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Multimedia Information Representation in Enhancing Historical Thinking and Reasoning-*Chrono-Map* Web-based History Learning Design and Development

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ABSTRACT

Various issues and problem had been reported in history learning especially in exercising the history thinking. A central problem is to address the needs of learner with different learning styles, and how the historical information organize to match students' learning styles and boost their higher order thinking skills (HOTS). Another problem is to reduce their memorizing efforts on learning the history facts while embedded their historical thinking and reasoning skills. Thus, in this paper, we present a systematic approach methodology to web-based history learning which consist of two modes of web-based multimedia information representation, which are chronological information representation and thematic information representation—namely Chrono-Map. The design and development is based on cognitive theory of multimedia learning (CTML), concept map strategy, chronological frame of references, and history reasoning theoretical framework.

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INTRODUCTION

In the historical education settings, the used of World Wide Web had been become the dominant source of access of historical resources and knowledge. It is initially preceded by the use of multiple-text textbook, then integrated into world-wide web (WWW) by implementing interactive timelines, finally integrated into 3D spatial virtualization, aim at deliver historical content narratively and chronologically. History subject as a humanitiessubject requires the deep learning by generating critical thinking, creative thinking, analytical thinking and history thinking and reasoning skills.

Students' effective learning of history subject is largely relies on the structure of the history information organized and represented as well as impact on students' higher order thinking skills. When students developed the knowledge, they tend to connect historical knowledge in chronological structure rather than think it as isolated pattern. In simple words, they represent the knowledge in narrative (for example: story-telling, chronological-conceptual frame of reference in history, spatial frame of references) order, simplifies the history content learn. They tend to recall the core events or biographical events of history events rather than peripheral details (Barton, 2008). However, the

learning materials are being developed without proper consideration on the design and information representation, especially lack on emphasize on learning the historical facts from diverse perspectives and themes such as political, social and cultural. Indeed, there is still lack of empirical studies in the effectiveness of how the thematic information representation may influence on students' historical thinking and reasoning, especially in Malaysia educational settings. In order to invoke historical thinking, it is necessary for the student to learn the substantive historical concept and meta-concept by providing reasonable and critical judgment.

Problem Statement:

Traditional approaches that stresses on recalling and memorizing are no longer the alternative means as it makes the knowledge less transferable (Spiro *et al.*, 1991). Learners tend to memorize only part of historical event without understanding the whole history and organizing them (Favero *et al.*, 2007; Lo, Chang, Tu, & Yeh, 2009; Spoehr & Spoehr, 1994)

The student learns history without undergoing the process of deep learning and reasoning (Hwa, 2004). Jabar (2006) reported a situation in Malaysia history educational settings in which the students can only understand the causal-effect relationships of events when signaled and supported by teachers

through verbal strategies such as asking causal reasoning questions. This does implies to enhance students' chronological understanding, both time and major historical events should be represented. Same problem reported by researchers and scholars in which the students are unable to see the change and continuity of the past and make connection with the present (Lee, 2004, 2007; Howson, 2009; Shemilt, 2011). They tend to understand only the fragmentary of the history key events, person and date or period involved without adding substantive knowledge. It is argue that they are unable to see the relationship or causal-effect of events. In a consequence, this may not help students to develop the abstract concept and content of a chapter and relate it with other topic or events within a chapter (Yong, 2013). This problem may be caused by students' understanding of history part that due to lack of temporal differentiation and sense of total discontinuity with the present. This may due in part of formation of inappropriate information representation due to problem of chronology (Masterman & Rogers, 2002).

Based on mentioned problem, it is important for designate of the information representation of historical content to equip the students with the ability and desire to think critically by giving logical evidence. An action research study by Hwa (2004) showed that cooperative learning work effectively in solving history learning problem which in memorizing the facts as the results of students' passive attitude and surface learning. In facts, the instructional materials if properly planned with integration of critical thinking strategy, the effort of memorization and regurgitation can be minimized.

