Journal of Informatics and Web Engineering
Vol. 1 No. 1 (March 2022) eISSN: 2821-370X

The Impacts of the use of Thematic & Chronologic Multi-modal Information Representation on Sequential and Global Learners' Historical Understanding

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Abstract - The purpose of this study was to assess the effects of multimodal information presentation on sequential and global learners' historical understanding: theme and chronological. There were 134 secondary school learners enrolled (69 learning in chronological mode, 65 learning in thematic mode). Prior to the start of the treatment session, learners took a pre-test. The findings indicated that multimodal information presentation had no distinct effect on historical understanding between learners who learn chronologically and those who learn thematically. It was claimed that the chronological frame of reference technique, which resembled an interactive timeline, aided learners' sequential learning in chronological mode. On the other hand, learners who learnt in a theme method made bigger increases in historical understanding than learners who learned in a chronological mode. Learners who demonstrated a significant difference in their assessment of historical understanding demonstrated the efficacy of multimedia information presentation in the acquisition of abstract historical concepts.

Keywords— Thematic Instructional Design; Chronologic Instructional Design; Quasi-Experimental Study; Historical Understanding.

Received: 03 December 2021; Accepted: 10 February 2022; Published: 16 March 2022

I. INTRODUCTION

The ability of learners to recognize and solve problems analytically and rationally through critical thinking and problem solving is regarded as a important skill in the twenty-first-century knowledge society. The National Education Blueprint (2013-2025) vision of critical thinking is being used to promote the development of new learning environments in Malaysian educational institutions in efforts to support learners acquire their higher-order thinking skills (HOTs).

Journal of Informatics and Web Engineering
https://doi.org/10.33093/jiwe.2022.1.1.4

Published by MMU Press. URL: https://journals.mmupress.com/jiwe

Learners must be prepared to develop critical thinking skills and knowledge in order to adapt to an ever-changing environment [1,2]. It becomes increasingly difficult for instructors and learners to provide high-quality learning experiences and increased retention rates [3]. Educators face a challenge when it comes to offering more complex and dynamic blended learning options than traditional face-to-face courses while maintaining a high standard of instruction. Learners must apply empathy, historical thinking, reasoning, and analytical abilities to analyse the intricacies of ideas and concepts when studying history. Historical thinking is a subset of critical thinking that entails the application of critical thinking principles and elements to the construction of historical understandings [4, 5]. It is critical to ascertain learners' historical understanding so that educators may comprehend their learners' understanding of a historical issue.

The purpose of this study is to examine the impact of various teaching techniques (thematic and chronological) on learners' historical understanding. The following are the sub-objectives:

1. To compare the effects of chronologic versus theme instructional design on sequential and global learners' historical understanding.
2. To compare the gains in historical understanding scores between the pre- and post-tests for learners who learn in these two ways.

II. RESEARCH QUESTIONS

This study aimed to answer the following questions:

1. Is there a significant difference in historical understanding between learners who learn chronologically and those who learn thematically?
2. Do sequential and global learners learning in the chronological mode have significantly different post-test scores for historical understanding?
3. Do sequential and global learners learning in the thematic mode have significantly different post-test scores for historical understanding?
4. Do global learners learning in chronological mode and those learning in thematic mode have significantly different post-test results for historical understanding?
5. Do sequential learners learning chronologically and thematically have significantly different post-test results for historical understanding?

III. RESEARCH HYPOTHESES

Below are the hypotheses of this study:

$H_0 1$	Learners who learn chronologically and those who learn thematically do not differ much in their historical understanding.
$H_0 2$	Historical understanding post-test results do not differ significantly between sequential and global learners that learning in chronologic modes.
$H_0 3$	Historical understanding post-test results do not differ significantly between sequential and global learners learning in thematic modes.
$H_0 4$	Between sequential learners studying in chronological mode and sequential learners studying in thematic mode, there is no statistically significant difference in the mean post-test score of historical understanding.
$H_0 5$	The mean historical understanding post-test scores of global learners learning in chronological and thematic modalities are not significantly different.

IV. LITERATURE REVIEW

A. The Strategies applied in Thematic Information Representation

The use of theme-based unit-based learning that is tailored to the learning styles and preferences of learners can help to improve critical thinking, cultural literacy, and technical literacy. It can also help learners grasp history in a broader context by boosting conceptual knowledge [6], allowing for self-directed learning [7], and strengthening critical

thinking [8, 9]. When properly organized, themed training can help learners develop their critical thinking and Socratic questioning skills [10].

