The Potential Benefits of Multimedia Information Representation in Enhancing Students' Critical Thinking and History Reasoning

Ang Ling Weay, Mona Masood

Abstract—This paper discusses the potential benefits of an interactive multimedia information representation in enhancing students' critical thinking aligned with history reasoning in learning history amongst Secondary School students in Malaysia. Two modes of multimedia information representation were implemented; chronologic and thematic information representations. A qualitative study of an unstructured interview was conducted among two history teachers, one history education lecturer, two *i-think* experts, and five students from Form Four secondary school. The interview was to elicit their opinions on the implementation of thinking maps and interactive multimedia information representation in history learning. The key elements of the interactive multimedia (e.g. multiple media, user control, interactivity and use of timelines and concept maps) were then considered to improve the learning process. Findings of the preliminary investigation reveal that the interactive multimedia information representations have the potential benefits to be implemented as an instructional resource in enhancing students' higher order thinking skills (HOTs). This paper concludes by giving suggestions for future work.

Keywords—Multimedia Information Representation, Critical Thinking, History Reasoning, Chronological and Thematic Information Representation.

I. INTRODUCTION

THE Malaysia Education Blue-print (2013-2025) emphasizes on the development of student's higher-order cognitive thinking skills (*Kemahiran Beraras Tinggi/KBAT*) including problem-solving, reasoning, creative thinking, and critical thinking. Critical thinking skill is among one of the six blue-print that is expected to contribute to the transformation of the educational system.

According to the preliminary blue-print (2013-2025), "by 2016, 80% of the national examination questions of UPSR, 80% of Form Three central assessments, 75% of the questions for SPM core subjects, and 50% of the questions for SPM elective subjects" will be revamped to focus on higher-order thinking skills (HOTs). Towards this shift of the educational system into a thinking school, recently, thinking maps were introduced. Pilot studies are being conducted in Malaysian secondary and primary schools as the supplemental instructional tools for all the subjects. It has been used as the

L. W. Ang is a doctoral student at the Centre for Instructional Technology and Multimedia, Universiti Sains Malaysia, 11800 Penang, Malaysia (e-mail: alw12_tpm016@student.usm.my).

M. Masood is an Associate Professor at the Centre for Instructional Technology and Multimedia, Universiti Sains Malaysia, 11800 Penang, Malaysia (e-mail: msmona@usm.my).

tool to visualize students' thinking with the purpose of enhancing their thinking skills and well-written argumentation point and historical narratives.

History, as a subject, requires deep learning by generating critical thinking, creative thinking, analytical thinking, and history reasoning skills. More specifically, critical thinking and history reasoning are the two higher order thinking emphasized by scholars in history learning [1], [2].

Chronological understanding of historical events had become dominant modes of instruction in the Malaysian history syllabus. Students understand history in the traditional chronologic (time-oriented) manner rather than the thematic (themes-oriented) manner or the combination of both methods. However, an important issue is the maturity of students' chronological way of thinking and understanding the concepts of time especially in learning history. The students' skills in mastering the concepts of time are less emphasized and this skill depends on one's cognitive maturity [3]. Besides, teachers normally emphasize on memorizing the facts. This may lead to students being over dependent on the teachers' instruction while they display an impulsive behavior which is rigid and reserved opinion [4], and this may sacrifice their history thinking skill. Indeed, they are unable to see a broader context from different perspectives; for example, comparing and contrasting the difference between two history events, interpreting, and critiquing besides reasoning by providing the evidence of history. This state of affairs may be attributed to students' different learning styles in learning history, especially for sequential and global learners. Sequential learners may learn better than global learners when the information is arranged chronologically.

