

EFFECTS OF MULTIMEDIA-BASED GRAPHIC NOVEL PRESENTATION ON CRITICAL THINKING AMONG STUDENTS OF DIFFERENT LEARNING APPROACHES

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ABSTRACT

This study investigated the effects of graphic novels on the critical thinking skills in history learning among 291 Secondary Two students in three secondary schools in Malaysia. This research consisted of two parts, namely, development and evaluation. In the first part, the multimedia learning material entitled '*Japanese Occupation of Malaya 1942-1945*' was designed and developed. In the second part of this research, this study investigated the critical thinking effects of three multimedia graphic novel instructional modes on students of different learning approaches – deep and surface. This study utilized the quantitative method to gather information. ANOVA and ANCOVA analyses were conducted to test the five hypotheses in this study. The results showed that students who were exposed to the Graphic novel and Narration (GN) mode performed significantly better than their counterparts in the Graphic novel and Text (GT) mode and the Graphic novel, Text and Narration (GTN) mode. Both the surface-approach students and the deep-approach students who were exposed to the GN mode performed significantly better than those in the GT mode and the GTN mode. It was also found that the GN mode provides equivalent benefits to both surface-approach and deep-approach students. The interaction effects between the students' learning approach and the three learning modes related to the posttest scores were not significant. The conclusion of this study is supportive of the positive value of the GN mode multimedia graphic novel learning environment based on Mandell and Malone's Thinking like a Historian (TLH) model to enhance and facilitate students' critical thinking skills toward history learning.

Keywords: multimedia-based graphic novel learning environment, TLH model, critical thinking skills, history learning.

INTRODUCTION

The development of critical thinking is a significant goal of our education system as a crucial tool for participating in the 21st century's knowledge society. The ability to think critically and to reason well has been regarded as an important and necessary outcome of education. Prior to this, evidence of the desire to address critical thinking skills were addressed under the Malaysia's New Economic Model (NEM) which recommended that education should promote the intellectual growth of students by developing their critical thinking skills for performing successfully in a complex and rapidly changing world.

Additionally, the rapid development and advances in instructional delivery system has created a promise to ushering in a new age of learning with technology enhanced learning environments unconstrained by time and space. The infusion of computer technologies in education has the potential for improving the way teachers teach and students learn which had created a significant impact on the instructional content development and the methods of communicating information to learners. As such, the increasingly visual domination of mass communication now practiced in the world makes it both natural and essential for teachers to incorporate the visual resources into their teaching.

In the context of learning in Malaysia, educators and researchers have developed strategies to improve education based on constructivism. Several studies using constructivism learning environment has shown positive outcome whether cognitively or motivationally (Kong, 2006; Krihnasamy, 2007; Neo & Neo, 2009). These studies have shown that infusion of constructivist technology-based learning environment has created a major impact on the instructional content development and the methods of transferring appropriate knowledge to learners.

With the aforementioned introduction in view, this study aims to design, develop and evaluate the multimedia learning material embedding the philosophy of graphic novel in history learning. The focus of this study will be on the effectiveness of the interactive multimedia-based graphic novel learning environment both as a tool and instructional medium to foster students' critical thinking skills in the learning of history.

THE POPULARITY AND POTENTIAL OF GRAPHIC NOVELS IN EDUCATION

Graphic novels have the particularity of combining two very rich forms of cultural expression – the literature and the arts which make them a very effective pedagogical tool. One of the most comprehensive benefits of graphic novels is their supporting role in theories of multiple literacies (Schwarz, 2004). Instead focusing on text-based literacy, additional attention is given to critical and visual literacies (Cary, 2004). Educators will move away from “one size fits all” literacy instruction through the use of graphic novels (Carter, 2007). Multiple literacies take information and channel it through different modes. Students who do not understand a concept from direct text may understand it through the visual representation in graphic novels. In this case, graphic novels are especially important in promoting ideas of visual literacy and accommodating students who are classified as visual learners. The combination of images and words increase students’ comprehension (Chute, 2008). This visual scaffold is the best way to understand the concepts the study is presenting compared with text alone. By combining both words and pictures, graphic novels have an enormous power to tell stories and to transmit messages (Williams, 2008).

