the anonymity of the study. In this study, autonomy was emphasized by informing respondents that participation was voluntary, and they could withdraw at any time without any consequences. Some concerns that were not generally considered in ethical practices were also addressed by the researcher. The researcher made sure that there would be no effect of the participants' decision to take part in the study on their academic performance, relations with the institution and themselves respectively.

To ensure that the participants did not feel uncomfortable, the survey questions were made to be neutral and less offensive. Furthermore, the researcher ensured that the participants did not feel uncomfortable in any way during the data collection process and even provided them with a soothing atmosphere to enable them to give their true response.

The data collection process was done in a systematic and organized manner using the validated instruments. The researcher distributed the questionnaires to the participants to ensure that they understood the instructions and that they did not have any problems with the survey. The time frame of 10-15 minutes was chosen to avoid over-burdening the respondents and, at the same time, allow for some thoughtful responses.

After the data collection was complete, the researcher made sure that all the data was analyzed while observing the principles of data confidentiality. As required by the Data Privacy Act of 2012, the personal data and survey responses were de-identified, and no other information was kept in the database. The physical survey forms were kept in the office during the analysis and then destroyed, and the digital data was encrypted and saved in a password-protected file. Only the aggregate data were presented in the results, and no individual data were presented in the publications or conference presentations.

Upon completion of data analysis, the manuscript was submitted to the research adviser for review and evaluation. Feedback from the adviser and the research panel was incorporated to refine the study further, enhancing its overall rigor and relevance. The final manuscript underwent plagiarism and grammar checks by the Research and Publication Office before being subjected to final copyediting and approval. This review process ensured that the study met the highest academic and methodological standards.

Overall, this study adhered to rigorous ethical and methodological principles. The research instruments were validated through a pilot study, ensuring reliability. The recruitment process emphasized voluntary participation and informed consent, while data security measures aligned with legal and ethical requirements. By maintaining academic integrity and ethical compliance, the study contributes valuable insights into instructional material formats, enhancing Social Studies education practices.

Data Analysis

This study used both descriptive and inferential statistics to analyze the data collected on the effects of different instructional material formats-textual, visual, and interactive on students' cognitive load. The following statistical techniques were applied to analyze the data:

For participants' engagement levels and cognitive load scores, descriptive statistics such as means, medians, modes, and standard deviations were used to summarize the data for the three groups of instructional material formats. These measures gave a clear picture of the data distribution, and the researcher was able to see the trends and patterns in each group.

Descriptive statistics are very important in quantitative research as they present the results of the study in a form that can easily be

understood. According to Lee and Kim (2022), descriptive statistics give an overall description of the data in terms of location and spread of the data. This is because they give an overall view of the performance and the level of engagement in each of the instructional material formats.

One-Way ANOVA was used to establish whether there were any real differences in cognitive load and engagement between the three instructional material formats. A one-way Analysis of Variance (ANOVA) was conducted. This test was used to compare the group means (textual, visual, and interactive formats) and the within-groups to establish the significance of the instructional material format on cognitive load and engagement. When ANOVA results were significant, post hoc tests such as Tukey's Honest Significant Difference (HSD) were done to compare which groups were different.

The one-way ANOVA is a very popular statistical method for comparing means across three or more categories. It helps researchers to establish whether any observed differences in group means are statistically meaningful while at the same time taking into consideration the within groups variation. Gillard and Gillard (2020) pointed out that ANOVA is perfect for research that focuses on comparing cognitive load scores since it focuses on comparing between and within group.

Results and Discussion

This section presents the findings of the study, focusing on the analysis of student engagement and cognitive load with different instructional materials. The results are organized according to the problems set in Chapter 1.

Problem 1. What is the level of engagement of college students with the instructional material when grouped according to the following format:

1.1 Textual Format;

1.2 Visual Format; and

1.3 Interactive Format?

Table 1 presents the level of engagement of college students with the instructional material using the textual format. As shown in Table 1.1, the level of engagement of college students in instructional materials in Textual Format generally indicates high level of engagement as indicated by the overall mean (M = 3.84) described as Agree. The data suggest that students were found to be generally highly engaged in the instructional material presentation under the Textual Format. This means that college students are generally engaged and focused when learning through textual materials, likely because this format supports clarity, familiarity, and self-paced learning. However, the overall standard deviation (SD = 0.82) indicates variability in student responses, suggesting that while some students engaged highly with the materials, others showed lower levels of engagement.

Table 1.1 *Level of engagement of college students with the instructional material using the Textual Format*

Indicators	*Mean*	*SD*	*Description*	*Interpretation*
1. Text materials help me focus on understanding key historical concepts while maintaining my interest in the topic.	4.13	0.83	Agree	High
2. Reading text summaries helps me organize and comprehend key dates and historical sequences effectively.	4.13	0.78	Agree	High
3. Detailed text explanations make complex historical events easier to analyze and understand.	4.23	0.63	Agree	High
4. Well-organized text materials guide me in following historical timelines and understanding their broader significance.	4.00	0.74	Agree	High
5. Narrative descriptions in the text make historical events relatable and support a deeper understanding of their context.	3.73	0.74	Agree	High
6. Reading text summaries helps me remember important historical events without needing to review the entire material again.	3.86	0.73	Agree	High
7. Text-based materials balance detail and clarity, making it easier to process and understand historical content without feeling overwhelmed.	3.46	0.94	Neutral	Moderately High
8. Written descriptions encourage me to think critically about historical contexts and their broader implications.	3.60	0.86	Agree	High
9. Text-based explanations help me visualize the flow of historical events and their relationships.	3.63	0.99	Agree	High
10. Text materials provide clear and sufficient background information, helping me connect and make sense of different historical events.	3.66	0.96	Agree	High
Overall Mean	3.84	0.82	Agree	High