Given concerned encountered by students in learning history, this study intends to design and develop two modes of multimedia information representation in which thematic information representation represented with knowledge structure of interactive timelines while chronologic information representation represented with interactive concept map. We named these two modes of multimedia information representation as Chrono-Map (Chronological timelines and interactive concept map).

By associating the constructivist learning perspectives with the integration of multimedia information representation, we define multimedia information representation as the delivery of instructional content with the implementation of multimodal that include visual and auditory information and knowledge structure. More specifically, multimedia information representation is defined as structured organization arrangement of multimedia elements which are audio, images, video, graphics and text in organized manner (Masterman & Rogers, 2002). In this study, it was defined as arrangement of history content in chronological or thematic form and as descriptive representation in explaining the peripheral details of history. Section

below will discusses about the strategies used for design and development of Chrono-Map.

The Strategies Used:

In history learning, there are several strategies that had been used to improve the learning of historical chronology. The ideas of the implementation of multimedia in history learning are acknowledge, with diverse strategy to enhance chronological understanding of students. For example, implementation of 3D virtualization to engage high-spatial memory in improving students' learning of chronology (Korallo, 2010), integration of interactive multimedia (IMM) in enhance children history chronology (Masterman & Rogers, 2002), implementation of multimodal information representation using 2D timelines in representing chronological frame of references. Some others researchers and scholars to contextualize the history events by using different approach with regard to human matters (for example, frame of references and narratives approach by Barton and Levstik (2004), diverse frame of references (eg: chronological frame of references, spatial frame of references and social frame of references) by De Keyser and Vandepitte (1998), spatial frame of references in virtual environment (Foreman., Davis., Moar. Korallo, & Chappell., 2007); Interactive Multimedia by Masterman and Rogers, (2002). The effect of multimodal information representation in learning material had shown the positive results in the domain of science and technology as well as the individual use of these multiple presentation (Mayer. 2001). Combination use of visual and verbal through interactive timeline in education settings are widely used as supplemental instruction in showing the history events sequentially. Given the pervasiveness integration of multimedia in history learning, in this study, we implement chronological frame of references as the "scaffold" of designation of biographical events in interactive timelines. We adopt Haydn, Arthur and Hunt (2001) framework of time and chronology representation for history teaching and learning:

- a) time dating system and conventions, time vocabulary, and how the time work.
- b) building framework or map about the past events
- c) develop the increasing range of historical topic, sub themes.
- d) understanding on the deep time.

Their framework is useful to be implemented in this study due to its consideration on the time concept that and stressed on represent the change and evolution of the history events chronologically, giving the significance and coherence to the study of history.

By making assumptions that the implementation of timelines with multimedia may invoke learner's

visual-verbal sensory, and finally help learners develop their declarative information of episodic knowledge. They can recall the date or persons that happened within historical periods. Whereas learner who learn through concept map with implementation of multimedia, their visual-verbal sensory are encoding into a knowledge structure of semantic meaning. They can see the relationship of historical concept with the causal-effect semantically.

The main design guidelines for multimedia information representation are rooted in the cognitive theory of multimedia learning (CTML). CTML build on extensive empirical support and established theories such as dual coding theory and cognitive load theory that assist in designation of multimedia instruction and explain the learning outcomes from cognitive psychology perspectives. CTML describes how the information processing within human cognitive thinking through receiving the visual and auditory stimuli from outside and re-organized them into coherent mental representation. Thus, in this study, we implement historical reasoning theoretical framework (van Drie & Boxtel, 2008) as the design guidelines of collaborative learning, which stress that knowledge is actively constructed and mediated

through argumentation and collaborative learning by the use of history materials and resources. History reasoning and critical thinking processes can be enhanced through collaborative learning among peer and these HOTS are assessed through history essay writing. This framework consists of six components: a) asking historical questions, b) using sources, c) contextualization, d) argumentation, e) using substantive concepts, and f) using meta-concepts. These processes involved are inter-relatively influence each others. In their view, history reasoning is an activity in which students organize information by compare, describe the progressive change, explain the historical phenomena. In simple word, both interactive timeline and concept map (Chrono-Map) are designed based on CTML and history reasoning theoretical framework, the differences is we build the “scaffold” of interactive multimedia based on chronological frame of references while concept map based on concept map strategy as shown in Figure 1. However, in this study, we only discuss about the designate and development of interactive timeline using chronological frame of references.

