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Cultivating Interest in History and Culture using Augmented Reality for Elementary Students

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Abstract: Local history and culture are vital elements shaping the identity of a society and its civilization. Yet, the appreciation of local history and culture among the younger generation are decreasing, where this could be observed in the social or history classes offered in schools. In Taiwan, elementary schools would organize field trips visiting local historic sites to encourage and improve students' appreciation of the local history and culture. Past research had shown that technology could assist in engaging and motivating students to better appreciate the history and culture. Hence, a design based research was conducted with the objective of cultivating students' interest and increasing their appreciation towards the local history and folk culture by designing an augmented reality application which used the strategy of situated learning and critical thinking in designing the learning content and assessment. After conducting two iterations, the research found that after using the designed application, students' interest in local history and culture had increased, and the students were engaged in the learning process as the situated learning strategy and critical thinking questioning were applied.

Keywords: Design based research, History and culture, Situated learning, Critical thinking, Augmented reality

1. Introduction

Understanding the local history and preserving its folk culture are important elements for the inheritance of future generations. The appreciation of the historic value and folk culture are interests that should be cultivated in the younger generation at an early age. However, most of the younger generation are in the opinion that history and culture were "meaningless recitation of names, dates, and facts" (Squire & Barab, 2004, p. 506) and often do not recognize nor appreciate the importance of these folk cultural practices. Most students are in the opinion that social class which covers history and cultural learning are "the most boring" subject in schools (Loewen, 1995; Squire & Barab, 2004), including students in Taiwan. In order to mitigate this problem, most elementary schools in Taiwan would organized field trips and visits to historical landmarks and villages with the aim of cultivating students' appreciation of local culture and history. Past research had shown that by integrating technology into the learning process of the social class would increase motivation and engagement of students in learning and understanding the historic and cultural elements of the class (Squire & Barab, 2004; Chang, & Hwang, 2014). These research had shown that with the usage of technology in the learning process during the field trip, this could promote students' appreciation of local culture and history (Chang & Hwang, 2014).

With the current rapid development in the work field and industry, critical thinking was no longer deemed as a preferable skill of the elite group, instead it is considered as an essential competency required in each individual in order for them succeed in their respective fields (Kettler, 2014; Kay, & Greenhill, 2011). Therefore, along with the advancement of technology in augmented reality and its increasing popularity among the younger generation, this research's objective was to utilize augmented reality in designing a learning system on the topic of history and culture, complimented with critical thinking questions regarding these historic and cultural topics, to promote

students' interest and appreciation towards local history and culture. The research questions of this research were

(1) How does the designed learning system assist in instilling interest in students on the topic of history and culture?
(2) How does situated learning affect the students' critical thinking thoughts as compared to classroom setting?

2. Literature Review

Design based research is a combination of "empirical education research with theory-driven design of learning environments" which "help create and extend knowledge about developing, enacting and sustaining innovative learning environments" (The Design-Based Research Collective, 2003, p. 5). As proposed by The Design-Based Research Collective (2003), design-based research consist of five characteristics: (1) Learning environment and theory development are closely associated during the designing process; (2) Continuous improvements are made through different cycles of design, analysis and redesigns; (3) Research's design would share theoretical suggestions that would be useful for practitioners and for future research; (4) Research should clarify reasons the research design conducted in authentic settings are appropriate, sharing its success and failure, identifying its interaction with students and its learning issues; (5) Methods used in the research design are documented along with the processes resulting to the research's outcome. This research utilized design based research in order to identify elements of the designed learning system which were effective in promoting students' interest and appreciation towards local history and culture, and examined elements which were less effective as they were expected.

Situated learning involves having students experiencing events and learning regarding a topic in its actual environment, and applying what was learnt to solve problems which occurs in the environment itself (Dawley, & Dede, 2014). Past research had found evidence on the importance of situated learning which enabled students to learn and experience the learning topic in its authentic settings, and providing students with the opportunity to solve problems involved in its real environment (Chu, Hwang, Tsai, & Tseng, 2010). Hence, this research utilized the situated learning strategy in designing the learning content on local history and culture, and to provide students the opportunity to learn about the local history and culture at the actual site, facilitated with the designed application.

