From Text-based to AR-based: an investigation of students' motivation in learning history topics for secondary school*

Del Texto a la Realidad Aumentada: una investigación de la motivación de los estudiantes para aprender temas de historia para la escuela secundaria

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ABSTRACT

History is a subject to which students may be resistant due to the nature of the content and the length of the texts involved. Studies had also shown that for this subject, students find it difficult to memorize facts and events. However, technologies may help to improve students' learning, if designed in a meaningful way. Augmented Reality (AR) has been widely used in many areas in enhancing students' learning and understanding. Among the advantages of AR is that it offers a fun way of learning and also triggers learners' motivation to learn abstract topics. This study aims to examine the challenges students face in learning history and their views on the use of AR-based learning materials in history. This single case study involved a group of form four students (16-year-old secondary school students) who scored less than 40 percent during their early year assessment. The data for this research was collected through one-to-one semi-structured interviews with all the respondents. The findings indicate factors the made learning History a challenge to the students. However, students showed positive feedbacks on the use of AR-based booklet. This paper further discusses the benefits of AR-based material to enhance students' engagement as well as the limitations of AR-based integration in teaching and learning. The findings of this study also highlight the importance of learning activities designed by educators to ensure that the planned activities have a positive impact on students' meaningful learning.

Keywords: Argument Reality, Motivation, History, Technology, meaningful learning.

RESUMEN

La historia es un tema al que los estudiantes pueden resistirse debido a la naturaleza del contenido y la longitud de los textos involucrados. Los estudios también han demostrado que para este tema, a los estudiantes les resulta difícil memorizar hechos y eventos. Sin embargo, las tecnologías pueden ayudar a mejorar el aprendizaje de los estudiantes, si se diseñan de manera significativa. La Realidad Aumentada (AR) se ha utilizado ampliamente en muchas áreas para mejorar el aprendizaje y la comprensión de los estudiantes. Una de las ventajas de AR es que ofrece una forma divertida de aprender y también activa la motivación de los alumnos para aprender temas abstractos. Este estudio tiene como objetivo examinar los desafíos que enfrentan los estudiantes en el aprendizaje de la historia y sus puntos de vista sobre el uso de materiales de aprendizaje basados en AR en la historia. Este único estudio de caso involucró a un grupo de cuatro estudiantes de forma (estudiantes de secundaria de 16 años) que obtuvieron menos del 40 por ciento durante la evaluación de principios de año. Los datos para esta investigación se recopilaron a través de entrevistas semiestructuradas uno a uno con todos los encuestados. Los hallazgos indican factores que hicieron del aprendizaje de la Historia un desafío para los estudiantes. Sin embargo, los estudiantes mostraron comentarios positivos sobre el uso del folleto basado en AR. Este documento analiza los beneficios del material basado en AR para mejorar la participación de los estudiantes, así como las limitaciones de la integración basada en AR en la enseñanza y el aprendizaje. Los resultados de este estudio también destacan la importancia de las actividades de aprendizaje diseñadas por educadores para garantizar que las actividades planificadas tengan un impacto positivo en el aprendizaje significativo de los estudiantes.

Palabras clave: Realidad del argumento, Motivación, Historia, Tecnología, aprendizaje significativo.

INTRODUCTION

It is an undeniable fact that learning with the assistance of technology has been proven to enhance students' motivation (Tekedere & Goker, 2016; Zakaria & Khalid, 2016), has an impact on students' learning capabilities (Koutromanos, Sofos & Avraamidou, 2015; Daud & Khalid, 2014), and increases students' understanding of the topics they learn (Coimbra, Cardoso & Mateus, 2015; Herron, 2016; Joan, 2015; Kysela & Storkova, 2015, Khalid et al., 2014). However, despite the rapid growth in available technology for teaching and learning, teachers in schools still practice traditional methods that focus more on teachers as the source of knowledge (Yusuf Hashim, 2015; Mohiddin & Khalid, 2014). Traditional approaches such as the use of static hardcopy books, however, have been found to be less interesting due to their inflexibility, and are less effective in promoting active learning (Rongting et al., 2017; Zhu, 2016). Among the current technologies that have vast potential in promoting more meaningful and fun learning is Augmented Reality (AR) (Saidin, Halim & Yahaya, 2015; Uluyol & Sahin, 2016). AR refers to "human-computer-interaction, which adds virtual objects to real senses that are provided by a video camera in real time" (Ludwig & Reimann, 2005, p. 4); in other words, AR is a technology that "allows computer generated virtual imagery to exactly overlay physical objects in real time" (Zhou, Doh & Billinghurst, 2008, p. 193).