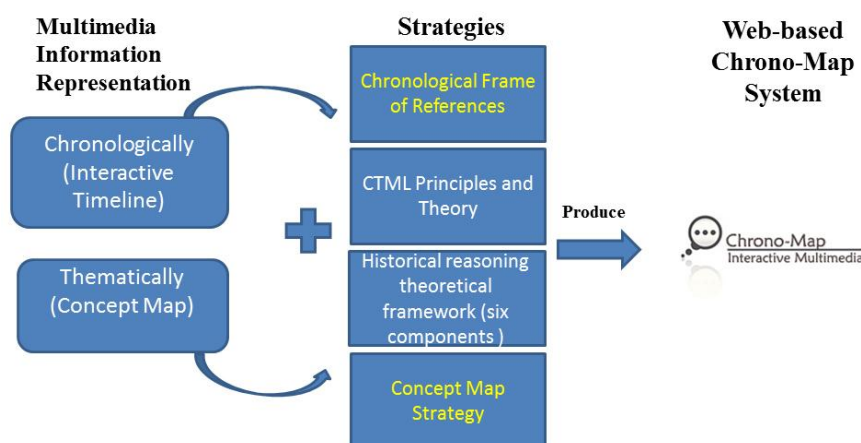


Fig. 1: Illustration of multimedia information representation

Web-Based System Design And Development: Chrono-Map:

Figure 2 shows the interactive timeline that represents the chronologic information representation. The subject unit of the learning contents is Mesopotamia civilization. As linked to CTML, to alleviate extraneous load, we implement signaling principle, contiguity principle and coherence principle. The coherence principle states that the unrelated multimedia elements should be eliminated rather than include in multimedia learning to as it will disrupt the schema formation as well as induce the learner focus attention on relevant key information. Thus, at the timeline, we include the

key events, person and iconic images involve in relate periodization. With these biographical events, students can understand how the relationships between these events with others to an overview when the name of people, dates or periods of happening, and location are given by teacher. Besides, we implement signaling principle to highlight and show the cues of the essential hyperlink. For example, the color of a link (Figure 2 (D)) shows there were a hyperlink as well as status of the corresponding target page. We align the words to corresponding graphic based on contiguity principle (Figure 2 (F)) and (E)) so that students can construct mental between the words and graphic.

In general, chronological frame of references consists of three knowledge bases: (1) historical phenomena, (2) temporal and causal relations, and (3) concepts describing phenomena and relations. History phenomena show the events, structures and themes of an era. The events are the narratives elaboration of the history events that happen in particular period or time, for example, the emergence and construction of empire by king of Sargon during Akkadian Government to the collapse of Mesopotamia during Chaldea Government (Figure 2 (G)). Structures are made up of social element with more complex descriptive features, for example, the social structure and the hierarchical structure of ancient Mesopotamia. In the designate of chronological timeline, there are two historical relations involves, which are a) temporal relations, and b) causal relations. Temporal relationships include the conversion of time of historical events. The historical phenomena was depicted in the form

of timeline follow the chronological period. Students could mouse-click on the text or pictures (iconic images of historical events) represented in a temporal-spatial order along the timeline, in order to reveal and view more details information along the timeline. In this study, timeline provides the basic scaffold in incorporating dates, time, textual description of history phenomena and occurrence in an organize manner as shown in Figure 2 (B) and (C). However, this timelines just visualize temporal relationship of the events in periodization and chronological overview. It gives limited support in illustrate the continuity and change as well as causal and effect of history events. Thus, it is necessary to incorporate timeline with verbal depictive and schematic visualization (pictures, verbal descriptions, and arrows indicating causal relations) in showing the causal-effect relationships of history concepts and relationships aspects within these visualization, in order to shows the causal relations.