Critical thinking is one of the essential 21th century skills (Kay & Greenhill, 2011). Facione (1990) defined critical thinking as "purposeful, self-regulatory judgment which results in interpretations, analysis, evaluation and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or conceptual consideration upon which that judgment is based (p. 3)." Critical thinking consist of six sub skills (i.e., interpretation, analysis, evaluation, inference, explanation, self-regulation) which involves understanding and analyzing claims and arguments, assessing the credibility of the statement, identifying required items in order to draw reasonable conclusions, and explaining the reasons behind a judgment made (Facione, 1990; Lai, 2011). Based on Facione's (1990) definition of critical thinking and its sub skills, past research had used different methods in designing critical thinking assessments for elementary students, i.e., written assessment using comic script, vocal assessment using story-telling (Gelerstein et al., 2016; Lin et al., 2017). This research designed critical thinking questions based on local history and culture in order to examine the effect of students' thoughts during classroom setting and during situated learning setting.

In the recent years, the amount of attention allocated on the application of the augmented reality in education is increasing rapidly along with its popularity (Tăbușcă, 2015; Liou, Yang, Chen, & Tarng 2017). Augmented reality involved having an application embedding and integrating the digital information into the real environment, resulting in a better simulation which would improve and engage students during the learning process (Tăbușcă, 2015). Past research had shown that augmented reality could improve and enhance the students' learning process and experience (Chiang, Yang, & Hwang, 2014). As mentioned by Chu et al. (2010), "it has become an important and challenging issue to place students in a series of designed lessons that combine both real-world and

digital-world learning resources" (pp. 1619). Therefore, in order to implement the situated learning strategy into the designed application, augment reality was used to facilitate and improve the learning strategy, and to engage students in the learning process.

3. Design Based Research (DBR) Design

The objective of this research was to utilize augmented reality in designing a system to learn about the local history and culture. In order to achieve this, Blippbuilder by Blippar was used in building the augmented learning contents of the system. The research's system consist of a quiz for each learning topic, these questions were critical thinking questions regarding these historic and cultural topics. Prior to the research, a demand analysis was conducted by having a discussion session with the elementary school teacher to understand the current measures used by the school in inspiring students to be interested with the topic. Some of the activities included:

- The school organized field trips for students to visit different places of interest throughout the year. In order to enrich the students' experience during their visits, the teachers would design activities or games around these landmarks, including station games, treasure hunt and sports day.
- During the field trip, local spokespersons or local business owners were invited to have a sharing session with the students to talk about the significance of the local history to other fields. After each session, students were allowed to ask questions about the topic if they had any inquiries.
- With the readily available platform of Google, teachers also utilized tablets and Google Classroom to create quiz to ensure students paid attention during the field trip and managed to understand the basic concept of the landmark's history.

During these field trips, the teacher shared that students were not interested with the content of the field trip (i.e., the guide or tour around the landmark, the key information of the landmark and local culture). The teacher observed that students were more interested in the games or activity prepared and they seem to lose their focus on the local history and culture, causing failure to achieve the objective of the field trip. As these field trips were only organized few times a year with limited number of participants, hence the appreciation of local history and culture was not conducted continuously.

With the input from the teacher, this research conducted a design based research was conducted with the aim of instilling interest in local history and culture among elementary school students. This research consisted of two phases, with Phase 1 addressing the issues identified in the demand analysis which was shared by the elementary school teacher, and Phase 2 addressing the issues observed during Phase 1, and the feedback received from the students and teachers (as shown in Figure 1).