Researchers in this area have proven that AR-based material has been found to raise students' motivational levels, and to have a positive impact on learning experiences, especially for weaker students (Liberati, 2016; Vidal et al., 2016; Dieck & Jung, 2017). Learners who use AR materials are also reported to show improvements in their creative thinking, as well as their understanding of the subjects they were exposed to. AR-based material also helps students to be able to describe abstract concepts as it contains visual (2D or 3D) and audio elements (Kraut & Jeknic, 2015). AR applications have been found to offer a new, fun learning experience that encourages students to carry out self-exploration based on the topics learned (Baccs et al., 2015; Okimoto et al., 2015). Since AR technology can help produce more interactive and fun learning experiences, it has been widely adopted by educators (Mahale, 2016). The adoption of AR technology in the education field has made learning and teaching processes more meaningful (Mesarosova et al., 2015; Kersten, Tschrchwitz, & Deggim, 2017).

An abundance of research has been conducted by researchers in different educational settings, for example in primary schools (Alkbattabi, 2017), secondary schools (Bacca et al., 2015; Saltan & Arslan, 2017) and higher educational (Khalid & Su Luan, 2017; Dinis et al., 2017; Huang et al., 2016; Le et al., 2015). AR research has covered a range of subjects, from technical and vocational education (Bacca, Baldiris, Febregat, Hinshuk & Graf, 2015), sports (Vidal, Ty, Caluya & Rodrigo, 2016), architecture (Mesarosova, Hernendez & Mesaros, 2015), mathematics (Coimbra et al., 2015), welding (Okimoto et al., 2015), medicine (Herron, 2016) and engineering (Dinis et al., 2017; Le et al., 2015). However, little research has focused on subject such as history that involve long texts (Kersten et al., 2017; Kysela & Storkova, 2015; Persefoni & Tsinakos, 2016; Zaibon et al., 2015). Learning history involves reading long texts and learning dates, and it has been found that it is difficult for students to memorize the necessary facts and events (Persefoni & Tsinakos, 2016). This difficulty is understandable, as Joan (2015) asserts that a human will not be able to imagine what they have never seen, unless they are given supportive learning materials such as pictorial descriptions or animation. Having to memorize facts without being able to relate them to their real lives may cause low motivation for students (Persefoni & Tsikanos, 2016). Kersten et al. (2017) also add that history is a tough subject without the help of learning aids like videos, acting, and so on. In response to this, Persefoni & Tsinakos (2016) promote the integration of AR technology in schools to support students in mastering history. With the use of AR technology, learning history can be more fun, and spur students' interest to learn about the subject (Zaibon et al., 2015). For the purpose of this study, we developed a booklet using AR technology that covers one of the main topics in the history syllabus, early civilization kingdoms in South East Asia. The syllabus was derived from the textbook for form four secondary school students in Malaysian schools. The selection of the topic was based on its complexity, which covers nine sub-topics and was found to be daunting for students to imagine the different activities and positions of the governments in early kingdoms in South East Asia (Yusup Hashim, 2012). This study aimed to explore the challenges students face when learning history, and the impact of this AR-based booklet on history students.

ARCS Model

In the design and development of our AR-based booklet, we carefully embedded the ARCS model that focuses on learners' motivation, as the ARCS model component plays a critical role in motivating students throughout the learning process (Serio et al., 2013). Keller's (2008) model illustrates a motivational design process, which first involves gaining and sustaining students' attention, which will spur their curiosity to explore the topics that they should learn. Secondly, it is vital to design learning activities that fulfill the actual and personal needs of the learners so that the learning will become relevant for them. The next step is to help learners to build their confidence by feeling in control and having an expectation of success. According to the model, learners should build their confidence because the degree of success achieved will determine the amount of effort learners will invest to complete activities. Finally, according to this model, to ensure learners to feel motivated towards their learning, there must be a sense of satisfaction, which can be assessed through their performance as well as their reflection.