Based on the mentioned problem, to help students to construct knowledge without memorizing many facts and impeding thinking skills, information representation of historical concepts in a coherent chronological and thematic view is necessary. Thus, this study focuses on how the history contents are contextualized by using an interactive multimedia (IMM). The interactive multimedia is an appropriate information representation that can be developed as an effective, dynamic, and interactive representation as well as activities that invoke cognitive thinking, aimed at bridging the conceptual gaps and enhance students' critical thinking and history reasoning. It is important to impose the information representation of historical content in order to equip the students with the ability and desire to think critically by giving logical evidences. The ability of students in matching the

World Academy of Science, Engineering and Technology
International Journal of Educational and Pedagogical Sciences
Vol:8, No:12, 2014

events and personalities to the dates and historical periods as well as present their point of view by giving logical reason is fundamentally critical to history reasoning. This state of affairs leads this study by implementing IMM (for example, picture, text, video) to represent the historical contents by using thinking maps to visualize students thinking. This may help students to elaborate, restructure and present their ideas critically in a more effective way.

II. PRELIMINARY STUDY FINDINGS

Preliminary studies were conducted by the researcher through separate interviews with 5 secondary school students, 3 history teachers (a lecturer who is an expert in history education and two *i-think* trainer experts).

The researcher conducted personal communications with 5 secondary school students; all admitted that they studied by following the textbook delivered by the teacher and the reference books as the supplemental instruction. Yet, they rarely use the online learning materials and interactive multimedia in learning history. When asked about how they understand the history facts and concepts especially on learning world civilization, three of them admitted that they memorized the facts and period of the civilization. While two drew their concept maps / thinking maps with keywords. They expressed that these keywords such as the key events, people involved (for example, Hammurabi) and the development of civilization in a specific period (for example, Persian Babylonia) may help them to understand and recall the history events. They can understand how the relationships between these events with others occur to an overview of people's name, dates or periods of happenings and the location that were given by the teacher.

The researcher conducted an unstructured interview with two history teachers from a secondary school in the urban area of Kedah, Malaysia. One of the teacher admitted that they have started to implement thinking maps as the supplemental tool in history learning and teaching as this school was selected as a pilot school in conducting the *i-think* program that started in 2013. They admitted that the lessons are delivered linearly and chronologically based on the syllabus provided by the Ministry of Education (MOE). Prior to delivering the lesson, the teacher will briefly explain the outline of the topic before going into detail. In view of the Malaysian history curriculum, three basic standards of history learning dimensions are: i) the major historical themes, ii) chronological periods, and iii) ways of thinking and knowing about history.

The ways of thinking and perception about history (historical thinking) consists of two fundamental parts: a) historical knowledge and perspective, and b) historical analysis and the metacognitive (thinking about thinking) interpretation. The most common way of organizing is by chronology in which contents are organized based on periods of past events. For example, the history learning of form 4 syllabus starting from the prehistory of Paleolithic, Mesolithic and Neolithic to four civilization which are a) Mesopotamia Civilization, b) Ancient Egypt Civilization, c) Hindu

Civilization, and d) Hwang Ho Civilization. Each of these civilization are studied from several aspects (for example; politic, social, economy), structure organization (settlement, religion and belief, scripting, work specialization, the characteristics of government administration), and events (the contribution of civilization from diverse aspects, as well as the rise of civilization and human evolution). The HOTs questions depend on the teacher to regulate and design the question based on students' learning. Indeed, experts and trainers of the *i-think* program suggest using 8 thinking maps that are suitable for showing students' thinking and as the guideline for teachers and instructors to design the questions.

All teachers, the lecturer of history education, and *i-think* experts think that the implementation of the concept map with an interactive multimedia may be different. They agreed that linking of history events shows how previous events affect the later life that will also help students to understand the topics precisely and make critical arguments during collaboration. They agreed that students can use thinking maps to visualize their thinking separately depending on the types of questions. The *i-think* experts suggested that by incorporating the thinking and concept map will enable the educator to "see" the students' thinking. By organizing the lessons around open-ended questions and chronologic and thematic way, rather than the definitive text, students are able to see the causal-effect relationship of past-events. They can think critically, craft the history in an explanative way and summarize the content [5].