Graphic novels offer a means for representing complex materials in ways that reduce the cognitive demand of reading dense text while portraying sophisticated concepts. Thus, graphic novels have been touted as being a beneficial tool for engaging reluctant and struggling readers (Sullivan, 2002; Crawford, 2004). Reluctant readers may not be able to detect certain literacy elements such as tone, mood, theme, and foreshadowing from text alone. The images in graphic novels provide these elements at a level easier to reach for many readers (Beers, Probst, & Roef, 2007). Booth (2009) stresses that through the use of graphic novels, students can make associations between the images and the text to help simplify the reading process and aid comprehension. Moreover, the simple sentence structure and visual demonstrations of literacy in graphic novels can be beneficial to struggling readers with frustrating reading experience. The text format of many graphic novels using text bubbles and short sentences may be easier to read and less daunting for struggling readers (Little, 2005). The reduced amount of text and attention-grabbing graphics in graphic novels motivate reluctant readers, enable struggling readers, and even challenge the higher-level learner infer, predict, and reflect on what they read (Frey & Fisher, 2008).

Aside from engagement, graphic novels also help to develop analytical and critical thinking skills through thought-provoking discussions that occur after reading (Frey & Fisher, 2008). Graphic novels are becoming more important today as classrooms are becoming more diverse, and more expectations are being placed on students to be creative and independent thinkers (McVicker, 2007). One of the advantages of using graphic novels to bring critical thinking into the classroom is that they are often shorter and quicker to read than other texts. Graphic novels are not only creative in nature but also encourage creative explorations, experimentation, discovery, and innovation. It is also quick to branch out into theme representing cultures and ethnicities around the world. While some graphic novels allow a release from reality in superheroes and fantasy adventures, family relationship, first romance, abuse, homelessness, and youth subcultures, many historical concepts have been written about in graphic novel such as Art Spiegelman’s *Maus* (1986, 1991) concerning the event of Holocaust during War World Two. In this case, graphic novel provide a unique, personal insight into historic events and political situations which could be used to promote critical thinking discussion in history and social studies classes (Schwarz, 2004).

While much has been said about the potential and learning with graphic novel, what role can the graphic novel as the visual element play in the history classroom? Studies by Tally and Goldenberg (2005) demonstrate that historical images – photos, lithographs, cartoons, and maps present instantly recognizable features and information that promote historical thinking among students. Moreover, the visual impact possessed by graphic novel was believed to contain the dramatic power to convey important truths about human situations (Lavin, 1998). Whereas Buhle (2007) and Zinn (2008) in their studies stated the potential of graphical histories address crucial issue in society such as war, poverty, justice, inequality, and gender rights enable and prepare students to respect other people and cultures in a democratic society. Moreover, Study by Schnakenberg (2010) promoted graphic novel as initial stimulus material to motivate student towards history learning.

Heinich et al. (2002) stated that the realism of a visual element did not always ensure effective communication but under certain circumstances, realism actually interfere with effective communication and hamper learning. Visuals tend to become less useful in instruction as they approach the extremes of very abstract or very realistic (Heinich et al., 2002). Learner will be distracted from the minor details and miss the centre thought of representations either the realism of a figures are too much or too little. Therefore, cartoon or partially real object is more effective for graphical representations.

Thus, the central issue in this study is to find out whether the concept of graphic novel provided by multimedia environment facilitate the learning of history by the students. Given the visual and audio power of this multimedia-based graphic novel learning environment, history teaching can be effectively and vividly presented and would encourage the development of an increasingly student-centered, active-learning curriculum by facilitating the birth of what came to be known as “history in the graphic novel” as proposed by history scholars in the 21st century (Frey & Noys, 2002).

CRITICAL THINKING SKILLS IN HISTORY

One of the main aims of history learning is the development of critical and creative thinking in order to provide students with the necessary tools to become active and autonomous citizens, as well as lifelong learners (Levstik & Barton, 1997). These competencies can be achieved through the stimulation of students’ deep learning, namely through questioning or inquiry-based learning. Questioning play a central role in the process of teaching since students’ learning, thinking, participation and their level of engagement depend on the kind of questions teacher formulate (Levstik & Barton, 2005). In other words, questions initiate and maintain interaction and discussion in the classroom, it stimulate thought and is one of the greatest impacts on students’ critical thinking skills.