Legend: 5 (4.50–5.00) – Strongly Agree: Very High | 4 (3.50–4.49) – Agree: High | 3 (2.50–3.49) – Neutral: Moderately High | 2 (1.50–2.49) – Disagree: Low | 1 (1.00–1.49) – Strongly Disagree: Very Low

This variability reflects the diverse learning experiences of students with the textual materials. The table also reveals that respondents exposed to the textual format reported the highest mean (M = 4.23, SD = 0.63) for indicator number 3: "Detailed text explanations make complex historical events easier to analyze and understand." This result supports Cognitive Load Theory (Sweller, 2022), which

posits that structured content can help reduce intrinsic load and enhance schema development.

The data suggests that detailed and well-structured texts improve students' ability to analyze complex historical information, thereby increasing engagement. Positive feedback from respondents suggests that well-organized and sufficiently detailed text explanations are more engaging. The mean score indicates that students felt more motivated by the text material when it helped them navigate abstract content more easily.

This aligns with Yadav's (2023) findings that well-prepared written materials simplify learning while promoting deeper cognitive engagement. Similarly, Schmitt, Witmer, and Rowe (2022) emphasized that clear and coherent text-based materials enhance comprehension and learner motivation in Social Studies. Conversely, the lowest indicator score (M = 3.46, SD = 0.94) was indicator number 7: "Text-based materials balance detail and clarity, making it easier to process and understand historical content without feeling overwhelmed." This suggests that some students found the materials either too dense or insufficiently clear, leading to cognitive overload.

According to CLT, when instructional materials introduce unnecessary complexity or are not well-aligned with the learner's cognitive capacity, extraneous cognitive load can increase, thereby impeding learning (Sweller et al., 2020). This result highlights a key challenge in designing textual materials: balancing depth of content with readability and clarity. These findings are consistent with Schmitt et al. (2022), who emphasized that reading comprehension and instructional text readability significantly influence student engagement and learning outcomes.

The study suggests that while textual materials are valuable, their effectiveness hinges on how well they are designed and organized. Poorly structured texts with excessive detail may hinder rather than support learning by overwhelming students' working memory. In conclusion, while textual materials can support engagement when well-structured, their effectiveness is contingent on clarity, coherence, and cognitive alignment. Instructional designers must strive to strike a balance between depth and simplicity to ensure that students remain engaged without becoming overwhelmed.

Table 1.2 presents the level of engagement among college students when using instructional materials in a visual format. The overall mean engagement score was 4.38, which falls under the "High" category, indicating that students generally found visual materials to be effective for learning. The findings indicate that students were highly engaged with visual materials, suggesting that this format is perceived as an effective tool for supporting their learning. The overall standard deviation (SD = 0.72) suggests some variability in responses, meaning that while many students engaged highly with visual materials, some had differing levels of engagement.

Table 1.2 *Level of engagement of college students with the instructional material using the Visual Format*

Indicators	*Mean*	*SD*	*Description*	*Interpretation*
11. Visual timelines help me understand and organize historical events more effectively.	4.66	0.48	Strongly Agree	Very High
12. Maps and visuals make historical content more engaging by helping me visualize connections between places, people, and events.	4.53	0.57	Strongly Agree	Very High
13. Diagrams and images make important dates and historical events easier to recall.	4.20	0.71	Agree	High
14. Photos and other visual materials make history more interesting and encourage me to explore historical contexts.	4.63	0.61	Strongly Agree	Very High
15. Diagrams help me arrange events chronologically, making it easier to understand their sequence and significance.	4.23	0.77	Agree	High
16. Photos and visual elements make the progression of historical events clearer and help me identify their relationships.	4.43	0.63	Agree	High
17. Visual materials simplify complex historical topics, making them easier to understand and remember.	4.26	0.91	Agree	High
18. Infographics and images assist me in retaining specific details and understanding historical trends.	4.30	0.70	Agree	High
19. Flashcards with images enhance my memory of historical timelines and significant events.	4.22	0.94	Agree	High
20. Visual aids help me connect and relate different historical events within a broader historical context.	4.30	0.84	Agree	High
Overall Mean	4.38	0.72	Agree	High

Legend: 5 (4.50–5.00) – Strongly Agree: Very High | 4 (3.50–4.49) – Agree: High | 3 (2.50–3.49) – Neutral: Moderately High | 2 (1.50–2.49) – Disagree: Low | 1 (1.00–1.49) – Strongly Disagree: Very Low

The respondents exposed to this format reported the highest mean score for Indicator 11, "Visual timelines help me understand and organize historical events more effectively" (M = 4.66, SD = 0.48). This supports Cognitive Load Theory (Sweller, 2020), which posits that structured visual materials reduce the mental effort required to process complex information, allowing learners to focus more on comprehension and retention.

Under CLT, visuals like timelines help reduce intrinsic cognitive load by organizing dense historical data into sequential and

manageable parts. This organization fosters schema-building and deeper understanding two essential components of learner engagement in content-heavy subjects like Social Studies. Sequentially presented visual information has been shown to facilitate the retention of historical details, improve the recognition of event relationships, and strengthen conceptual connections. These results suggest that the development of instructional materials should prioritize clarity, structural coherence, and a systematically organized sequence to maximize student engagement and learning outcomes.