[6] implemented a theme-based approach to teaching children about China's history. To investigate specific themes, they performed self-study research with 27 freshman high school learners in a classroom setting. They employed a mixed-method approach, gathering and evaluating student viewpoints as well as a pre-test for the unit evaluation. Learners fared better in terms of knowing the Chinese dynasty's larger context, according to the data. Learners were able to relate history knowledge to a broader context and enhanced their conceptual grasp after participating in thematic courses, they discovered. The kids grasped the historical lessons and were able to apply what they had studied to future occurrences. Their findings proved the value of a theme-based approach to history education. Their study showed the potential benefits of a thematic approach to history learning in terms of understanding, but it didn't show how it would improve learners' historical thinking, which involves both understanding and analytical reasoning. Furthermore, the sample size of their study was tiny, and the findings cannot be applied to the full population.

[11] investigated the effect of thematic education on inspiring and engaging culturally and linguistically diverse learners in self-directed learning in an empirical study. Curriculums that incorporate themes and threads, he pointed out, create a link for instruction and evaluation with the implementation of different bits of intelligence. To strengthen other intelligence, he chose visual, auditory, and bodily/kinesthetic intelligence based on the learners' preferences. Learners benefited from thematic integrated instructional content because it enabled them to interact in self-directed implementation what they had learned, according to the findings.

Thematic instruction focuses all or part of the training on a single topic, allowing for a more in-depth exploration of that topic. The learning process may be hampered by an information overload. Furthermore, learners frequently have difficulty connecting historical events. Furthermore, learners frequently have difficulty connecting historical events. Furthermore, when studying history, learners frequently struggle to connect historical events due to the discontinuity of events and persons. As a result, Kris's study's use of integrated theme training and themed instruction employing a range of approaches may help to resolve this problem [12 – 15]. According to the findings, multimodal thematic training can benefit learners with historical thinking as well as higher-order thinking.

Numerous research has demonstrated that integrating multimodal representations improves learning outcomes when concept maps or semantic/schematic information representation are used [16, 17]. When learners learn using a concept map, they mentally construct the mental representation. They connect the notion to other substantive concepts and show how the concepts relate to one another in order to comprehend historical happenings [18]. Additionally, when multimedia elements are used, it has been demonstrated that adding motion to a concept map improves learning in comparison research with static concept maps [19]. Additionally, it has been demonstrated that including multimedia components into concept maps benefits learners' learning experiences in Business Law [20]. However, the majority of learners did not complete the exercises because they were too time consuming and difficult. The integration of concept maps with multimedia elements is important to build a new approach for ensuring that all learners have a positive learning experience.

The thematic framework of education integrates concepts, ideas, themes, subthemes, and difficulties to create a vast interconnected structure or "big picture." To strengthen brain-seeking patterns, it is necessary to immerse them in a rich context of imagery, emotion, and motion pictures [21]. The history lessons are topically organised and illustrated with suitable interactive multimedia to help learners connect concepts and ideas. [22] demonstrated that secondary learners who were taught history using the concept map effectively grasped the historical idea of knowledge. Additionally, learners' historical understanding increased significantly after using the concept map to learn history.

B. The Strategies and Approach used in Chronologic Information Representation

Several research used a variety of strategies to contextualize historical events using the information representation structure. [23] used interactive multimedia (IMM), [24] used diverse frames of reference, and diverse frames of reference [25-28]. According to research, causal-effect explanations, which are a series of frames depicting the major steps in a process, can help students achieve higher levels of achievement in history [24, 29] and a better understanding of the concept of time or chronology [24, 30, 29] and a better understanding of the [23].

[27] studied how several forms of co-constructed representations (textual, multimodal, and integrated multimodal) influenced the establishment of a chronologic-conceptual frame of reference during history learning. According to the

findings, multimodal representations integrated into a timeline give greater short-term memory effects than textual representations co-constructed. The usefulness of the chronologic frame of reference in boosting learners' historical conceptual and chronologic understanding through visual presentation was studied by [23] and [25].

According to [25], one of the actions that elicit historical thinking is the interpretation of historical occurrences. Inquiry-based learning and constructivism as a learning philosophy, they claimed, are inexorably intertwined. [31] corroborated this in their suggested framework for historical reasoning by emphasizing the interrelated activities of study, application of the historical idea, and argumentation when invoking historical reasoning. [32] recommended employing cooperative tactics to solve complicated reasoning tasks and offered a detailed explanation of how historical reasoning activities are constructed and how these collaborative activities interact to build learners' historical reasoning. They promoted the use of selective attention tactics like as focusing on keywords and identifying significant concepts and details, as well as the use of imagery and graphic organizers to visualize the links between ideas.