Past research indicated that questions can be used to activate learners’ meta-cognitive processes that result in more efficient learning and engaging students in analysis, problem-solving and inquiry process (Ikuenobe, 2001). Teaching techniques that promote memorization do not support critical thinking skills among learners. Critical thinking skills is a cognitive process that requires a higher level, deeper thinking logic, analysing, inferring, judging, planning and problem solving (Scriven & Paul, 2008). Therefore, instruction that supports critical thinking uses higher cognitive questioning techniques that require students to analyze, synthesize, and evaluate information to solve problem and make decisions (think) rather than merely to repeat information (memorize) (Hazri, 2003).

This study attempts to integrate Mandell and Malone (2007) Thinking Like A Historian (TLH) model to facilitate historical thinking skills, going beyond the prescribed textbooks in order to have students engage in doing history, a process of producing works by logical thinking process and questioning the clues of the past (historical evidence/materials) with a critical approach. It is suggested that the use of TLH model in the constructivist learning environment with questioning approach motivate the learner to expand and find more about into the subject area thus creating a lasting interest in history learning.

THINKING LIKE A HISTORIANS MODEL

Thinking Like a Historians (TLH) model serve as a framework and historical literacy method in history teaching and learning through historical themes while analyzing and interpreting the historical concepts in order to make connections and apply the knowledge. TLH identifies historical study as a 3-steps historical process as follows;

1. Asking questions about the past
2. Gathering sources and evaluating the evidence in those sources
3. Drawing conclusions, supported by the evidence, that answer the questions

TLH incorporates the historical process (the disciplinary skills and procedures that historians use to study the past) and historical categories of inquiry (the conceptual patterns that historians use to make sense of the past). It determine a focus for questions by engaging students in historical meaning making through the use of five categories of specific inquiry questions based on the skills of inquiry used by historians. The intended outcome is that students will gain a better understanding of what is ‘doing history’. In other words, it is the improvement in the skills of developing arguments from evidence and developing relevant and answerable research questions. The five categories of inquires serve as the way of organizing investigations and interpretations of the past as follow;

1. *Cause and Effect* – What were the causes and effect of past events?
2. *Change and Continuity* – What has changed and what remained the same?
3. *Turning Points* – How did past decisions or actions affect future choices?
4. *Using The Past* – How does the past help us make sense of the present?
5. *Through Their Eyes* – How did people in the past view their world?

This research asserts that students’ critical thinking skills can be more successfully met when apply a constructivist approach to teach history. By incorporating the TLH as the framework into the design of the multimedia-based graphic novel learning environment through its variety of tools which provide rich

information with the possibilities for individualized instruction and interactive component, history topics will come alive for students, offering new light to boring facts with photographs, animated images, maps and narration. Students are given the opportunity to examine information, consider alternative, collaboration and multiple sources of information, all in an effort to reach their own conclusions, making learning an active process and thus enhancing and facilitating their learning in history.

DESIGN AND DEVELOPMENT OF THE MULTIMEDIA LEARNING MATERIAL

The design and development of the multimedia learning material in this study incorporating Mandell & Malone TLH model of historical thinking, Mayer’s (2009) cognitive theory of multimedia learning, Sweller’s (2005) cognitive load theory, and Keller’s (2010) motivation model. The history learning material was constructed based on the principles and guidelines derived from these models and theories. Adobe Flash CS3 was the programming tool for designing and Adobe Illustrator CS3 was used to edit some of the graphics. The animated part of the graphic novel images and text was created by Flash program. This study was conducted by developing three modes of interactive multimedia courseware, namely Graphic novel and Text (GT) mode, Graphic novel and narration (GN) mode and Graphic novel, Text and Narration (GTN) mode. Graphic novel and Text (GT) mode provided the content in the form of simultaneous on-screen text next to the graphics (Figure 1). Graphic Novel and Narration (GN) mode provided the verbal content in the form of simultaneous audio narration with the graphics (Figure 2). Graphic Novel, Text and Narration (GTN) mode provided both audio narration and on-screen text with the graphics (Figure 3).