The results are supported by the study of Turkay (2022), which found that students using whiteboard animations reported significantly higher enjoyment and engagement compared to those using on-stage lectures or narrated slides. This indicates a high level of engagement with instructional materials in social science topics.

Moreover, a study by Arif et al. (2023) supports these findings by showing that the Social Sciences Animation Video-Based Teaching Material (S2AV) received a positive response from eighth graders, achieving a 97% engagement rate. This suggests high levels of engagement when instructional materials are presented in a visual format.

Furthermore, the research by Komalasari et al. (2022) highlights that using picture media and projectors significantly enhances student engagement in social studies. These visual formats make learning more enjoyable, broaden students' knowledge, and help maintain their interest, leading to improved learning outcomes.

On the other hand, students obtained the lowest indicator (M = 4.20, SD = 0.71) was recorded for Indicator 13: "Diagrams and images make important dates and historical events easier to recall". The lower engagement with diagrams suggests that while they aid recall, they lack the contextual depth necessary to facilitate deep engagement compared to timelines and photos. Diagrams often present isolated information, requiring students to actively associate and recall details, whereas timelines visually link events in a structured sequence, making them more intuitive and engaging.

According to Dual-Coding Theory, (Sadoski, M., & Paivio, A. 2023), visual learning is most effective when paired with meaningful context. Diagrams, though useful, may lack the contextual cues necessary to facilitate deeper engagement, making them less effective than structured visuals like timelines.

The findings suggest that students engage more with visual materials that provide structured connections rather than standalone images. While diagrams and images are useful for reinforcing recall, they may not be sufficient as primary learning tools without contextual integration. This highlights the importance of enhancing diagrams with supporting narratives or interactive elements to improve engagement.

Furthermore, Chen et al. (2022) found that interactive visual elements, such as annotated timelines, were more effective than static diagrams, as they provided contextual cues that helped students retain and connect information more effectively.

Table 1.3 *Level of engagement of college students with the instructional material using the Interactive Format*

Indicators	*Mean*	*SD*	*Description*	*Interpretation*
21. Virtual reality and role-playing activities help me comprehend historical events by immersing me in the context.	4.06	0.83	Agree	High
22. Role-playing activities improve my understanding of events and timelines by letting me experience them from different perspectives.	4.16	0.83	Agree	High
23. Drag-and-drop timelines support my recall of key historical events by helping me actively organize them.	3.96	0.61	Agree	High
24. Interactive virtual tools allow me to connect different historical periods by visualizing their relationships and transitions.	4.13	0.86	Agree	High
25. Interactive elements, like timelines and maps, make it easier for me to remember dates and events by engaging me in hands-on activities.	4.46	0.63	Agree	High
26. Working with interactive materials increases my interest in learning history and motivates me to explore topics further.	4.16	0.70	Agree	High
27. Interactive activities, like simulations or puzzles, make the sequence of events clearer and easier to understand.	4.06	0.74	Agree	High
28. Games and quizzes reinforce my understanding of historical topics by challenging me to apply what I've learned.	4.20	0.89	Agree	High
29. Interactive quizzes, especially those with immediate feedback, make it easier to remember important events and their significance.	4.26	0.87	Agree	High
30. Using images and visual aids in interactive materials helps me place historical events in the correct context and understand their significance.	4.53	0.63	Strongly Agree	Very High
Overall Mean	4.20	0.76	Agree	High

Legend: 5 (4.50–5.00) – Strongly Agree: Very High | 4 (3.50–4.49) – Agree: High | 3 (2.50–3.49) – Neutral: Moderately High | 2 (1.50–2.49) – Disagree: Low | 1 (1.00–1.49) – Strongly Disagree: Very Low

Table 1.3 shows the level of engagement among college students when using instructional materials in an interactive format. The overall mean (M = 4.20) categorized as "High" indicates that students generally agreed with statements regarding their engagement with instructional materials. Meanwhile, the overall standard deviation (SD = 0.76) indicates that responses varied, with some students engaging more strongly than others. As shown in the table, students exposed to this format reported the highest mean score for Indicator

30, "Using images and visual aids in interactive materials helps me place historical events in the correct context and understand their significance" (M = 4.53, SD = 0.63).

This finding highlights how multimodal interactive content supports contextual understanding by acting as cognitive anchors. Joynt (2024) found that interactive videos not only enhance engagement but also significantly reduce extraneous cognitive load when they follow multimedia learning principles. The exceptionally high rating for this indicator suggests that students find interactive visual aids highly effective in helping them comprehend historical events within a meaningful context.

When images and visual aids are incorporated into interactive learning environments, they serve as cognitive anchors, making it easier for students to relate historical content to real-world contexts. According to Amin and Sundari (2021), combining multimodal inputs in interactive learning reduces the mental effort required to process complex ideas and improves both comprehension and engagement. These results emphasize the value of integrating structured interactivity with visual components. Students were more engaged when materials helped them build context and make meaningful connections. This supports the need for educators to prioritize digital tools that encourage active exploration of content while providing visual support.

The study by Rahmat et al. (2023), supported the findings above on which multimedia-based learning promotes high engagement by fostering enthusiasm, discipline, and active participation. This aligns with the high mean scores observed in this study for interactive quizzes, timelines, and simulations, indicating that students engage more actively when instructional materials require hands-on interaction.

Similarly, these findings are consistent with the study by Izhar et al. (2023), which emphasizes that interactive learning multimedia enhances student engagement by facilitating active knowledge construction, reinforcing the effectiveness interactive and student-centered tools in enhancing engagement in social studies education. These findings highlight that interactive instructional materials incorporating images and visual elements significantly enhance student motivation, understanding, and participation.