Figure 1. Steps in ARCS Model (Keller, 2008)

AR-based booklet

The topic covered in the AR booklet developed by the researchers and used in this study was early civilization kingdoms in South East Asia. The nine sub-topics included in the booklet were: a) Introduction to countries in South East Asia, b) Introduction to two early civilizations in South East Asia, c) Agrarian civilizations, d) Maritime civilizations, e) The relationships between agrarian and maritime civilizations, f) The influence of Buddhism and Hinduism on South East Asia, g) The influence of Buddhism and Hinduism on government systems in South East Asia, h) The influence of Buddhism and Hinduism on architecture in South East Asia, i) The influence of Buddhism and Hinduism on language, and j) Writing in South East Asia. The trigger images and overlay videos for this AR booklet were developed using Adobe Photoshop CS4, Adobe Animate CS5, and Adobe Premiere Pro CS5. The completed animation and trigger images were then uploaded to HP Reveal (previously known by Aurasma) before it was ready to be used.
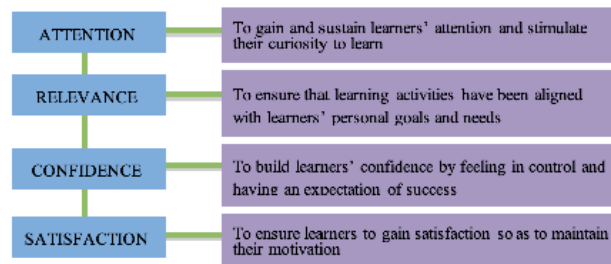

Figure 2. AR booklet used in the study on early civilization kingdoms in South East Asia

Figure 3. An example of trigger images and overlay videos in the AR-based booklet

METHODOLOGY

This study employed (Denscombe, 2014) a single case study research design that involved 20 secondary school students (eight male and female) in form four (16 years old). The case study is an approach that focuses on one or a small number of groups to investigate a contemporary phenomenon within its real context (Yin, 2009), for the purpose of gaining an in-depth understanding of the "events, relationships, experiences or processes occurring in that particular instance" (Denscombe, 2010, p. 52). All the students were studying history as a compulsory subject at school. The selection of the participants was done based on a purposive sampling. The selected participants were among those who scored lower than 40 percent in this subject, based on their first exam of the year, which indirectly indicates a low level of achievement in history. For the purpose of this study, research participants were involved in learning activities using our AR-based booklet, and they were provided with smart phones and tablets to scan the trigger images as a way of facilitating their access. The overall duration of this study was five weeks, as summarized in Table 1. In the first week, the participants were given a briefing on how AR works and how to use the AR-based booklet, i.e. by scanning the trigger images. We also conducted one-to-one interviews with the participants, asking them to share how they valued history as a subject, their motivation to learn the subject, the challenges they were facing in learning the subject, and possible factors leading to their current state of motivation.

In the second week, participants were asked to learn Topics 1 to 3, followed by active discussions about these topics. A similar approach was conducted in Weeks 3 and 4, with each session taking two hours. In the fifth week, we

once again conducted one-to-one interviews with the participants. In this interview we focused more on students' motivation to learn the subject after they had undertaken the learning experience using the AR-based booklet.

Table 1. The activities during the project

Week	Activities
1	Introduction to the use of AR and the booklet
	One-to-one interview
2	Topics 1 to 3
3	Topics 4 to 6
4	Topics 7 to 9
5	One-to-one interview

Interview data was analyzed using a thematic analysis (Braun & Clarke, 2006). After the coding was completed, the codes were classified into categories (Miles & Huberman, 1994). In doing this, we made links between the data (Denscombe, 2010). As a result, several categories emerged, as presented in the findings section.

Research findings

The challenges students have in learning History

Based on the analysis (Figure 4), four main factors leading to students' low performance in history emerged, namely: a) the nature of the subject, b) teachers' teaching approach, c) learning materials, and d) learning techniques.