Figure 1: GT mode



Figure 2: GN mode

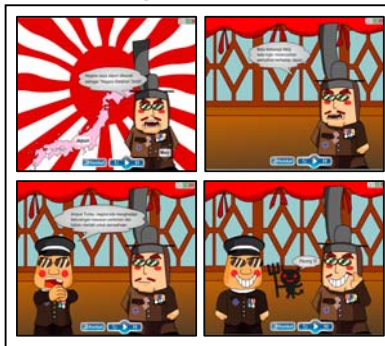


Figure 3: GTN mode

METHOD

A quasi-experimental design was conducted in this study to investigate the effects of the three modes of multimedia graphic novel treatment used to measure students’ performance scores towards history learning. A 2 × 3 quasi-experimental factorial design was used to investigate the three modes of multimedia treatment on students’ performance scores at each category of the learning approach (surface and deep) of the students. Analyses for the moderator effects in the factorial design are shown in Figure 4.

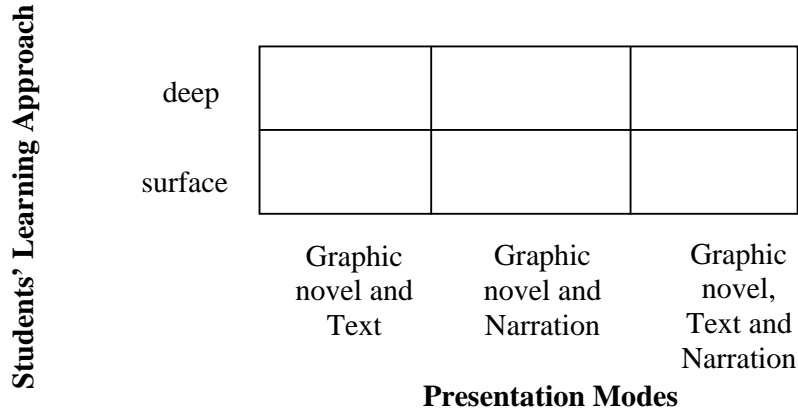


Figure 4: A 2 × 3 quasi-experimental

This study employed one of the major types of the quasi-experimental design, the non-equivalent control group design, whereby similar intact classes were randomly assigned to their respective treatment group (Gay, Mills & Airasian, 2009). The three treatment groups were pretested, administered a treatment, later posttested and interviewed.

Research Design

The three different modes of presentations were given to three different treatment groups. The students’ distribution within the treatment groups were conducted randomly. The details of the research’s treatments and instruments were administered as in Figure 5.

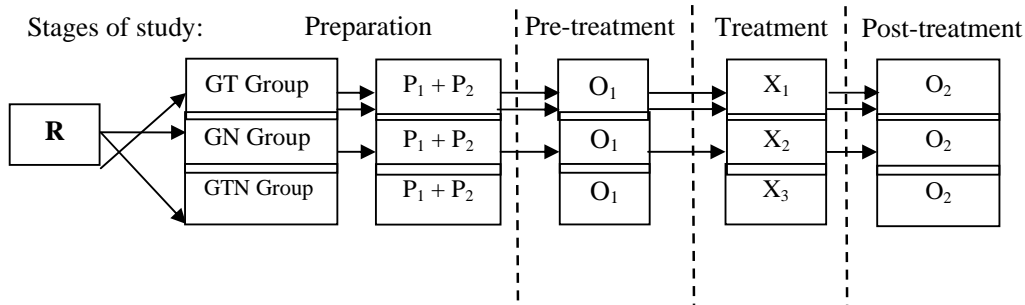


Figure 5: Research design of the study.

- R = Random assignment
- GT = Graphic and Text Group
- GN = Graphic and Narration Group
- GTN = Graphic, Text and Narration Group
- P₁ = Briefing to the teachers regarding teacher actions during the study
- P₂ = Briefing to the students regarding the courseware prior to treatment
- O₁ = Pretest
- X₁ = Treatment using the Graphic and Text mode
- X₂ = Treatment using the Graphic and Narration mode
- X₃ = Treatment using the Graphic, Text and Narration mode
- O₂ = Posttest

Variables

The independent variables in this study were the three modes of multimedia treatment, namely, GT, GN and GTN. The dependent variables are the performance scores of the students. Students' performance refers to the posttest scores. The moderator variable was the students' learning approaches, surface and deep learning approaches.