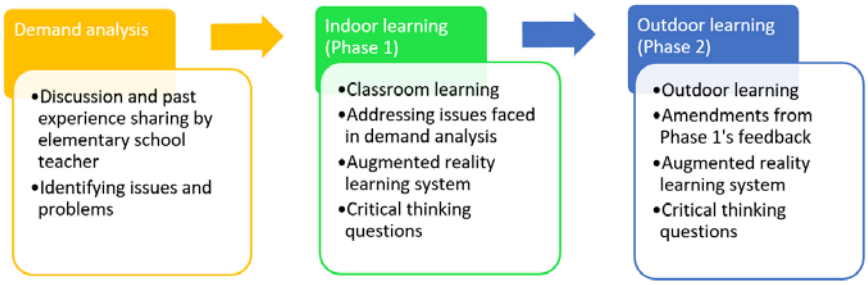

Figure 1. Research process.

3.1. Participants

The participants of this research were students from two elementary schools, each from Kaohsiung and Taichung city. The students were from Advanced Placement (AP) classes of their schools, ranging from Grade 3 till Grade 6. There were a total of 14 students from the Kaohsiung school and 13 students from Taichung, making it a total of 27 students for this research.

4. History and Culture Learning in Classroom (Phase 1)

For the first phase of the research, the learning content were cultural inheritance and historical sites of Tainan. Four learning topics were selected, including "Dan-Tsu noodles," "coffin bread," "Fort Provintia" and "Old Tait & Co. Merchant House." Considering that the students were from Kaohsiung and Taichung city, they would be unfamiliar with the culture and history of Tainan city.

4.1. System Design

The research utilized the Blippar app which was installed on Android tablets supplemented with headsets for the browsing of multimedia material during the learning process. The research's system was mainly designed by using Blippbuilder by Blippar which enables users to design and customize augmented objects or images corresponding to each target markers. The quiz was built on a webpage using the database system of MySQL to collect real time feedbacks or answers from students. The research required students to use the Blippar app to scan markers from the learning sheet that indicated each learning topic to begin the learning session (shown in Figure 2a). After scanning the marker from the learning sheet, the app would display the augmented image of the item or landmark along with two buttons of selections, (1) *Tour*, and (2) *Quiz* (as shown in Figure 2b).

Figure 2. (a) Learning sheet; (b) Scanned results from Blippar.

The *Tour* portion provided and introduced students with the knowledge and information on the learning topic, including significant historical events of the landmark, the origin of the culture practiced, the background story of building of the local business, and the production process of the local delicacy. Prior to the research, these information of the learning topics were shared and discussed with teachers of the elementary schools, and were verified to be accurate and were suitable for students. The "Tour" portion was built using Blippbuilder by Blippar, portraying the collective information regarding the learning topic which were displayed in the form of a short presentation with write ups on the important key points or time stamps of events regarding the learning topic, supplemented with different images of the learning topic. These information were spread into several pages, depending on amount of information of the learning topic. After the students had completed reading and understanding each page, they would click on the "Next" button to move on. For each learning topic, an informational video were embedded at the end of the learning session to further compliment and enrich the learning content. For example, for the "Dan-Tsu noodle," the information on origin and history of noodle were shared with students, along with a short video on the background story of the noodle which were embedded in the Blipp.

As for the *Quiz* portion, for each learning topic, five questions were designed in accordance to the five sub skills of critical thinking (i.e., Interpretation, Analysis, Evaluation, Inference, and Explanation). These questions were discussed with the elementary teachers to determine their appropriateness and relevance to the learning topics. With four learning topics, the total number of questions were 20 questions, with four questions for each sub skills. For the questions on the sub skills of critical thinking "Interpretation" and "Analysis," the relevant information to assist students in answering these questions were provided in the "Tour" portion, either in the short presentation or short video. Questions for "Interpretation" and "Analysis" skill were mostly multiple choice questions or short answer questions. As for the sub skills of critical thinking "Evaluation" and "Inference," questions designed required students to provide short written answers which would be relevant to the learning topic. For the questions on the critical thinking sub skill "Explanation," students would be required to provide a short essay in explaining their answers and they were encouraged to be as thorough as possible, providing as much relevant details as possible. Students could utilize the keyboard (using the function of typing in or writing on) or Google's speech-to-text function to input their answers. These questions were designed on a webpage with the hyperlink inserted in Blippar. The data of the question's input from students were collected and monitored in real time through the database built on the webpage (i.e., MySQL).