Figure 4. Four main factors leading to students' low performance in history

One of the themes was the nature of the subject itself. It was found that the students were traumatized by having to memorize so many years and events. This difficulty was not only because of their cognitive capacity, but also due to the lack of ability to relate the events with their current world. For example, the students stated:

"I was having trouble memorizing all the years and events, and I kept mixing them up no matter how hard I tried. I got fed up, and to a certain extent I felt unmotivated. I failed the subject many times and I don't see any other way to solve this problem." (Shanita)

"I really hate to say that I don't like history. Of course I cannot say this to my teacher but I just know it. Maybe I am not the type of person who can memorize all the numbers, years and the strange names. I gave up." (Azam)

Students also revealed that they did not appreciate history because they could not understand why should they take the subject and the importance of it for their future. For example:

"I know as a student I must learn all the subjects given to us in school. But to be honest, I cannot see the relevance of learning it [history]. I cannot spend time to study all the chapters." (Zaleha)

"Maybe not everyone is in favor of history, just like mathematics or physics. I wish we were given an option to take or to drop [the subjects]." (Haida)

The teacher was also a theme that emerged from the analysis. Based on the data, it was found that students were concerned about the teaching techniques used by their history teachers. Some of them described their learning experiences in history as "dry". This can be seen from these answers:

"I know I shouldn't have said this, but I think if our teacher could make the learning more fun, it would be easier for me to absorb the content. But, all this while, we just have to read the long notes and create our own summary. It was not motivating at all." (Sham)

"When it comes to the history period, my mood will swing. I think our teacher is not interested in teaching the subject as well! We just learn from the textbook and the only activities that we have in class are group discussions and then presentations." (Hamdi)

The students also complained that their teachers were not creative enough in designing learning activities that were

fun and enjoyable. For example:

> "There was once, I remember she [the teacher] brought us to the computer lab and asked us to search for information related to the topic that we were supposed to learn that day. I had a good time searching on websites and YouTube. I think if she could let us do this more often, I would be more interested in learning history." (Azam)

The next theme was learning materials. The majority of the students shared their concerns about the lack of learning materials and references for them to learn history. Their only references were the textbook and the reference books they had bought from bookshops. For example:

> "Since the subject is boring, I think we need something that can help spur our motivation. Unfortunately, we only have the textbook and reference books as our primary sources." (Rahim)

The final theme was students' learning techniques. The students admitted having limited learning techniques for history. When asked to describe their learning techniques for history, the majority mentioned memorization as the main technique they used. Aside from that, a few students named mind mapping and infographic notes.

Students' views on the use of the AR-based booklet

Another aim of this study was to examine the impact of the AR booklet on students learning history. Based on the analysis (Figure 5), the students gave positive feedback on the AR-based booklet. The themes that emerged were: a) easy to memorize, b) motivating, c) fun, d) contextual, e) user-friendly, and f) attractive.

Figure 5. Students' views on the use of the AR-based booklet

Satisfying

The students had mentioned in the previous interviews that they found it difficult to memorize all the facts and dates in history. However, using the AR-based booklet, many of the students shared their joyful feelings about the new learning approach. Since the booklet is equipped with animated videos for each sub-topic, students found it to be helpful for them to memorize better and thus made them feel more satisfied with their learning process. For example:

> "To be honest, when you find something to be different and fun, you tend to remember it even better. I think I can memorize many facts in the videos as I can actually visualize the animation in my head, and this new experience helped me to fell more satisfied with my own achievement." (Azam)

> "Satisfaction! That's all I can say. I feel like I have learned something meaningful. I could easily differentiate the differences between the civilizations." (Sapura)

Motivating

The students in this study shared how they feel about learning history. Many of them admitted having low motivation to learn the subject due to the reasons presented in the previous section. Based on the analysis, we found much evidence of how they the AR-based booklet had elevated their motivation to learn the topic. Some examples are:

> "Okay, on a scale of 1 to 10, I would choose 8.5 [answering the question 'how much do you think the AR-based booklet motivated you to learn the topic?']." (Daniel)

> "This is so motivating! I was shocked to see how sophisticated the booklet was. The design itself is appealing but the videos are even more outstanding! I give a ten score! Thank you for this opportunity to let me learn something interesting!" (Haida)