Sampling

The population of this study comprised Form Two students from three Malaysian secondary schools. They range in age from 14-15 years old. The students involved have not been exposed to the topic entitled "*Japanese Occupation of Malaya 1942-1945*". A list of secondary schools in Penang Island that fulfilled certain criteria such as (a) similar socio-economic background, (b) co-education, and (c) well-equipped with multimedia computer laboratories were prepared. Three different secondary schools were randomly selected (based on the simple random sampling technique) from the list. For each school, three intact classes were chosen. As the students in these schools were streamed based on their overall academic performance, this facilitated the selection of the three classes which were involved in the study. One class was of above average ability, one class of average ability, and the other class of below average ability. Each of the three classes from the same school was assigned to the same treatment. The three schools were randomly assigned to either one of the three treatment modes namely the Graphic novel and Text (GT) mode, Graphic novel and Narration (GN) mode, and the Graphic novel, Text and Narration (GTN) mode.

Data Collection

Four weeks before the subjects were exposed to the experimental treatment, the pretest was administered during a 45-minute lesson. Another 40-minute lesson was used to administer the LPQ test. During the experimental treatments, three classes from each of the sample schools used the three versions of the multimedia learning materials in the computer lab respectively. The subjects were required to explore and study the learning materials in six different 40-minute lessons. Immediately after the instructional treatment, the students were required to complete the posttest. The researcher gave strict instructions prior to the data collection procedure to maintain consistency of the implementation of the designed lesson.

Internal and External Validity

This study employed pretest-posttest quasi-experimental design which involved random assignment of the intact groups to treatment, rather than random assignment of individuals. In this type of experimental design, validity threats or extraneous variables such as regression and interaction between selection, maturation, history and testing may arise (Gay, Mills & Airasian, 2009). If these extraneous variables are not controlled in the experiment, the observed differences in the experimental groups may be due to the extraneous variable and not to the experimental treatment.

To minimize these threats, the following steps were taken to ensure the internal validation of this study:

- i. To minimize threats to internal validity due to maturation or history of the subjects, the experimental study was carried out for a brief period of three weeks.
- ii. To minimize the "test-wise" effect, the pretest was conducted four weeks before the treatment. The treatment was then conducted for the period of three weeks. The gap of 8 weeks between the pretest and posttest is long enough to reduce the threats of "test-wise" effect. The pretest questions were rearranged and the posttest was given immediately after the treatment so that the students might not remember the questions given in the pretest.
- iii. To prevent the interaction of the students, the three schools selected were randomly assigned to one of the three multimedia instructions. Each student of intact classes was provided with an independent computer to avoid any interaction.

To minimize the threat to external validity, the following steps were taken:

- i. First the three schools were carefully chosen to ensure similarity in terms of age, sex, scholastic aptitude, achievement and socio-economic status of the pupils.
- ii. The pretest was used as covariate to ensure the equivalence of the groups in their prior knowledge and pre-requisite ability before taking part in the treatment. Analysis of covariance (ANCOVA) was used to statistically equate the groups.
- iii. To minimize the Hawthorne effects, the students involved in the treatment were not informed regarding the treatment implementation. In this study, the treatment was conducted in the school computer laboratory during the normal history lesson period.
- iv. To minimize the experimenter effect, the study was conducted by history teacher assistants with detailed descriptions of procedures and explicit directions.

FINDINGS

A number of statistical analysis techniques were employed, namely descriptive analysis, Pearson correlation, analysis of variance (ANOVA) and analysis of covariance (ANCOVA). One-way ANOVA was used to find out whether they were any significant difference in the mean posttest scores between the three learning modes, whereas one-way ANCOVA was conducted to compare the effects of the three treatment modes on students' performance toward the multimedia graphic novel lesson. The data was analysed to determine if there was any significant difference in the adjusted mean of the dependent variable (posttest scores) between the three treatment modes, while controlling the pretest scores as the covariate. Two-way ANCOVA was also employed to test the interaction effect between the treatment modes and students' preference learning approaches (Surface and Deep). The results of inferential statistics was discussed based on the hypotheses of this study at the significant level, $p=0.05$.