On the other hand, students obtained the lowest indicator (M = 3.96, SD = 0.61) was recorded for Indicator 23: "Drag-and-drop timelines support my recall of key historical events by helping me actively organize them." The relatively lower engagement with drag-and-drop timelines suggests that while interactive features can be useful, they may not always provide enough structure for effective learning. In contrast to conventional timelines, which allow students to know what happened and when in sequence, drag-and-drop tasks force students to rehearse that information on their own. Some students may find this difficult too as the task does not give a clear indication of where to start and finish.

The higher cognitive demands of the interactive timelines could be responsible for the lack of engagement as these tasks could be considered too complex or burdensome mentally to interact with. Skulmowski and Rey (2020) reported that poorly scaffolded interactive tools often increase extraneous load, as users struggle to navigate without structured support.

Recent CLT research also emphasizes the importance of adhering to multimedia design principles, such as reducing split-attention and ensuring content segmentation. Ayres and Sweller (2024) found that well-designed microlearning modules incorporating interactive visuals but with clear signaling and chunking significantly improve engagement and reduce cognitive overload

Table 1.4 *Summary of Mean Scores for the Level of Engagement of College Students with the Instructional Materials*

Categories	*Mean*	*SD*	*Description*	*Interpretation*
Textual Format	3.84	0.82	Agree	High
Visual Format	4.38	0.72	Agree	High
Interactive Format	4.20	0.76	Agree	High
Overall Mean	4.14	0.76	Agree	High

Legend: 5 (4.50–5.00) – Strongly Agree: Very High | 4 (3.50–4.49) – Agree: High | 3 (2.50–3.49) – Neutral: Moderately High | 2 (1.50–2.49) – Disagree: Low | 1 (1.00–1.49) – Strongly Disagree: Very Low

Table 1.4 provides a summary of the mean scores for the level of engagement of college students with instructional materials.

As presented in the table, respondents exposed to visual formats achieved the highest mean score (M = 4.38, SD = 0.72), followed by those using interactive formats (M = 4.20, SD = 0.76), and then textual formats (M = 3.84, SD = 0.82). The overall mean (M = 4.14) suggests that students generally agree with having a high level of engagement with the instructional materials. The overall standard deviation (SD = 0.76) indicates that the data are widely dispersed around this mean.

The strong performance of the visual format supports research showing that visual scaffolds such as diagrams, animations, and other multimedia elements enhance student engagement by improving clarity and reducing cognitive strain (Zhao & Liu, 2022). These visual supports are particularly effective in content-heavy subjects where learners must organize complex information efficiently.

Interactive formats also demonstrated high engagement levels. Tools such as simulations, timelines, and interactive quizzes allow learners to actively explore content and receive immediate feedback, which promotes motivation and retention (Troussas et al., 2022).

Additionally, studies have shown that integrating technologies like gamification and augmented reality improves learner immersion

and sustained attention (Lampropoulos, Keramopoulos, & Diamantaras, 2022).

Although the textual format received the lowest engagement score, it remains a valuable component of instruction when well-structured. Clear and coherent textual materials can still support learner autonomy and understanding, especially in blended environments that combine text with other modalities (Chiu, 2021).

These findings suggest that no single format is universally best; rather, engagement is optimized through a balanced combination of formats. Educators are encouraged to design materials that integrate structured text, engaging visuals, and interactive features to address diverse learning needs and support deeper understanding.

Problem 2. What is the level of cognitive load experienced by learners when engaging with historical content, considering the following:

2.1 Intrinsic Load;

2.2 Extraneous Load; and

2.3 Germane Load?

Table 2.1 *Level of cognitive load experienced by learners when engaging with historical content in terms of Intrinsic Load*

Indicators	*Mean*	*SD*	*Description*	*Interpretation*
31. I can follow historical timelines more effectively when the content is clearly presented.	4.30	0.91	Agree	High
32. The materials balance complexity and clarity, making it easier to connect events.	4.01	0.87	Agree	High
33. I find historical concepts easier to learn when the material avoids unnecessary information.	4.02	0.79	Agree	High
34. The materials present historical topics at a level that matches my understanding.	4.00	0.91	Agree	High
35. The clarity of the material makes learning challenging but manageable.	3.92	0.91	Agree	High
Overall Mean	4.05	0.88	Agree	High

Legend: 5 (4.50–5.00) – Strongly Agree: Very High | 4 (3.50–4.49) – Agree: High | 3 (2.50–3.49) – Neutral: Moderately High | 2 (1.50–2.49) – Disagree: Low | 1 (1.00–1.49) – Strongly Disagree: Very Low

Table 2.1 presents the level of cognitive load experienced by learners when engaging with historical content in terms of Intrinsic Load. The overall mean score (M = 4.05, SD = 0.88) indicates that there is a high level of cognitive load of historical content experienced by the students, showing that the learners have moderate difficulties in processing historical content. The overall standard deviation (SD = 0.88) suggests a moderate variability of the students' responses, implying a variance of learners' experiences of cognitive load of historical content.

As shown in the table, students obtained the highest mean (M = 4.30, SD=.91) for indicator number 31 "I can follow historical timelines more effectively when the content is clearly presented" This high mean suggests that students view clearly structured timelines as most effective in reducing their cognitive load by allowing them to process historical events chronologically and coherently. Historical timelines offer a chronological, visual representation of a series of events making it easier for students to understand complex historical content and to follow the sequence of historical events.