Since history events are abstract, the implementation of the elements of the interactive multimedia as a mean of visualization in depicting and conveying the history information to students is necessary. In other words, the concept map and history timelines can only convey the basic information of history events (such as the icon images, date, period, and key events), details of the history events can be represented with the usage of multimedia.

Thus, the next section discusses the strategy for chronologic and thematic information representation.

III. IMPLEMENTATION OF MULTIMEDIA INFORMATION REPRESENTATION IN HISTORY LEARNING

Multimedia information is a combination of images, picture and sound which can be represented, disseminated and conveyed through diverse means and strategies. Previous researches on collaborative construction of information representations have shown positive results for both the learning processes and learning outcomes [2], [6], [7]. Different field of study have different possibility of the use of multimodal representation [8]. Different information representation and organization influence on the human cognitive process. The effect of a multimodal information representation in the learning material has shown positive results in the domain of science and technology as well as the individual use of these multiple presentation [9].

A. Chronological Information Representation

Students' effective learning of history largely rely on the

World Academy of Science, Engineering and Technology
International Journal of Educational and Pedagogical Sciences
Vol:8, No:12, 2014

structure of the organized and represented history information as well as the impact on students' higher order thinking skills. When students developed the knowledge, they tend to connect historical knowledge in chronological structure rather than consider it as an isolated pattern. In simple words, they represent the knowledge in a narrative form (for example; story-telling, chronological-conceptual frame of reference in history), simplifies the history content learnt. They tend to recall the core happenings of history events rather than peripheral details [10]. The combination of visual and verbal through interactive timeline in education settings are widely used as supplemental instruction in showing the history events sequentially. Researches show that the causal-effect explanations, for example, a sequence of frames depicting the major steps in a process may enhance learning achievement in history learning [11], [12].

History subjects are related to humanity studies that consist of complex chronological frames of references that include people, events, structure of society, abstract concepts, and sub-themes. It involves the processes of history reasoning and critical thinking that require the learners to explain the history phenomena, showing the causal-effect of events chronologically that cannot be represented with the visual language (i.e., arrows, shapes in flowcharts, cycle diagram, and schematic representation) as does the natural sciences representation. Different information representation and organization affects the human cognitive process. The combination of multimedia provides interactive ways of information representation that invokes the thinking of learners through learning processes and presents the abstract history concept in explicit ways. Thus, the suggested method for conveying historical information is through chronological frame of references that show the periodization of events by using timelines.

During history learning, students are challenged to think critically and chronologically. Students are able to arrange many images and text in chronological order. They understand the temporal distance of the past. First, they view history chronologically and in general, arrange images in broad categories. For example, they categorize the images based on "ancient times happening" with "last decades happening". This enables them to recall the images that are arranged in sequence simply by counting backwards by years or decades when they forget about the time and dates of past events [13]-[15].

Through the literature review, history content is recalled chronologically with the aid of multimedia (such as picture, video, motion picture instead of just text-alone or multiple text that impede cognitive load), searching for evidence (primary and secondary resources) in supporting argumentation, analyzing the causal and effect of past events, and hence, the history reasoning of students are provoked. To examine the students' comprehension on the history events, they are asked to provide supporting evidences during argumentation. The only concern is the fact that learners may not see the continuity and interconnectivity of the visualized historical events that might have happened in parallel especially when

viewed in social, political, and economic dimensions that are commonly presented separately. Thus, this study also includes history information conveyed thematically to examine the interconnected relationship among these events from a multidimensional view.

B. References

The term *themes* are defined as ideas or topics built through historical periods [16]. It is a big idea that connects integrated areas in relevant, rich, related, rigorous and recursive means in the development of a curriculum [17]. There are two general theme builders: a) subject and b) concept themes. *Subject themes* involve a topic or an historical event (for example, the civilization of Mesopotamia) that can be explored through the curriculum (the contribution of Mesopotamian civilization towards science and technology) while *concept themes* involve broad topics that underlie many ideas. In general, the themes of history include social interaction, ideas, individuals, politics, economics, religion, culture, science and technology, time, and geography. Organization and teaching of the history curriculum in thematic form shows connection of important themes in history such as politic, economy, culture, social, and environment or others of that particular period and region that recurred over time.