Hypothesis Testing

Hypothesis 1

There is no significant difference in the mean posttest scores between students using the three treatment modes (GT, GN, and GTN).

Table 2: Descriptive Statistics of Mean Posttest Score of the Three Treatment Modes

Variable	Treatment Mode	N	Mean	Standard Deviation
Posttest Score	GT	99	52.28	12.578
	GN	100	59.72	10.420
	GTN	92	55.62	10.144

Table 3: One-way ANCOVA Results for Posttest Scores by Treatment Mode With Pretest Score as Covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Covariate: Pretest	10290.903	1	10290.903	116.609	0.000
Main Effect: Treatment Mode	3248.994	2	1624.497	18.408	0.000

^aR Squared = 0.341 (Adjusted R Squared = 0.334). $p < 0.05$

The results of ANCOVA in Table 3 indicates a significant difference existed between the posttest score of the three treatment modes, $F(2, 287) = 18.408, p = 0.000$. It can be concluded that after statistically controlling for the pretest score (covariate), the Multimedia Graphic Novel treatment in the form of GT, GN and GTN did have an influence on the posttest score. The students exposed to the GN mode obtained significantly higher mean posttest scores than the students who were exposed to the GT mode. The students exposed to the GN mode also obtained significantly higher mean posttest scores than students who were exposed to the GTN mode. Besides, the students exposed to the GT mode obtained significantly higher mean posttest score compared to the students who were exposed to the GTN mode. Therefore, this hypothesis was not supported.

Hypothesis 2

There is no significant difference in the mean posttest scores between surface-approach students of the GN mode and the deep-approach students of the same mode.

Table 4: Means, Standard Deviations, Adjusted Means, and Standard Errors of Posttest Score by GN Learning Modes for Surface and Deep-approach Students

Posttest Score					
Learning Approach	N	Mean	Std. Deviation	Adjusted Mean	Std. Error
Surface	65	58.338	10.8430	58.847 ^a	1.088
Deep	35	62.300	9.1845	61.356 ^a	1.486

Table 5: ANCOVA of Mean Posttest Score by Learning Approach With Pretest Score as Covariate for GN Mode

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Covariate: Pretest	2974.833	1	2974.833	38.901	0.000	0.286
Main Effect: Learning Approach	140.999	1	140.999	1.844	0.178	0.019

^aR Squared = 0.310 (Adjusted R Squared = 0.296). $p < 0.05$

The results in Table 5 show that there was no significant difference in the mean posttest scores for the surface and deep-approach students exposed to the GN mode, $F(1, 97) = 1.844, p = 0.178$. Although the deep-approach

students obtained higher adjusted mean posttest scores of 61.36 compared to the surface-approach students with an adjusted mean posttest score of 58.86 by the GN mode (Table 4), the difference was not significant. Therefore, this hypothesis was supported.

Hypothesis 3

There is no interaction effect between students’ learning approaches and the treatment modes related to the mean posttest scores.

Table 6: Two-way ANCOVA of Posttest Score by Treatment Mode and Learning Approach With Pretest Score as Covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Covariate: Pretest	9773.742 ^a	1	9773.742	111.228	0.000	0.281
Main Effect: Treatment mode	3249.470	2	1624.735	18.490	0.000	0.115
Learning Approach	279.921	1	279.921	3.186	0.075	0.011
2-way interaction: Mode*approach	85.800	2	42.900	0.488	0.614	0.003

^a R Squared = 0.351 (Adjusted R Squared = 0.337). $p < 0.05$

Table 7: Means, Standard Deviations, Adjusted Means, and Standard Errors of Posttest Score by Treatment Mode and Learning Approach