The organized and clear presentation of historical timelines considerably decreases cognitive overload. This suggests that students find visual aids that provide a chronological order of information more effective in handling the intrinsic cognitive load of historical content. This aligns with the principles of Cognitive Load Theory, which state that content should be presented in a way that supports working memory by reducing unnecessary processing demands (Kalyuga, Chandler, & Sweller, 2021). The use of structured visuals enables learners to mentally integrate events more efficiently, supporting schema construction and long-term retention.

On the other hand, students obtained the lowest indicator (M = 3.92, SD = 0.91) for indicator number 35 "The clarity of the material makes learning challenging but manageable". This indicator received a relatively lower rating, suggesting that while students find some aspects of historical content challenging, they still consider it manageable. This could imply that the complexity of the material itself is a challenge, but the clarity of presentation helps students handle it effectively.

The slightly lower engagement with this indicator suggests that while students acknowledge the challenge of understanding historical content, they may find some areas of the material to still be overwhelming, even when presented clearly.

This finding indicates that while clarity in instructional materials is crucial, there is still a limit to the cognitive capacity of learners. Historical content with a high level of complexity or interrelated concepts may still cause cognitive overload despite clear presentation, particularly for students who may not have a solid foundational understanding of the topic.

Ayvaz-Tuncel and Demir (2024) also suggest that effective instructional design can mitigate high intrinsic cognitive load by aligning content with students' cognitive capacity. Girard and Arnal (2019) also note that high interactivity between concepts can increase

cognitive load, especially when students are expected to connect multiple events, dates, and contexts simultaneously.

Table 2.2 *Level of cognitive load experienced by learners when engaging with historical content in terms of Extraneous Load*

Indicators	*Mean*	*SD*	*Description*	*Interpretation*
36. The organization of the materials allows me to focus on learning without feeling confused.	4.01	0.81	Agree	High
37. The materials are easy to understand and free from unnecessary distractions.	3.92	0.84	Agree	High
38. The materials do not include irrelevant features that disrupt my learning process.	3.73	0.85	Agree	High
39. The format of the materials helps me stay focused and avoids causing frustration.	3.85	0.91	Agree	High
40. Important points in the materials are highlighted or made clear, making it easy to identify key information.	4.24	0.80	Agree	High
Overall Mean	3.95	0.84	Agree	High

Legend: 5 (4.50–5.00) – Strongly Agree: Very High | 4 (3.50–4.49) – Agree: High | 3 (2.50–3.49) – Neutral: Moderately High | 2 (1.50–2.49) – Disagree: Low | 1 (1.00–1.49) – Strongly Disagree: Very Low

Table 2.2 presents the level of cognitive load experienced by learners when engaging with historical content, specifically in terms of Extraneous Load. The overall mean score (M = 3.95, SD = 0.84) indicates that students generally agree that they experience a high level of extraneous cognitive load when engaging with the instructional materials. The standard deviation suggests considerable variation in student responses, indicating differences in how learners perceive and process extraneous cognitive load.

As shown in the table, students reported the highest mean score (M = 4.24, SD = 0.80) for indicator number 40: "Important points in the materials are highlighted or made clear, making it easy to identify key information." This indicates that signaling and clarity are effective in reducing cognitive strain. Research by Das et al. (2024) shows that visual highlighting directs attention and reduces extraneous load, as learners can more easily focus on salient information. Similarly, Achor et al. (2022) reported that well-organized learning materials especially those without clutter significantly improved students' performance in social studies by lowering cognitive distractions.

On the other hand, the lowest indicator (M = 3.73, SD = 0.85) was recorded for indicator number 38: "The materials do not include irrelevant features that disrupt my learning process". This indicates that students still encounter distracting or unnecessary elements such as extraneous visuals, unclear instructions, or poor formatting requiring additional mental effort to filter out. Skulmowski and Xu (2022) discuss how poorly designed multimedia and split-attention effects in digital learning environments increase extraneous load, hindering learning efficiency.

These findings align with Cognitive Load Theory, which emphasizes the need to remove irrelevant elements and use signaling, coherent layout, and spatial contiguity to optimize comprehension. Surbakti et al. (2024) further support this, showing that instructional materials designed without extraneous features led to lower reported cognitive load and better learner outcomes.

In summary, this data highlights the critical role of clear, distraction-free instruction. While well-signaled content helps reduce cognitive burden, the presence of unnecessary elements still contributes to extraneous load. Educators and instructional designers should audit materials to eliminate irrelevant features, apply CLT principles such as coherence and signaling, and ensure instructional flow supports optimal cognitive processing.

Table 2.3 presents the level of cognitive load experienced by learners when engaging with historical content in terms of Germane Load. The overall mean (M = 4.03, SD = 0.82) indicated that the students agree that a high level of germane cognitive load is being experienced while learning historical content in instructional materials. The high standard deviation implies variability in students' responses, which suggests that different students engaged with historical content in different ways. As shown in the table, students obtained the highest mean (M = 4.13, SD = 0.82) was recorded for indicator number 42 "Well-organized materials encourage me to think about the causes and effects of historical events".

This demonstrates that structured instructional content prompts higher-order thinking and causal reasoning. Instructional Science (Klepsch & Seufert, 2020) confirmed that organized presentations enhance learners' schema-building and comprehension—core aspects of germane cognitive load.