Fig. 2: Interactive Timeline

The historical aspect that shows the continuity and change that not only visualize in flow map and timelines but also using the causal arrow in representing the causal relationships which shown the historical phenomena to another events as shown in Figure 3. This is emphasized in history reasoning theoretical framework in which the historical thinking can be invoked through students active involve in explain the causal-effect, change and continuity of historical events.

By using video playlist (Figure 4) to show the instruction on how to use Chrono-Map Web-based system, students are able to retrieve and playback whenever they need the help. This method is supported by multimedia principle as well as voice and image principles. Multimedia principle suggested that combination presentation of words and pictures rather than words alone may encourage the student to learn better as it enables the cognitive process of integrating words and pictures.



Fig. 3: The causal-effect relationships of historical events

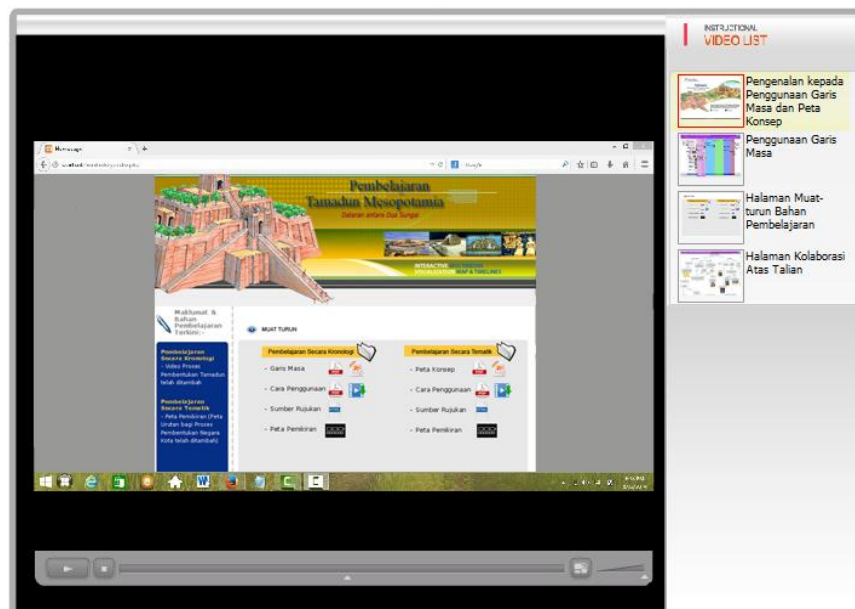


Fig. 4: Video Instruction

The Chrono-Map system is evaluated by two contents and subject matter experts in history learning. They suggested some refinements to attract students' learning motivation. For example, the prompt-out window consists of long description text that may make students feel bored or more attracted to the illustration rather than informative text. Thus, the keywords should be highlighted in bold or other color. Besides, some animation or vivid photograph may catch learners' attention and motivation. They suggested that the learning objectives should be stated properly and the learning contents should be organized according to the learning purpose and emphasized on the important point. To this point, the researcher stated precisely the learning objectives,

online learning activities and tasks to be completed by creating a teaching and learning wizard in introduction pages.

Conclusion:

The design and development of Web-based Chrono-Map system was entirely based on real-world context with the aim to solve the history learning problem encountered by secondary school Form 4 students. This paper provides the insight into the design and development of interactive timeline with the implementation of chronological frame of references, history reasoning theoretical framework and cognitive theory of multimedia learning (CTML). The tendency of the CTML in focusing on

the presented representation rather than the co-construction of representation makes it suitable to be applied in this study. A well-design instruction materials require the adaption of multimedia information representation with the deep understanding of how the cognitive process of adolescent for effective representation in history learning, and also the way the information interpreted by students. Future studies also should consider employing the concept maps in discuss how the thematic information representation may enhance students' historical thinking and reasoning, as compare to chronological information representation.

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