> "I wish we could have this kind of booklet for all the history topics. This is the first time I have felt that I am in love with history. I give it ten out of ten." (Zaleha)

Fun

The students found that it was undeniable that learning with something new injected elements of fun. The majority of the students agreed that using the AR-based booklet was a fun learning activity. The excitement to explore the AR-based booklet made learning more interesting and was valued as a positive experience among the students. For example:

> "This is the best experience I have ever had. Never had I imagined using such an interesting app like HP Reveal and what is more, to use it for learning history. I think this is also considered as part of the history of my life! [laughs]." (Hashim)

> "Very excited about this type of learning method. It's easy to remember and very fun to learn with." (Leo)

> "I am a gamer. I spend a long time playing games on my smartphone. But AR is rather interesting and fun too. I wish our teachers in school could provide us with more of such things." (Daniel)

Contextual learning

The AR-based booklet was found to be relevant to the students' learning context. The topics about ancient civilizations seemed to be disconnected from the students' current world, but with the booklet, the students were able to visualize and imagine the situation of each civilization through the animation available in the booklet. For example:

> "Because it is just like a real one ... I felt like I was in that era. At least I could imagine myself being there for a while. It is effective in that it helped me to relate myself with the situation in the animation, and thus helped me to remember the differences between the different governments we learned about in the topics." (Shuhada)

> "My biggest weakness is imagining the situation in each civilization. It is so disconnected from my own life. What I did before was to sketch and use symbols to help myself to memorize the civilizations. But having this kind of animation or video I think helped me a lot to visualize the situation." (Hashim)

User friendly

The students also found the AR booklet to be user-friendly. All they had to do was to use a smartphone to scan the trigger image and the video would appear on their smartphone. For example:

> "The application is so simple and easy to use. We just have to scan the images and the video will be played. You just have to have a mobile phone and the internet." (Bakhtiar)

> "Surprisingly, we don't need laptops to use this technology. Once you have the apps on your mobile phone then you are ready to learn." (Shauqi)

Attractive

The attraction for learning came from the learning material itself. The majority of students cited that they were amazed by the attractive illustrations in the trigger images, and when they saw the animation their amazement grew. For example:

> "I was so amazed by this booklet. It is beautiful, it really caught my eye and is attractive. I can already memorize the flow of the stories by watching the video few times." (Timothy)

> "I found it easier to memorize [the information] now because of the different colors used. The animation was awesome. The characters were cute too. One of the most attractive materials I have ever dealt with." (Bashid)

> "I can't believe seeing the 'waves' coming from the animation .. and what amazed me more is the sound effect coming from the waves … it is so real! It makes me want to learn multimedia and create such stuff on my own! [laughs]" (Izzah)

> "The voice on the video is quite clear and masculine. There are sounds of birds chirping and the sea breeze. Very dynamic and interesting." (Juhaida)

Participants also stated how they were triggered to try out the quizzes due to the attractive booklet.

> "Initially, I didn't expect the booklet would have a 'wow' factor. I tried the quizzes once and it was not bad at all. The questions were clear, and really helped me to memorize the facts, unlike the one we have in school. All written questions in A4!" (Bustaman)

Discussion

This study aims to explore the challenges students face when they learned history, and the impact of an AR-based booklet on students learning history. The participants in this study were students who had low performance in history. Four factors were mentioned by the participants that made learning history a challenge. Among the factors was the nature of the subject itself. Students reported to have been struggling to memorize all the facts and events. This finding supports Persefoni and Tsinakos (2016), who posit that when learning history, which involves reading

long texts and learning dates, students find it difficult to memorize the facts and events. Another factor related to the challenge of learning history was the approach used by teachers. Most of the students complained about the way their teachers taught the subject. Teaching approaches and the design of learning activities have an impact upon students' motivation and interest to learn. This is not a surprising fact, as other researchers have also noted that students may be struggling with learning history due to the lack of effective teaching strategies (Tok, 2016). With more initiative, teachers could design learning activities more creatively, for instance by involving students in drama based on certain events in history. While participating in drama, students would be intensely involved in history and able to relate the events and morals into their present lives and become connected to the issues and concerns of the past (Kernfeld & Leyden, 2005). Another interesting approach that has been frequently used in teaching history is storytelling; a combination of the art of telling stories and a variety of digital multimedia, such as images, audio, and video. This type of activity can generate interest, attention and motivation for the students (Robin, 2008). This is in line with Burmark's (2004) findings that the integration of digital storytelling is helpful in engaging students with the content, in facilitating discussions about the topics presented in the story, and in helping make abstract or conceptual content more understandable.