Table 2.3 *Level of cognitive load experienced by learners when engaging with historical content in terms of Germane Load*

Indicators	*Mean*	*SD*	*Description*	*Interpretation*
41. The materials help me connect new historical ideas to what I already know.	4.08	0.83	Agree	High
42. Well-organized materials encourage me to think about the causes and effects of historical events.	4.13	0.82	Agree	High
43. The materials make it easier to understand how historical events are related.	4.11	0.81	Agree	High
44. The materials encourage me to think deeply about and analyze historical events.	3.98	0.83	Agree	High

45. Using the materials motivates me to engage more deeply with history topics.	3.94	0.88	Agree	High
46. The materials make historical events relevant by connecting them to modern issues.	3.88	0.77	Agree	High
47. Logical organization in the material makes it easier to remember important ideas.	4.03	0.83	Agree	High
48. The materials support critical thinking by prompting me to evaluate historical outcomes.	4.06	0.78	Agree	High
49. The materials help me retain key concepts and apply them in new contexts.	4.05	0.84	Agree	High
50. The materials are designed to help me analyze patterns and trends in history.	4.08	0.86	Agree	High
Overall Mean	4.03	0.82	Agree	High

Legend: 5 (4.50–5.00) – Strongly Agree: Very High | 4 (3.50–4.49) – Agree: High | 3 (2.50–3.49) – Neutral: Moderately High | 2 (1.50–2.49) – Disagree: Low | 1 (1.00–1.49) – Strongly Disagree: Very Low

Similarly, the Frontiers in Psychology meta-analysis (2022) highlights that instructional designs minimizing extraneous load and supporting meaningful engagement foster germane processing, leading to stronger learning outcomes.

On the other hand, the lowest indicator (M = 3.88, SD = 0.77) was for indicator number 46: "The materials make historical events relevant by connecting them to modern issues." indicates lower germane load due to insufficient contextual relevance. When learners cannot relate content to contemporary contexts, their motivation to invest effort diminishes. This is consistent with findings reported in Educational Psychology Review (2021), which underscore the importance of context-rich materials for activating meaningful cognitive engagement. The low score suggests that the instructional materials did not adequately help students make connections between historical events and present-day issues. This lack of contextualization may have hindered students from recognizing the relevance of historical events in today's world.

In conclusion, while well-organized materials strongly support germane load by facilitating targeted cognitive processing, the lack of real-world relevance may limit deeper engagement and schema integration. Ensuring historical content connects to present-day contexts can significantly enhance germane cognitive investment and learning effectiveness.

Table 2.4 *Summary of Mean Scores for the Level of Cognitive Load Experienced by Learners When Engaging With Historical Content*

Sub-variables	*Mean*	*SD*	*Description*	*Interpretation*
Intrinsic Load	4.05	0.88	Agree	High
Extraneous Load	3.95	0.84	Agree	High
Germane Load	4.03	0.82	Agree	High
Overall Mean	4.01	0.85	Agree	High

Legend: 5 (4.50–5.00) – Strongly Agree: Very High | 4 (3.50–4.49) – Agree: High | 3 (2.50–3.49) – Neutral: Moderately High | 2 (1.50–2.49) – Disagree: Low | 1 (1.00–1.49) – Strongly Disagree: Very Low

Table 2.4 shows the Summary of Mean Scores on the Level of Cognitive Load experienced by the learners in dealing with historical content. The overall mean (M = 4.01, SD = 0.85) of the data indicates that, on average, the students agreed on having a high level of cognitive load in their engagement with historical content. This implies that although the content was cognitively demanding, it was still manageable within their learning capacity. Meanwhile, the overall standard deviation (SD = 0.85) of the data presents moderate deviation in their responses which means that some students have availed higher cognitive load than the others depending on individual differences in learning strategies and prior knowledge.

As presented in the table, students had the highest mean for Intrinsic Load (M = 4.05, SD = 0.88), followed by Germane load (M = 4.03, SD = 0.82), while the lowest mean score was for the Extraneous Load (M = 3.95, SD = 0.84). The findings of descriptive statistics indicated that the complexity of historical content itself (intrinsic load) was the most demanding element in terms of cognitive processing, whereas the students acknowledged the effectiveness of instructional materials in avoiding irrelevant distractions (extraneous load).

The high mean score for germane load also highlighted the fact that learners actively engage in a deeper and constructive processing of historical content, integrating them into each other and making a critical examination of them. This is consistent with findings by Seufert (2020), who emphasized that instructional coherence and structured guidance help learners manage intrinsic load while promoting germane processing. Her study demonstrated that well-organized content improves learning outcomes by supporting both understanding and integration of complex material. Moreover, Achor, Zaria, and Achor (2022) argued that instructional materials that reduce unnecessary cognitive demands can enhance both performance and learner engagement. In their study on social studies instruction, clear organization and focused content helped learners maintain attention and better comprehend key concepts.

However, while effective design plays a critical role, Greenberg and Zheng (2022) highlight that working memory capacity also significantly affects how learners experience and manage cognitive load. Their findings suggest that even when instructional materials are optimized, students with limited cognitive resources may still face challenges in processing dense content. This underscores the need to align instructional strategies not only with cognitive load principles but also with learner capacity.

In summary, the instructional materials used were largely successful in facilitating historical learning by balancing cognitive demands.

Nonetheless, ongoing efforts to align content structure, learner support, and working memory considerations are necessary to further enhance engagement and retention.

Problem 3. Is there a significant difference in the level of cognitive load of learners when grouped according to the type of instructional material used?

Table 3.1 presents the results of One-Way ANOVA analysis to determine the mean difference in the level of cognitive load of learners based on the type of instructional material used. The results show that there is a significant difference ($p < 0.05$) in the mean scores of intrinsic load, extraneous load, germane load, and overall cognitive load among the students who learned from different instructional formats. As can be seen in the table, students exposed in the visual format had the highest intrinsic load mean (M = 4.47, SD = 0.41), highest extraneous load mean (M = 4.34, SD = 0.38), highest germane load mean (M = 4.42, SD = 0.38), and overall cognitive load mean (M = 4.41, SD = 0.33).