By co-constructing multimodal information representations in the timeline and textual representation, [33] contrasted the learning results and method of history learning. In contrast to previous research that focused solely on presented multimodal representations and individual settings, he emphasized constructivist learning by creating constructed multimodal representations and collaborative settings by integrating multimodal representations of the timeline using chronologic frames of reference based on dual coding theory and the Cognitive Theory of Multimedia Learning (CTML). [33] emphasized collaborative situations in where students were permitted to use visual representations like as arrows, flow charts, and labels to develop their own understanding of depiction. A chronology, a storyboard, causal maps (network charts), a description of a historical picture (structure diagram), and a cartogram were all needed of the students. Integrated multimodal representation, according to the findings, fosters discussion and leads to superior learning outcomes. Finally, learning results are favorably correlated with a schematic multimodal representation that contains visuals and more domain-specific ideas. A timeline, as well as graphical renderings of historical processes, were employed in this study as a result of these principles of merging multimodal information representation with visual representation.

The recommended approach for transferring historical information is through chronologic frames of reference that indicate the periodization of events, according to a detailed review of the benefits of multimedia information representation and prior research. It has been demonstrated that the temporal representation of timelines and the graphic representation of historical information in coherent chronologic ways can help learners improve their chronologic understanding when used in conjunction with collaborative strategies that engage their higher-order thinking skills. Learners with chronological understanding will have created a mental image of their episodic learning recall. Learners can become more involved in studying history as a sequence of events when it is given in narrative and visual formats by displaying events on timelines. It is possible to explore how to understand and evaluate chronologic frames of reference, including how to utilize timelines and visual representations to describe temporal concepts and events that happened throughout periodization. Time and chronology framework is well-suited for scaffolding and supporting the reasoning process as a temporal frame of reference [33]. Rather than focusing solely on the pictorial or schematic data, the researcher uses a chronologic frame of reference that includes biographical events (e.g., time conversion, periods, and significant events) as well as abstract visualizations (e.g., causal diagram, flow map, and arrow) that depict the causal effect, progression, change, and continuity of historical phenomena.

C. Sequential Learners and Global Learners in History Learning

Sequential learners benefit from a step-by-step and chronological approach to learning. Sequential learners organise their knowledge in a linear or chronological fashion [34]. Nevertheless, some kids are global thinkers but are unable to think sequentially [35]. They prefer to begin with the big picture or holistic perspective. Instructions that do not give the big picture of how topics and underlying subthemes are covered may hinder the global learner's learning process. Global learners approach learning holistically and make significant jumps in their education [36]. As a result of this, we hypothesized that sequential learners do better when they learn in chronological order in this study.

In history lessons, sequential learners benefit from having materials presented chronologically, as this aids in the development of learners' chronologic historical reasoning. Traditionally structured learning information is typically

organized around dates and times, and learners are expected to memorize these events without understanding their relationships. Nonetheless, understanding the causal and effect relationships between time and historical events should be an integral element of history education [25, 18, 37, 38]. As a result, it is considered that sequential learners do better than global learners when things are presented in a chronological and logical order that highlights event dates and occurrences.

[39] discovered that sequential learners scored much higher on historical understanding than other types of learners. By providing a global viewpoint, global learners' performance can be enhanced. On the other hand, the majority of the elements in the history curriculum are organized sequentially. This may make abstract concepts more difficult to grasp for global learners. As a result, the debate over whether thematic or chronological representation of information is preferable for global learners is critical.

V. RESEARCH METHODOLOGY

The independent variables included multimedia information presentation and two distinct treatment modalities (chronological and thematic). The findings of the essay about learners' historical understanding and reasoning were the dependent variables. Learning style was the moderator variable (global and sequential). To analyze the research data, descriptive and inferential statistics were used. A 2X2 factorial design and a pre- and post-test are used in this quasi-experimental study. Using one-way analysis of variance, the means of the independent groups, which are the multimodal modes, were compared (ANOVA). Using two-way analysis of variance, the effect of two predictor factors on a continuous outcome variable was investigated (ANOVA). The research design notation is depicted in Figure 1.