The majority of the students also shared their concerns about the lack of learning materials and references for them to learn history. Their only references were the textbook and the reference books they had bought. The status quo is worrying, and students may develop less and less motivation and interest to learn history. In relation to this, Joan (2015) and Kersten et al. (2017) urge for history students to be given more supportive learning materials, for instance visual materials and animations, as Joan (2015) asserts that students will not be able to imagine what they have never seen unless they are given supportive learning materials such as pictorial descriptions or animations. Persefoni and Tsikanos (2016) also note that if students are not able to memorize the facts and to relate them to their real lives, their motivation will go down.

In this study, students mentioned having limited learning techniques to learn history. The majority of the students, when asked to describe their learning techniques for history, cited memorization as the main technique they used. Aside from that, very few students named mind mapping and infographic notes. Having effective learning techniques will help students to master the subject more effectively. Based on Tok (2016), learning history should not only involve the memorization of names, years, or events, but should be associated with the process of building historical knowledge through the use of primary sources, conducting historical inquiry, and encouraging students to think chronologically, and to analyze and interpret historical evidence. For these expectations to be realized, students should be helped to develop various learning techniques, not just memorization alone.

With regard to the use of the AR-based booklet, students gave positive feedback. Among the feedback given was that the AR-based booklet helped them to memorize facts more easily. This finding supports Liberati (2016) and Dieck and Jung (2017), who report how AR-based material has a positive impact on students' learning, especially among weaker students. The AR booklet was found to be motivating for the students to learn the topics over the weeks. This is in line with other research that proves that AR-based material raises students' motivational levels (Liberati, 2016; Vidal et al., 2016). In addition, the findings reveal that the students perceived the AR-based booklet as fun, and it encouraged them to explore all the quizzes and to scan the trigger images repeatedly. When learning is perceived to be fun, it will encourage students to do self-exploration based on the learned topics (Baccs et al., 2015; Okimoto et al., 2015). These findings further confirm the suitability of AR materials to promote learning, increase students' levels of motivation, and make learning more fun (Martín et al., 2012).

As mentioned previously, the development of the AR-based booklet was based on the ARCS model (Keller, 2008), through which we tried to make the booklet something meaningful for the students and a source of motivation for them while learning history. ARCS is an abbreviation of Attention-Relevance-Confidence-Satisfaction. From the students' feedback, they found the booklet attractive and it successfully grabbed their *attention*. Students also cited having more contextual learning using the AR booklet, which is associated with the *relevance* element. However, the third element, *confidence*, did not clearly emerge from the analysis of the students' interviews. This might be due to the fact that these students are weaker students in history, and therefore, it may take a little while for them to develop more confidence about their ability and performance in this subject. The final element, *satisfaction*, was clearly seen from the students' answers, which show that the learning experience in using the booklet helped them to feel more satisfied with their learning. All this evidence seems to further support the relevance of the ARCS model in the design of any learning materials, and AR-based material is no exception. These research findings also prove the effectiveness of AR materials in attracting students' interest to a difficult topic. This research is in line with past research conducted by Bacca et al. (2015), Koutromanos et al. (2015), Okimoto et al. (2015) and Saltan and Arslan (2017), who all found that students gain more understanding and develop more interest to learn difficult topics when they use AR-based materials.

CONCLUSION

This study gained an insight into the challenges that students face while learning history. It was found that the challenges are not merely related to the nature of the subject alone, but are also associated with other factors, namely teachers' teaching approaches, the lack of supportive learning materials, and students' current learning techniques. This study embedded the ARCS model in the design and development of an AR-based booklet. Overall, students gave positive feedback on the use of the AR booklet in increasing their motivation and satisfaction in learning history.

This study also highlights the importance of integrating technology in designing and developing more purposeful learning materials that benefit and fulfill the actual needs of students.

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