Table 3.1 *Results of One-Way Anova Analysis for the Significant Difference in the Level of Cognitive Load of Learners When Grouped According to the Type of Instructional Material Used*

Variables		*N*	*Mean*	*SD*	*F*	*P*	*Interpretation*
Intrinsic Load	Textual Format	30	3.40	0.69	30.01	0.00	Significant
	Visual Format	30	4.47	0.41			
	Interactive Format	30	4.27	0.56			
Extraneous Load	Textual Format	30	3.42	0.59	24.89	0.00	Significant
	Visual Format	30	4.34	0.38			
	Interactive Format	30	4.09	0.56			
Germane Load	Textual Format	30	3.53	0.56	23.04	0.00	Significant
	Visual Format	30	4.42	0.43			
	Interactive Format	30	4.16	0.56			
Over-all Cognitive Load	Textual Format	30	3.45	0.55	34.68	0.00	Significant
	Visual Format	30	4.41	0.33			
	Interactive Format	30	4.17	0.48			

These results show that the type of instructional material used has a significant effect on the level of cognitive load experienced by students, with visual formats leading to the highest levels of intrinsic, extraneous, and germane load. The higher cognitive load in visual formats suggests that while they effectively enhance learning and engagement, they may also introduce additional cognitive demands due to their complexity. Further post-hoc analysis is needed to determine the exact nature of these differences and whether visual formats are more or less beneficial for cognition than other formats. As shown in the table, students got the highest intrinsic load mean (M = 4.47, SD = 0.41) was recorded for students using visual instructional formats, which means that learners considered visual materials as more complex than textual or interactive ones. This is most likely because visual formats incorporate different forms of information such as images, diagrams, animations, and text, thus demanding the learner to process several elements at the same time. The high intrinsic load in the visual format may be attributed to the increased mental effort required to integrate multiple types of information such as timelines, images, and diagrams when learning complex content like historical events. According to Sweller (2021), intrinsic cognitive load reflects the inherent difficulty of the material relative to the learner's prior knowledge. In this context, visual materials often present interconnected historical information, which demands deeper cognitive processing.

Supporting this interpretation, Shi, Zhang, Yang, and Yang (2020) found through a meta-analysis that the use of interactive whiteboard-based instruction significantly improves cognitive learning outcomes. Their findings highlight that well-integrated multimedia can enhance understanding and engagement, though they also caution against overloading learners with excessive or poorly coordinated elements.

The high extraneous load reported in the visual format group suggests that not all visual materials were optimally designed. Learners may have experienced distractions or confusion from visual complexity or disorganized layouts. Zhang, de Koning, and Paas (2024) emphasize that split-attention when related visual and verbal elements are separated can elevate extraneous cognitive load, reducing learning efficiency. Instructional materials must therefore ensure spatial contiguity and visual coherence to avoid overwhelming students. Likewise, Greenberg and Zheng (2022) point out that poorly structured or overloaded content impairs working memory efficiency, even when the material is engaging. Their study underscores the importance of minimizing irrelevant or excessive information to manage extraneous load effectively. Lastly, the high germane load scores indicate that students were cognitively engaged in processing, interpreting, and making meaningful connections from the content. Mayer (2021) argues that well-structured multimedia content fosters deeper learning through schema construction and critical thinking. When learners are supported with relevant, organized visuals, they are more likely to engage in meaningful reflection and application.

In summary, the significant differences in cognitive load across instructional formats confirm that the type and design of instructional materials significantly impact how learners process historical content. While visual formats promote engagement and deep learning, they also risk introducing excessive cognitive load if not designed with clarity and integration. Educators should aim for a careful

balance leveraging the strengths of visual materials while minimizing distractions to support optimal learning outcomes.

Table 3.2 *Results of Post Hoc Tests for One-Way ANOVA Analysis for the significant difference in the level of cognitive load of learners when grouped according to the type of instructional material used*

Dependent Variable	*(I) Group*	*(J) Group*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*
Intrinsic Load	Textual Format	Visual Format	-1.06667(*)	.14636	.000
		Interactive Format	-.86667(*)	.14636	.000
	Visual Format	Textual Format	1.06667(*)	.14636	.000
		Interactive Format	.20000	.14636	.363
Extraneous Load	Textual Format	Visual Format	-.91333(*)	.13393	.000
		Interactive Format	-.66667(*)	.13393	.000
	Visual Format	Textual Format	.91333(*)	.13393	.000
		Interactive Format	.24667	.13393	.162
Germane Load	Textual Format	Visual Format	-.88333(*)	.13387	.000
		Interactive Format	-.62667(*)	.13387	.000
	Visual Format	Textual Format	.88333(*)	.13387	.000
		Interactive Format	.25667	.13387	.140
Overall Cognitive Load	Textual Format	Visual Format	-.95444(*)	.11944	.000
		Interactive Format	-.72000(*)	.11944	.000
	Visual Format	Textual Format	.95444(*)	.11944	.000
		Interactive Format	.23444	.11944	.128

Table 3.2 presents the outcome of Post Hoc Tests for One-Way ANOVA analysis of the level of cognitive load of learners as a function of type of instructional material used. The results show that there are significant differences ($p < 0.05$) in intrinsic load, extraneous load, germane load, and total load between the students who learned from the textual format and those who learned from the visual and interactive format. However, no significance difference was found between the visual and interactive formats, which indicates that these two formats pose about the same cognitive load on the learner. These findings show that textual instructional formats always lead to lower cognitive load than visual and interactive formats. This means that while the use of visual and interactive elements can increase motivation, they may overload the cognitive system if not applied appropriately.