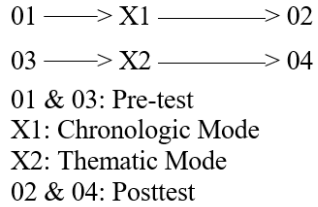

Figure 1. Research Design Notation

The treatment condition was included to examine if the findings could be distinguished. Both treatments were evaluated in two different ways: thematically using concept maps and chronologically using timelines with chronological reference frames. The treatments were tested in the same peer learning environment, for the same amount of time, and with the same multimedia content, but with different learning content or knowledge structure organization.

A pre-test was administered to the experimental groups for the two dependent variables. The treatments were administered to the experimental groups because they were related to a subject that had an effect on the experiment's method. The pre- and post-test experiment allows the researcher to document the participants' historical understanding prior to the treatments and compare the original results to the results following the experimental adjustments. We conducted a pre-test to determine the effect of attrition on the study's outcomes. To account for non-return essay questions and absence, each treatment group recruited approximately 65 to 70 individuals. Pre- and post-testing were conducted on the same learners.

The independent variables were multimedia information presentation with two distinct treatment modalities (chronological and thematic). The dependent variables were the essay's findings regarding learners' historical understanding and reasoning. The moderator variable was learning style (global and sequential).

The descriptive and inferential statistics were utilized to analyze the research data. In this inquiry, the analysis of variance was used as an inferential statistic (ANOVA). This analysis employed a quasi-experimental design with a pre- and post-test and a 2X2 factorial design.

The treatment condition was included to ascertain the validity of the findings. Both treatments were evaluated in two distinct ways: thematically through the use of idea maps and historically via the use of timelines with chronological

reference frames. The treatments were evaluated in the same peer learning setting, over the same time period, and with the same multimedia content, but with varying learning content or knowledge structure organization.

A. Population & Sample Size Determination

In Kedah, the SPM test was taken by 27,986 learners from 155 SMK Kebangsaan secondary schools in 2015. History is a subject that all secondary school learners must learn in preparation for the SPM examination. The school and population were chosen based on a range of factors, including the school's geographic location, national school affiliation, and computer and Internet accessibility. This investigation used a purposive sampling technique.

30 individuals per group is the bare minimum need for reliable results and the establishment of a relationship between existence and non-existence [40]. At a significance level of 0.05 and a power of.80, and an effect size of 0.50 on average, the sample size per experimental group should be 60 learners [41]. As a result, a sample size of at least 120 learners is necessary. 134 learners from Kedah's Form Four secondary schools were chosen to participate in this study.

69 children were picked from each of School A's two intact classrooms, while 65 learners were chosen from each of School B's two intact classrooms. They consist of 36 sequential learners and 33 global learners. In each of these samples, learners were divided into 17 groups of three or four learners. The group is alphabetically arranged, beginning with group A and ending with group Q. Groups A–I are comprised of 36 sequential learners who acquire knowledge in a chronological order. Group J to Q consists of 33 international learners who are learning using a theme approach.

Prior to the start of the treatment session, learners completed a pre-test study during the first week of training. To measure their reasoning ability, they were given four history essay questions to respond. Additionally, learners were assessed using the Index of Learning Styles (ILS) and were classified as sequential or global learners.

B. Research Instruments

In this study, the learners' historical understanding and reasoning, as well as their learning styles, were assessed using three major instruments. The learners' global or sequential learning styles were assessed using the Index of Learning Styles (ILS) questionnaire. Learners' historical understanding was assessed using the SOLO taxonomy evaluation (historical understanding assessment). Table 1 shows the resources, validation, and reliability of the instruments.

Table 1. Research Instruments Sources, Validation and Reliability Testing Methods

Instruments	**Validation**	**Reliability Testing**	**Sources**
Index of Learning Styles	Validated	Cronbach's alpha value = 0.73 (acceptable)	Felder and Soloman's (1997)
Historical Understanding Assessment	Validated	Cohen's kappa coefficient (κ value) for pre-test is .698 (acceptable); while for post-test is .662	SOLO Taxonomy (Biggs, J. & Collis, K.,1982).

A. Descriptive Analysis

Table 2 shows the mean post-test score, sample frequency distribution, and standard deviation for the two types of multimedia information display, as well as the learning methods used to assess learners' historical understanding. In general, the sequential learner's post-test mean score for historical understanding, M = 77.78, was somewhat (non-significantly) higher than the global learner's, M = 75.81. The chronologic mode's mean post-test score, M = 76.81, was somewhat lower than the thematic mode's mean post-test score, M = 76.92. Following treatment, both sequential and global learners achieved the maximum level of historical understanding (mean scores >76 percent), referred to as extended abstract. This indicates that the learners were able to expand the facts and concepts by generalizing the underlying ideas and applying these concepts to new material through the use of the relationships between the facts and concepts' numerous components.