4.2. Research Process

Before starting the experiment, students were provided with an Android tablet installed with Blippar, a learning sheet and a headset. A briefing session was conducted to introduce the usage and function of Blippar, and the research procedures. Students were then led to use Blippar to scan the marker of the learning topic on "coffin bread" and to begin with the "*Tour*" of the learning topic on "coffin bread." Students were reminded to watch the short video and were informed that they could replay the presentation and video again if they were unclear. After completing the "*Tour*," students would complete the "*Quiz*" of the learning topic which consist of five questions. With the completion of all five question of the learning topic's quiz, students would then move on to the next learning topic. In order to activate the next learning topic, students would then use the Blippar app to scan the next target marker on the learning sheet. Once the students had completed all four learning topics, they would be required to complete a feedback questionnaire. The whole session was one hour with the research taking place inside the classroom. Students from two school completed this experiment at separation sessions in their respective schools.

4.3. Results

The total input received from the participants of both schools for Phase 1 was 27. As there were four learning topics with each consisting five questions matching with the critical thinking sub skills (Facione, 1990), the total score for the quiz was 20. For each question, the students would receive the score "1" given that the answers provided were correct (for multiple choice questions) and fulfilled the criteria of the critical thinking skill intended to be capture through each questions (i.e., interpretation, analysis, inference, evaluation and explanation), else they would be scored as "0." The students' answers for the quiz were evaluated and scored among two researchers whereby the Cohen's Kappa coefficient was maintained above 0.9 and the Cronbach's alpha for the Phase 1 quiz was 0.84. As shown in Table 1, the mean score of the quiz for both school are 12.55 and 12.31 respectively, with t-value of 0.32 ($p > .05$). This indicated that there were no significant difference in the students' performance for both schools. However, there was significant difference in the students' performance in terms of their grade (as shown in Table 2). The students higher grades (i.e., Grade 5 and 6) would perform better compared to the students of lower grade (i.e., Grade 3 and 4). As the students' grade increases, the mean score of the quiz would increase, indicating that the questions designed for this research was with suitable difficulty that was capable of differentiating the students' ability in terms of their grades.

After completing the all four learning topics, students were required to complete a feedback questionnaire. The questionnaire consisted of seven questions with five questions that were measured by using a 5-Likert scale (i.e., Strong Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly

Disagree = 1) and two open-ended questions. A summary of the students' opinions collected from the feedback questionnaire was shown in Table 3. From the input of the feedback questionnaire, it was found that student were in the opinion that this application enabled them to understand and learn about Tainan's culture and history in an easier and more interesting manner. They expressed that they would prefer to have more information on the topic which showed that the research design had instill interest in students. Besides that, students found the critical thinking questions design in the application allowed them to actually think deeper instead of searching for the answers from the information provided. Most students believed that it might be better if the learning session could take place at the landmark itself complimented by the usage of the application. By taking into account the feedback shared by the teacher and students, the necessary amendments were made in Phase 2 of this research to further improve the application and learning setting for the students.

Table 1: Independent sample *t*-test on the quiz results for Phase 1 by school.

School	N	Mean	SD	*t*-value
1	14	12.55	2.24	.32 (p = .755)
2	13	12.31	1.62	
Total	27	12.43	1.93	

Table 2: Independent sample *t*-test on the quiz results for Phase 1 by grade.

Grade	N	Mean	SD	Grade level	N	Mean	SD	*t*-value
3	2	10.30	0.14	**Lower**	17	11.70	1.97	-2.93** (p = .007)
4	15	11.88	2.03					
5	4	13.25	0.98	**Higher**	10	13.68	1.05	
6	6	13.97	1.08					

Table 3: Result of the feedback questionnaire for Phase 1.