From the brain-based learning perspective, humans seek patterns to create meaning and understanding [18]. The brain seeks the coherence and structure pattern in creating the meaning [18], [17]. The thematic structure of instruction connects the ideas, concepts, theme, sub-theme, and problem together to form the large inter-correlated structure. Further, [19] stated that the connection of ideas and concepts requires the immersion of rich context of imagery, emotion, and motion picture in enhancing the strength of the brain-seeking patterns. In simple words, the history lessons are designed thematically and represented using appropriate interactive multimedia that relates the concepts and ideas of students which may first seek the pattern according to the occurrences. Also, thinking about the causal-effect relationship of an event with another. Thus, this study focuses on the usage of concept map in illustrating the thematic information representation of history learning that shows the causal-effects of history events from diverse aspects.

We hypothesize that the effect of both chronologic and thematic information representation on students' critical thinking and history reasoning, sequential learners may learn better than global learners when learning through history information that is organized thematically as they possess more chronological reasoning and understanding than global learner. Thus, both modes of thematic and chronologic information representation represent independent variables (IV), while students' critical thinking and history reasoning represent dependent variables (DV) with the students' learning styles of global and sequential as moderator variables (MV). Fig. 1 shows the graphical representation of these IV, DV, and MV relationships.
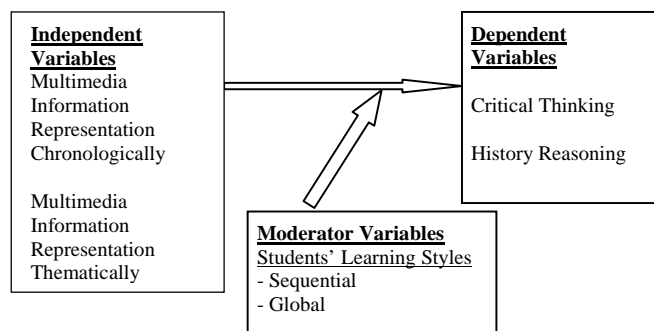
Fig. 1 Graphical Representation of Variables

IV. CONCLUSION

The effective dynamic, interactive representations and activities in the IMM, aimed at bridging the discontinuity of the past events with the present, and compensate for the lack of temporal differentiation. More specifically, the interactivity of multimedia elements such as the history context represented in chronological timeline and concept map that embedded with video, narration, sound, animation and other navigation button helps illustrate the causal-effect of events and abstract concepts, indirectly invoking students' reasoning and critical thinking skill. Designation of history contexts should consider this challenge by integrating suitable information organization approach: design of an integrating framework on overarching idea of organization with the purpose of cutting down the size while enhancing the learners' critical thinking and chronological reasoning. Hence, a possible application of the multimodal and multimedia information representation conveys the information chronologically showing the temporal relationships of events in timelines. In contrast, information in the thematic mode applies concept maps. Instead of these two modes of multimedia information representation, the other possible application uses 8 thinking maps in visualizing students thinking. Future study should be conducted on pre-test study of examining students' critical thinking and history reasoning prior to implementing treatment modes.