Treatment Mode	Learning Approach	N	Mean	Std. Deviation	Adjusted Mean	Std. Error
GT	Surface	54	50.148	12.3958	50.642 ^a	1.276
	Deep	45	54.700	12.4793	53.779 ^a	1.400
GN	Surface	65	58.338	10.8430	59.267 ^a	1.326
	Deep	35	62.300	9.1845	61.652 ^a	1.447
GTN	Surface	50	55.150	7.8800	55.139 ^a	1.166
	Deep	42	56.179	12.3939	55.645 ^a	1.586

The results of the two-way ANCOVA are shown in Table 6. It was found that there was no significant interaction effect between the treatment modes and the learning approaches, $F(2, 284) = 0.488, p = 0.614$. This indicates that the students’ learning approach did not affect the posttest scores among the three treatment modes. In other words, the effect of the treatment modes on the posttest scores did not depend on the learning approaches. Therefore, this hypothesis was supported. Although there was no significant interaction effect between the learning approaches and the treatment modes related to the mean posttest score, there were differences among the treatment modes for students of different learning approaches. Students with surface and deep learning approach who were exposed to the GN mode had a higher adjusted mean posttest score than the GT mode and the GTN mode. This is shown in Table 7.

DISCUSSION

The GN mode had a significant positive effect on learning. Students who were exposed to the GN mode significantly outperformed the students who were exposed to the GT mode. Students who were exposed to the GN mode also significantly outperformed the students who were exposed to the GTN mode. However, students who were exposed to the GTN mode significantly outperformed students who were exposed to the GT mode.

Students who were exposed to the GN mode obtained significantly higher mean posttest scores compared to students who used the GT mode. This result was supportive of the positive value of the modality principle or modality effect as proposed by Clark and Mayer (2008). The modality principle claims that students learn more effectively from graphics and narration than from graphics and on-screen text. This principle is based on the assumption that when graphics and words are both presented visually (i.e. graphic and on-screen text), the pictorial channel becomes overloaded whereas the verbal channel is not used at all. But when the written text is converted to spoken narration, it can be processed in the verbal channel, thus leaving the pictorial channel to process only the graphics. In this way, the information processed through the two channels are balanced and neither one of the channel is cognitive overloaded. This result is explained by the limited-capacity assumption of Mayer’s cognitive theory of multimedia learning (2009). Indeed, this assumption that emphasizes the importance of not overloading the visual and verbal channel is closely associated with Baddeley’s (1986) working memory model, Paivio’s (1990) dual-coding theory, and Sweller’s (2005) cognitive load theory.

Moreover, the GN mode provided equivalent benefits to both the surface-approach students and the deep-approach students. This was confirmed by the statistical results that the posttest scores of the deep-approach students did not differ significantly from the posttest scores of the surface-approach students of the same mode. This indicates that students benefit more in the GN mode irrespective of their different learning approaches.

The use of graphic novel and audio narration to explicitly present the historical scenario helped the students to stay oriented in the GN mode greatly and reduced the students' need to use their existing limited cognitive capacity. In the GN mode, the way for students to understand the spoken words was through the verbatim instruction method (audio narration). Students are able to listen and think rather than to read and memorize. This reduces the extraneous cognitive load imposed on the limited cognitive resources of the students, which subsequently enables the surface and deep approach students to spare most of the cognitive resources to build referential connections for comprehending the historical content. Whereas for those in the GT mode and the GTN mode, the students were compelled to exert an extra cognitive load in order to comprehend the on-screen text. They devoted their mental resources to activities not directly related to learning. Thus, the surface and deep-approach students of the GN mode significantly outperformed their counterparts in the GT mode and GTN mode. The GN mode was suggested to optimize the information-processing rate of both the surface and deep-approach students.

The finding that both the surface and deep-approach students in the GN mode significantly outperformed their counterparts in the GT mode and GTN mode may also be explained within the context of the motive and strategy approaches to learning by John Biggs (1987). It is possible that in this study, the use of the multimedia graphic novel with thought provoking questions as suggested by the TLH model (Mandell & Malone, 2007) challenged both the surface and deep-approach students to understand the learning task which eventually encouraged them to focus their attention on the content as a whole, try to see the connections between different parts and think about the structure as a whole. In doing so, the GN mode facilitated their learning strategies of seeing, hearing and doing through the rich information provided. This indicates that the GN mode is more successful in assisting the surface approach students to learn effectively, to think aloud over the historical information rather than utilizing rote learning and studying mechanically.