Feedback questions	Results
1. This application enables you to understand more about Tainan's culture and history.	4.08
2. The design of application fits your learning style.	3.42
3. By using this application in the classroom, it would allow you to be more concentrated, as compared to being outdoor.	3.00
4. By being physically at the landmarks in Tainan, it would assist you in solving the questions asked in the application.	3.69
5. The questions in the application would stimulate you to think more.	3.88
6. What improvement could be done by this application in order to make it more enjoyable?	
▪ The questions could be more challenging ▪ Increase the number of learning topics ▪ More information and further	▪ Learning could take place outdoor ▪ Enrich the learning materials to make it more interesting ▪ Separate the learning information and

explanation could be provided ▪ Pictures could be included in the question section	videos ▪ Games could be included ▪ Interaction or feedback could be provided
7. In your opinion, what are the benefits of learning with this application?	
▪ Learn and understand more about Tainan's history and folk culture ▪ Enjoyed that it allowed me to think of the answers instead of providing information for me to look for the answers. ▪ Different from what we learn in class and it shared some interesting facts that I hope to understand further	▪ Interesting and simple method of learning history and culture as I don't have to memorize and easy to remember ▪ I don't need to go outdoors and I could see the landmarks and actual food comfortably in the classroom

5. Outdoor History and Culture Learning (Phase 2)

For the second phase of the research, the learning content were cultural inheritance and historical sites of Qishan, Kaohsiung. This location was selected in conjunction with the joint field trip organized by both schools. Similarly with Phase 1, four learning topics were selected which consist of "Qishan train station," "Youth Banana", "Banana cake" and "Traditional Chinese seal."

5.1. System Design

Phase 2 of the research similarly utilized the Blippar app installed on Android tablets with headsets, with the application designed by using Blippbuilder by Blippar and the quiz built on a webpage using the database system of MySQL to collect the feedbacks or answers from students. The quiz for this phase was similar with Phase 1 whereby five questions were designed for each learning topic in accordance to the five critical thinking sub skills whereby either multiple choice questions or short answer questions were designed for "Interpretation" and "Analysis." As for "Inference" and "Evaluation," short answer questions were prepared, and short essay questions were designed for "Explanation." These questions were discussed and verified by the elementary school teachers to ensure the correctness of the sentence structure and suitability of the question's level of difficulty.

After considering the feedback received by students and the suggestions from the teachers during the Phase 1 of the study, several amendments were made. (1) The interface of the learning topic were redesigned whereby there would be several learning sections for students to choose from instead of fixing the learning process to a certain flow. For example, for the learning topic on "Qishan train station," students could choose to learn about the special features of the train station, the history of the train station, and the story behind the railway with no fixed sequence (as shown in Figure 3a) and they may revisit them if required. A short video clip regarding the learning topic was included in each learning topic. (2) The research was conducted outdoor where the markers were items or sign boards that were located at the landmark of the four learning topics. The marker images were shared with students in a map with the partial image of the markers displayed (see Figure 3b). (3) Students participated in designing the application interface and the map used for the research. This was done by including the artwork prepared by students in the application in order to create a sense of participation and belonging among students. (4) An additional creative activity was included into the research which would require students to create and design an item in accordance to the assignment given. For example, for the learning topic on "Qishan train station," students were assigned to create a train that

contains special features of Qishan. This task was completed using the application Sketch. (5) Questions were labelled with their score of 2 (for "Interpretation" and "Analysis"), score of 5 (for "Inference" and "Evaluation"), and score of 8 (for "Explanation"). This was to provide students with a sense of the amount of input expected of them for each of these questions.

Figure 3. (a) Interface in Blippar; (b) Map of the learning topics' location; (c) Student watching the short video of the learning topic.

5.2. Research Process

For Phase 2 of the research, it was conducted outdoor at Qishan, Kaohsiung. The participants of Phase 2 were there same group of students from Phase 1, excluding one student who was absent, making it a total of 26 participants. Students were divided into four groups where two groups had six students and another two groups had seven students. A researcher and a teacher were assigned to each group to lead and assist the students throughout the learning process. Each group would begin from a different landmark in order to avoid overcrowding. Each student was provided with an Android tablet with Blippar and Sketch installed, and a headset (as shown in Figure 3c). Before departing towards their first landmark, students were required to watch a short briefing clip on the tablet which would explain the research flow, their learning goals and ways to use Blippar and Sketch. Students were reminded that all learning sections were important and they were required to complete two tasks, (1) the quiz, and (2) the creative activity. They were required to inform the researcher once they had completed both activities at each landmark. Once every member of the group had completed all the tasks of the learning topic, they would move on towards their next landmark. Students had 20 minutes to complete each learning topic and both activities. After the students had completed all four learning topics, they would be required to complete a feedback questionnaire. The total duration of the learning session for Phase 2 was two hours.