ACKNOWLEDGMENT

REFERENCES

[1] Sofos, M. "Critical Thinking - a Historical Overview. Development of Critical Thinking for Successful Future Career in EU: Practical Approach". Retrieved 21 August 2014, from http://www.sdcentras.lt/ mind/CThistorical.pdf, 2004.
[2] Suthers, D. D., & Hundhausen, C. D, "An experimental study of the effects of representational guidance on collaborative learning processes". *Journal of the Learning Sciences*, 12(2), 183–218, 2003.
[3] Masariah Bt Mispari, "Konsep Pentakrihan Dalam Sejarah". *Persidangan Kebangsaan MGCM 2007*. Malaysia, pp. 139-149, 2007.
[4] Jabar, Baharuddin, "Pelaksanaan Kemahiran Pemikiran Sejarah dalam Pengajaran Guru-guru Sejarah: Satu Kajian Kes di Daerah Hilir Perak. In: Menanggapi keberkesanan dan perubahan." *Penerbit Universiti Pendidikan Sultan Idris*, pp. 1-24, 2006.
[5] Terrie, E, "Preparing History Teachers to Develop Young People's Historical Thinking". Retrieved, April 22, 2014, from http://www.historians.org/publications-and-directories/perspectives-on-history/may-2012/possibilities-of-pedagogy/preparing-history-teachers-to-develop-young-peoples-historical-thinking, 2012.
[6] Van Drie, J, C van Boxtel, J Jaspers, & G Kanselaar, "Effects of representational guidance on domain specific reasoning in CSCL". *Computers in Human Behavior*, 2005.
[7] Van Drie, J, C van Boxtel, J Jaspers, & Van der L. "Stimulating deep processing in a collaborative learning". Social interaction in learning and instruction: the meaning of discourse for the construction of knowledge environment, 2000.
[8] De Westelinck, K., & Valcke, M. "The impact of external graphical representations in different knowledge domains: Is there a specific effect?" In L. Verschaffel, E. DeCorte, G. Kanselaar & M. Valcke (Eds.), Powerful environments for promoting deep conceptual and strategic learning. *Studia Paedagogical* (pp. 213-232). Leuven: University Press, 2005.
[9] Barton, K.C, "Making Connections." *In Researching History Education: Theory, Method and Context*, 148-56. New York: Routledge, 2008.
[10] Deborah, S, J. "Time" Activities from the Mundane to the Sophisticated". Retrieved 12, August, 2014 from http://nationalhumanitiescenter.org/ows/seminars/tcentury/TimeActivities.pdf. 2011.
[11] Prangsma, M. A, "Multimodal representations in collaborative history learning". Dissertation Utrecht University. Retrieved, April 22, 2014, from http://igitur-archive.library.uu.nl/dissertations/2007-0620 201655/UUindex.html, 2007.
[12] Barton, K. C. "'Oh, that's a tricky piece!': Children, mediated action, and the tools of historical time". *Elementary School Journal,* 103, 161-185, 2002.
[13] Barton, K. C. "Narrative Simplifications in Elementary Children's Historical Understanding." In Teaching and Learning History. *Advances in Research on Teaching 6*, edited by J. Brophy, 51-83. Greenwich, Connecticut: JAI Press, 1996.
[14] Van Boxtel, C., & Van Drie, J. (2004). "Historical reasoning: A comparison of how experts and novices contextualise historical sources". *International Journal of Historical Learning, Teaching and Research*, 4(2), 89–97. Retrieved from http://www.ex.ac.uk/historyresource/journalstart.htm.
[15] Brian, S. & Leah,H, "Aiding Students Understanding Of History Through A Thematic Approach". Retrieved 29, April, 2014, from http://digitalcommons.iwu.edu/cgi/viewcontent.cgi?article=2630&context=jwprc, 2010
[16] Fogarty, R, "Problem Based Learning and Other Curriculum Models for the Multiple Intelligences Classroom Australia: Hawker Brownlow Education", 1997.
[17] Jensen, E, "Brain-based learning: The new science of teaching and training". San Diego, CA: The Brain Store, 2000
[18] Caine, R. N., & Caine, G. "Teaching and the human brain. Alexandria: Association for Supervision and Curriculum Development", 1991.
[19] Davies. M, & Rajni, S , "A Programmatic Approach to Teaming and Thematic Instruction". Retrieved, April 22, 2014, from http://www.napomle.org/May2010symposium/A%20Programmatic%20 Approach%20to%20Teaming%20and%20Interdisciplinary%20Instruction.pdf, 2010.