The highest intrinsic load in the visual group suggests that learners processed more complex, multimodal information requiring additional mental effort. Sweller (2021) explains that intrinsic load reflects the inherent difficulty of the content in relation to learners' background knowledge. Visual formats, which integrate images and animations, naturally increase processing demands but can encourage schema development if thoughtfully designed.

A meta-analysis by Festiyed, Daulay, and Ridhatullah (2023) confirms this trend, reporting that well-structured interactive multimedia such as whiteboards and simulations enhance learners' cognitive engagement and schema building, although effectiveness hinges on coherent integration of content.

In contrast, a high extraneous load in the visual format indicates that learners may have been distracted by unnecessary or poorly designed visuals. Zhang, de Koning, and Paas (2024) found that split-attention caused by disconnected visual-text elements can elevate cognitive load, reducing comprehension efficiency. This supports the need for spatially integrated designs to minimize processing disruptions.

Greenberg and Zheng (2022) further emphasize that ineffective instructional design, including cluttered visuals, burdens working memory and impairs learning. Therefore, managing extraneous load is crucial, even in engaging format designs.

The lower extraneous load in textual formats ($M = 3.84$, $SD = 0.74$) indicates less distraction. Achor et al. (2022) argue that organized text-based materials allow learners to focus more on essential content, conserving cognitive resources for deeper processing. Greenberg and Zheng (2022) reinforce that streamlined instructional design enhances learning efficiency by minimizing unnecessary cognitive demand.

In conclusion, while visual and interactive formats offer potential for deeper cognitive engagement, designers must carefully apply cognitive load theory principles. Visual ease must be balanced with clarity, coherence, and contextual integration. Given that visual and interactive formats showed no significant difference, designers can focus on other affordances like learner control, feedback, and relevance to enhance learning outcomes.

Conclusions

Based on the findings revealed in the study, the following conclusions are made:

The study compared the levels of engagement and cognitive load that college students have when using social studies instructional materials in the textual, visual and interactive modes. The findings of the study presented in this chapter give important insights into the effects of the format of the materials on students' engagement and cognitive load and the implications for the practice of instructional design in social studies education.

Visual formats were seen as the most interesting to the students, and the highly rated tools included visual timelines that helped students arrange and understand historical events better. However, on the one hand, the engagement rate was high, and the materials were accompanied by high cognitive load, especially related to the intrinsic and extraneous load. This means that although visuals can engage students and help them learn complex concepts, they need to be used properly to avoid overwhelming students with information or other distractions.

The level of complexity resulting from the use of various visual elements such as images, diagrams, and animations requires proper planning to ensure that they are used effectively for learning without overwhelming the learner.

Both visual and interactive formats that integrated multimedia components like quizzes and simulations also enhanced students' engagement. Students were most engaged with the interactive elements that used images and other visual aids to situate historical events in their context.

These formats assisted students in actively engaging with the content of the course, which helped to reinforce their learning and memory of historical concepts. However, some examples of interactive elements, such as drag and drop timelines, led to low engagement because some interactive tasks are complex and are made more complex if they are not well designed or scaffolded appropriately.

In general, the textual formats engaged students the least of all three formats, but they still helped to engage students in a meaningful way. When the textual materials were well-organized and offered detailed explanations, students deemed them useful for learning about complicated historical events. Nevertheless, matters such as balance in detail and clarity sometimes lead to cognitive overload in the case of extraneous load. This study found that the organization of text-based content is critical to keeping complexity and ambiguity in check, which in turn has implications for student engagement and cognitive load.

In terms of cognitive load, visual formats always yielded the highest intrinsic, extraneous, and germane load scores. Although this shows that the use of visuals can engage students in deeper cognitive work, it also shows that it is necessary to consider the principles of designing meaningful learning tasks to avoid an overwhelming amount of challenge. By way of comparison, textual formats proved to be less demanding in terms of extraneous load, which means that they are a less complicated way of delivering information to the student without many distractions.

Interactive formats appeared to follow the same pattern, with high levels of intrinsic and germane load, which indicates that these materials can indeed challenge learners to think more deeply, but only if they are developed so as not to overwhelm them cognitively.

In the end, this study recommends the use of combined textual, visual, and interactive materials to enhance students' engagement and cognitive load in social studies education. The balanced approach proposed here should help to address the learning styles of different students and provide them with a more meaningful and productive learning experience.

Teachers are therefore challenged to include these formats intentionally and design their instructional materials to not only capture students' attention but also reduce their cognitive load. This comprehensive approach will not only increase learning but also increase student learning retention and performance because it takes into consideration the cognitive demands and engagement that are associated with the different formats.

Based on the findings and conclusions of the study, the following recommendations are made to improve instructional design and enhance student learning outcomes.

School administrators. They may prioritize the integration of well-designed visual and interactive instructional materials to enhance student engagement, while ensuring these resources are structured to avoid cognitive overload.

Educators. It is recommended that educators prioritize the integration of visual instructional materials in their teaching practices. The study indicates that visual formats significantly increase student engagement compared to interactive and textual materials, making them an effective tool for capturing and sustaining learners' attention.

Students. Students are encouraged to utilize a variety of learning formats, but be mindful of managing their cognitive effort by actively seeking clarity and simplifying complex visuals.

Future researchers should explore how to optimize the design of visual materials to balance cognitive demand with educational effectiveness, potentially incorporating adaptive technologies that personalize content complexity based on learner needs.

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