5.3. Results

For Phase 2, the total participants' input received was 26. Similar with Phase 1, the total number of question for four learning topics were 20, with five questions for each learning topic. The scoring scheme for Phase 2 was similar with Phase 1 whereby score "1" was given if the answers provided were correct and satisfied the criteria of the critical thinking sub skill of the question. The students' answers for the quiz were evaluated and scored among two researchers with the Cohen's Kappa coefficient was maintained above 0.9 and the Cronbach's alpha for the Phase 2 quiz was 0.80. For the mean score for the quiz in Phase 2, there were no significant difference between the lower and higher grade students (see Table 4). Students shared that they enjoyed the critical thinking questions asked in the application as it allowed them to think about the issue and structure their answers accordingly. However, for the students' outdoor quiz performance, it was noticed that students did not perform better as compared to when they were indoor. It was observed that students were not as focus and concentrated when they were completing the critical thinking questions when they were outdoor.

After completing the all four learning topics, students were required to complete a feedback questionnaire. The questionnaire consisted of nine questions with six questions that were measured by using a 5-Likert scale (i.e., Strong Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree = 1) and three open-ended questions (shown in Table 5). From the feedback questionnaire, it was

found that in general students had positive feedbacks after using the application to learn about local history and culture on site. The results showed that students preferred learning on site more as compared to learning in the classroom. Students shared that by being at the actual location of the learning topic with the assistance of the application could assist them in their learning process as they could witness the surroundings of the landmark, communicate with the people around the landmark, and speak to the owner and ask follow up questions. This would provide students with a stronger impression of the learning topic and they would have a personalized experience at the landmark. Students shared that the application had contributed in instilling their interest in local history and culture.

Table 4: Independent sample *t*-test on the quiz results for Phase 2 by grade.

Grade	N	Mean	SD	Grade level	N	Mean	SD	*t*-value
3	2	8.60	1.13	**Lower**	16	8.44	2.24	-1.47 (p = .154)
4	14	8.41	2.39					
5	4	9.60	1.77	**Higher**	10	9.70	1.92	
6	6	9.77	2.18					

Table 5: Result of the feedback questionnaire for Phase 2.

Feedback questions	Results
1. This application enables you to understand more about Qishan's culture and history.	4.36
2. The design of this application fits your learning style.	4.08
3. By using this application outdoor, it would allow you to be more concentrated.	4.00
4. By being physically at the landmarks in Qishan, it had assist you in solving the questions asked in the application.	4.00
5. The questions in the application would stimulate you to think more.	4.28
6. Compared with the previous session in the classroom, using the application outdoors had assisted you in learning.	4.08
7. What improvement could be done by this application in order to make it more enjoyable?	
▪ More video could be included ▪ Lesser open-ended questions as it takes time to complete	▪ Make it a competition among students ▪ Creative activity could include other activities like photography or games
8. In your opinion, what are the benefits of learning with this application?	
▪ Get to be at the actual landmark and understand its surrounding environment ▪ It made me more interested to know more about the local history and culture ▪ I enjoyed the questions asked in the application as it makes me think	▪ Get to speak to the people or owner of the shop to understand further ▪ It improve my learning as it was easy to understand ▪ Got a better impression of the learning topic
9. Compared with the previous session in the classroom, what are the benefits of this session and	

what are some improvements that could be made?	
Benefit: ▪ Could get a better view of the item as compare to viewing it on the tablet ▪ Get to see the actual item ▪ Easier to understand and have my own experience about the learning topic	Improvements: ▪ Internet connection could be improve ▪ Markers were difficult to scan as compared to in classroom ▪ Hands-on activity at the landmark could be inserted into the learning as well