In other words, the GN mode did not prohibit the adoption of a deep learning approach but enabled the surface learning approach students who preferred rote learning to adopt the deep learning approach. This is consistent with the studies by Cope and Staehr, (2005) and Hamm & Robertson (2010) which stated that incorporating a multimedia-based learning environment promotes a deep learning approach.

Marton and Saljo (1976), Dart et al (2000) and Diseth (2007) are a few of those who emphasized that individual learning approaches are highly sensitive to the learning context. In other words, the students' learning approach is influenced by their perception of the learning environment. The findings of this study support this view. The structure and context of the multimedia graphic novel constructivist learning environment tends to stimulate the students' higher cognitive skills such as analyzing, and synthesizing and evaluating history contents promotes active and independent learning which the students' perceived as safe and supportive. In this regard, the GN mode has a positive influence on the level of deep learning which ultimately affects students' performance. This explains the finding that surface and deep-approach students in the GN mode performed better than the surface and deep-approach students in the GT mode and GTN mode.

The fact that the posttest scores in the GN mode showed statistically significant differences compared to the GT mode and the GTN mode could mean that the aforementioned environment positively supported the GN mode. As such the students could analyze, synthesize and evaluate the history contents and thus improve and enhance their critical thinking skills in history learning. It is possible that the GN mode of treatment in this study fulfilled the concept of active and meaningful learning which engaged the students to go through the learning content which was best suited to their learning approach and abilities. Therefore, the GN mode was able to support better learning irrespective of the students with different learning approaches. This finding supports the view that emphasizes the need for students to develop ways of processing information from the surface approach to deep approach for higher quality learning outcomes (Swanberg & Martinnsen, 2010; Yilmaz & Orhan, 2010).

CONCLUSION

This study aimed to investigate the effects of the three treatment modes of multimedia graphic novel among students with different learning approaches. The results of this study showed the positive effects of the GN mode. Surface-approach students obtained higher motivational scores from the three treatment modes as compared to the deep-approach students. Although the deep-approach students obtained slightly higher performance scores compared to the surface-approach students in the GN mode, the statistical results showed no

significant difference. This implies that the GN mode provided equivalent benefits to students irrespective of their different learning approaches.

This indicates that the GN mode could be an effective instructional design to facilitate history teaching. The use of the GN mode with appropriate audio-visual, presented graphically, appears to be an effective way to guide students to focus on the important facts in history, analyse and evaluate the historical content critically. Thus, the students are provided with a rich opportunity to work accessibly with both visual and audio representation graphics of complicated historical facts and to see the relationship between the various parts. The GN mode with a repertoire of graphic novel and audio narration was able to re-enact the actual scenario of Japanese Occupation of Malaya during War World II which would otherwise be quite difficult to capture using the textbook. The outcome of this study provides a strong justification that the GN mode makes an effective utilisation of the creative and innovative ways of using multimedia design principles to make learning effective.

In addition, this study has provided an appropriate and feasible instructional design theoretical framework for the design and development of the multimedia learning material. Mayer's (2001; 2009) cognitive theory of multimedia learning and Sweller's (1999) cognitive load theory were used in the design features and procedures to enhance learning; Keller's ARCS model (Keller, 2010) was used to ensure that the motivation aspects were featured in the multimedia learning environment; while Mandell and Malone's (2007) Thinking Like A Historian (TLH) model enabled a constructivist learning environment that promotes critical thinking skills in history learning rather than rote learning. Therefore, the successful development of the multimedia graphic novel-based learning environment resulted in the development of a framework that can be used to guide the design and development processes of other multimedia graphic novel instructional material.

In conclusion, the potential for multimedia instruction in history learning remains high. Multimedia graphic novel should be considered in the design and development of multimedia history courseware. However, in order to effectively develop these rich potential of the learning environments afforded by multimedia technology, data from this study tempers this enthusiasm by reminding us of the need to design instructions that are consistent with psychological principles about how people are motivated to learn in order to develop an effective and potential learning environment to support the desired learning outcomes.

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