Sequential learners got a higher post-test mean score for historical understanding (M = 80.07) than global learners (M = 73.05) in the chronologic mode. Sequential learners got a higher post-test mean score (M = 78.75) than global learners (M = 76.92) in terms of thematic mode. In comparison to global learners who achieve the SOLO level of relational thinking (M = 73.05), sequential learners exposed to chronologic modes achieved a higher SOLO level of extended abstract thinking (M = 80.07). Post-test mean scores for sequential learners exposed to chronologic mode were higher, M = 80.07 (extended abstract level), than for sequential learners exposed to thematic mode, M = 75.36. (relational level). In comparison, global learners who were taught chronologically had a lower mean post-test score for historical understanding, M = 73.05 (relational level), than global learners who were taught thematically, M = 78.75 (relational level) (extended abstract level).

Table 2. Mean Score of Post-test, Frequency Distribution and Standard Deviation for Modes with Learning Styles for Learners' Historical Understanding

Modes	Learning Styles	*M*	*SD*	*N*
Chronologic	Sequential	80.07	18.566	37
	Global	73.05	19.471	32
	Total	76.81	19.177	69
Thematic	Sequential	75.36	20.107	35
	Global	78.75	23.649	30
	Total	76.92	21.705	65
Overall	Sequential	77.78	19.339	72
	Global	75.81	21.606	62
	Total	76.87	20.365	134

B. Inferential Analysis

H01: Learners who learn chronologically and those who learn thematically do not differ much in their historical understanding.

The ANOVA test revealed no statistical significance (i.e., p = 0.975, which equals 0.05) for the mean of historical understanding across learners taught chronologically and thematically (see Table 3). The mean score for learners who were taught chronologically (M = 76.81; SD = 19.18) is greater than the mean score for learners who were taught thematically (M = 76.92; SD = 21.70) (see Table 2). This demonstrates that the first hypothesis cannot be rejected.

Table 3. One-Way ANOVA for Post-test Score

	Sum of Squares	df	Mean Square	F-value	*p*
Between Groups	.416	1	.416	.001	.975
Within Groups	55158.166	132	417.865		
Overall	55158.582	133			

H02: Historical understanding post-test results do not differ significantly between sequential and global learners that learning in chronologic modes.

Table 4 illustrates the two-way ANOVA for the mean posttest score by mode and learning style. There was no significant difference between modes and learning styles (p = 0.889 for modes; p = 0.609 for learning styles) (p = 0.889 for modes; p = 0.609 for learning styles).

Table 4. Two-Way ANOVA for Post-test Mean Score for Historical Understanding According to Mode and Learning Styles

Source	Type III Sum of Squares	df	Mean Square	F-value	*p*	Partial Eta Squared
Corrected Model	1032.161[a]	3	344.054	0.826	0.482	0.0187
Intercept	785352.784	1	785352.784	1886.248	0.000	0.936
MODES	8.200	1	8.200	0.020	0.889	0.000151
STYLES	109.511	1	109.511	0.263	0.609	0.002
MODES * STYLES	902.317	1	902.317	2.167	0.143	0.0164
Error	54126.421	130	416.357			
Total	846875.000	134				
Corrected Total	55158.582	133				

The main effect of learning styles is presented in Table 4, with F (1,130) = 0.263, mean square = 109.511, p = 0.609, and partial 2= 0.002019 suggesting that there was no significant difference in posttest mean between sequential and global learners exposed to the chronological mode (p = 0.05).

As demonstrated in Table 2, the mean score on the posttest for historical understanding was greater for learners who were sequential learners (M = 80.07; SD = 18.57) than for global learners (M = 73.05; SD = 19.47). The connection between learning styles and mean posttest score (partial 2=0.00202) had a small or negligible effect size. As a result, hypothesis two cannot be rejected.

H03: Historical understanding post-test results do not differ significantly between sequential and global learners learning in thematic modes.

The mean post-test score for historical understanding was considerably lower for sequential learners who were taught to use the theme mode (M = 75.36) than for global learners who were taught to use the same mode (M = 78.75). (Refer to Table 2). This demonstrates that there was no significant difference (p = 0.05) in the mean score on the posttest for historical understanding between these two types of learners with distinct learning styles exposed to the thematic mode at F-value (1,130) = 0.263, mean square = 109.511, p = 0.609, and partial 2= 0.002. (see Table 4). As a result, hypothesis three cannot be rejected.