6. Discussion

This research aimed to cultivate students' interest in local history and folk culture by designing an augmented reality application supplemented with critical thinking questions on the history and culture learning topics. A design based research with two phases was conducted to examine effective elements of the learning system and identify items that could be further improved. For Phase 1 of the research, after using the application, the students' feedbacks on their learning experience were positive. Students shared that the application allowed them to learn and understand more about the local history and folk culture. They enjoyed learning and showed great interest about history and culture using this application as it was different from the method they usually used to learn in classrooms. Students emphasized that they enjoyed the learning process and content provided in the application and they suggested that more relevant information could be included, especially since they were intrigued by the existing content and wanted to understand further. This showed that this application played the role of cultivating interest in students on local history and culture. As for the critical thinking questions, most students enjoyed this change of questioning as they were required to think about the topic or issue and share their thoughts and opinions regarding the topic or issue, instead of memorizing the learning content provided and search for the correct answers. The answers of the open-end question received from students in Phase 1 were mainly well-structured and logically explained. There were several improvements suggested by students and teachers which were implemented in Phase 2. This included the improvement on the interface of the application to be more user friendly, additional creativity activity were included, including students to take part in the application designing process, switching the learning environment from the classroom to the actual landmark, and the scores for each question were clearly labelled.

From the results of the feedback questionnaire received from Phase 1 and Phase 2 of the research, students were in the opinion that Phase 2 was better than Phase 1. Many students pointed out that being at the actual site of the historic landmark allowed them to have a clearer understanding of its significance and provided them with a better impression of the local history and folk culture. After learning from the application, it was observed that students would seek for further explanation from the people or shop owner. This portrayed that students gained interest of the history and culture of the landmark and they took the initiative to seek for further clarification. By doing so, students would had created their own learning experience and this would benefit other students of the group as this would inspire interest among peers. Students suggested that in future the learning process could insert the element of competition among students or group into the application, as this would increase students' motivation and increase their eagerness in completing the learning process. Furthermore, teachers and students suggested that more hands on activity could be included in the learning process at the actual site.

By comparing the results of the quiz for Phase 1 and Phase 2, there was a significant difference between both results whereby students performed better in Phase 1 (i.e., classroom setting). This may be due to the design of the critical thinking questions in the quiz that required students to think about the situation or issue, and share their reasoning and thoughts regarding the issue. In Phase 1, students completed the quiz in a quiet and comfortable environment where they could focus on their thoughts and ideas, and clearly type and structure their answers. Teachers suggested that for

outdoor learning, it may be better to have less open-ended questions as students tend to be less concentrated and easily distracted by their surroundings, or a separate session could be included where students could sit down and calmly answer these open-ended questions. For both phases, students were allowed to use different methods to input their answers into the application (i.e., by typing, using Google Speech-to-Text, writing the Chinese characters on the screen). It was found that students were unfamiliar with text input methods on the tablet, hence it takes them a longer time to input their answers. Some students faced difficulty in inputting their answers as they were unfamiliar with the input method of the keyboard. This could had contributed to lowering their performance in the quiz.

7. Conclusion

This research's objective was to cultivate and instill interest and appreciation in students on the local history and folk culture. In order to accomplish the objective, an augmented reality application was designed which utilized the situated learning strategy and complimented by critical thinking questions as a quiz of the learning topic. The findings of the research showed that this research was successful in inspiring students on the importance of the local history and folk culture as students expressed their interests on the learning topic and urged for more information. The results of the research provided some useful insights that could assist future researchers in designing their learning content and application. The augmented reality application, Blippar, was used in this research. Teachers found that this application was easily customizable and it was user friendly. The application allowed teachers to easily design augmented items for their classes, and the Blippar platform did not require the user to have programming skills. Furthermore, Blippar is operational on both Android and iOS operating system. For future research, further improvement based on the input received from the students and teachers of this research in Phase 2 could be explored. As Gelerstein et al. (2016) and Lin et al.'s (2017) research utilized comic and children's story to measure student's level of critical thinking skill, this research had provided another alternative approach in measuring the level of the skill.

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