H04: Between sequential learners studying in chronological mode and sequential learners studying in thematic mode, there is no statistically significant difference in the mean post-test score of historical understanding.

The main effect of modes reveals that there was no significant difference in the mean posttest score (p = 0.05) between sequential learners exposed to the chronological and thematic modes (F (1,130) = 0.020, mean square = 8.200, p = 0.889, and partial 2= 0.000151). Table 2 shows that sequential learners exposed to the chronological mode (M = 80.07)

had a higher posttest mean score than sequential learners exposed to the thematic mode (M = 75.36), while the difference was not significant. As a result, hypothesis four could not be rejected.

H05: The mean historical understanding post-test scores of global learners learning in chronological and thematic modalities are not significantly different.

There is no significant difference in the mean posttest score for learners' grasp of history between global learners exposed to the chronological and thematic modes (F (1,130) = 0.020, mean square = 8.200, p = 0.889, and partial 2= 0.000151) (Table 4). Table 2 shows that learners who used chronological approaches (M = 73.05) scored worse on the post-test than those who used thematic methods (M = 78.75). As a result, hypothesis five could not be rejected.

VI. RESULTS AND DISCUSSIONS

A. Impacts of chronological and thematic modes of information representation on Historical Understanding

The findings show that providing multimedia information in both chronological and thematic formats has a beneficial impact. Learners learning using the chronological approach had slightly lower average historical understanding scores than learners learning through the thematic mode (though not to a significant extent). One possible reason for the minor difference between these two modalities is that both groups of learners were exposed to the same collaborative learning activities and environment. As a result, the online collaborative activities of their peers, such as the development of arguments, historical reasoning, using the same resources, formulation of contextualization, learning the same substantive concepts, and meta-concepts, may have influenced their understanding of historical events. The idea map and the temporal representation in the timeline, which are also included in the multimedia elements, also aid to alleviate cognitive strain. With the classification level of SOLO, the two groups of learners exposed to both theme and chronological modalities exhibited higher levels of extended abstract thinking. They can employ philosophical and conceptual notions, historical events, history, and how to comprehend the real context to decipher the cause and effect links of the historical events investigated. This research supported the findings of [42] and [25], who found that knowing historical ideas, such as continuity and change, aids learners' intellectual development. Furthermore, when combined with multimedia instructional design, the results revealed that the reference time interval with time representation improved learners' historical learning.

The findings of this study, in terms of the thematic mode, are consistent with those of [22], who discovered that secondary school learners who learnt history using concept maps were able to understand the historical meta-concept and substantive idea. Despite the fact that the previous study had some issues with thematic teachings, such as the ability to understand cause and effect, this study discovered that learners who were exposed to thematic teaching were able to elaborate on new facts and concepts and clarify their significance or relevance. As a result, both thematic and chronological education, as suggested in hypothesis one, have been found to be beneficial in developing learners' grasp of history.

B. Impacts of Thematic and Chronologic Modes on Learners' Historical Understanding Based on Learning Styles

Learners who think chronologically are more likely to seek for patterns based on the order in which events occur and then correlate the causal-effect relationship between two events. Additionally, sequential learners outperformed global learners in the same mode (although not statistically substantially). This corroborates Felder and Soloman's argument that sequential learners benefit from sequential instruction, particularly when mastering time concepts and applying chronologic modes to historical questions [35]. This finding corroborated a preliminary study by [43], who revealed that sequential learners have a higher grasp of chronology than global learners, owing to their sequential study of historical topics.

The purpose of this study was to examine if a global learner performed better in theme mode than a sequential learner. According to [35], global learners are more likely to understand the "big picture" and quickly handle complicated or enormous challenges in order to develop rapport with them. Learners construct mental representations in their thinking by linking concepts in order to identify exact facts and connections required to grasp a historical episode. While some researchers have expressed concern that sequential learners may not perceive the continuity and interconnection of visualized historical events as parallel and thematic learners do, this study found no significant differences in historical understanding between sequential and global learners when exposed to thematic mode.

VII. CONCLUSION

The art of organizing and labelling web-based learning, as well as the interaction of learning with various forms of information architectures that are specifically tailored to meet the various learning styles of learners, are all related to learning content organization. It adds to the growing body of research about the impact of multimedia information representation on learners' historical understanding and reasoning, particularly among sequential and global learners, that has yet to be fully explored in the context of history and multimedia learning.

ACKNOWLEDGEMENT

We gratefully thank the secondary school teachers that help the researcher to facilitate the experimental study.

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