Using Augmented Reality Technology in Assisting English Learning for Primary School Students

Salin Boonbrahm, Charlee Kaewrat, and Poonpong Boonbrahm(✉)

School of Informatics, Walailak University,
Nakorn Si Thammarat 80161, Thailand
{salil.boonbrahm, charlee.qq, poonpong}@gmail.com

Abstract. Motivation is the most important part in childhood education. Many schools have invested a lot in information technology with the hope that it will create some motivation in learning but there is no significant proof that it worked. Augmented Reality may be the answer, since it provides children to interact with virtual object while still in the real world environment. In this research, we have created 3 AR experiments to prove the concept that AR can motivate children in learning English. These AR experiments will concentrate on writing, reading and conversation. Different AR techniques were used for this purpose i.e. marker-marker interaction and user-defined target. The results agree with the prediction that children really enjoy and eager to learn more.

Keywords: Augmented reality · Language learning

1 Introduction

Teaching English to children whose mother's tongues are not English face many difficulties due to differences in background, knowledge, and culture, but the most important thing is the lack of motivation. Most children are not interested in learning a new language. The obvious reason is that they see no need to learn new language. But in reality, they cannot ignore the fact that English language is used as a mean of modern day universal communication. For example, ASEAN community which will start in 2015 shall use English as its official language and if the children cannot use the language properly, then they will be at a disadvantage. To solve this problem, many schools have invested in information technology for the purpose of using them as tools to support learning especially English language learning. With the software, in the form of Computer Aided Instruction (CAI), children can play and learn at the same time, this makes them eager to learn. Due to the fact that the output from CAI is not interactive and usually, they are in the form of routine 2D or 3D animation, after a while, the interest dies down and not so many people use them anymore. In this paper, we have proposed to use Augmented Reality to spice up English class in the hope of motivating children to learn English. Augmented Reality (AR) is a live view of a real-world environment whose elements are superimposed by computer-generated virtual objects such as texts or 3D computer models. AR technology can be divided into 2 categories

P. Zaphiris and A. Ioannou (Eds.): LCT 2015, LNCS 9192, pp. 24–32, 2015.
DOI: 10.1007/978-3-319-20609-7_3

i.e. marker-based AR and markerless AR. Marker is the 2D figure that carrying out information to be displayed on top of real space (Fig. 1).

For markerless AR, its applications can be grouped into 2 types: image-based AR and location-based AR. Image-based AR needs specific labels to register the position of 3D objects on the real world image (Fig. 2). In contrast, location-based AR uses position data such as data from GPS to identify the location (Fig. 3). In our work, we have decided to use marker-based AR because we want children to learn not only by using computer but also by interacting with real object as well. Besides that, by using marker-based AR, there are many more ways that the children can play around with them.

Fig. 1. Marker AR [1]

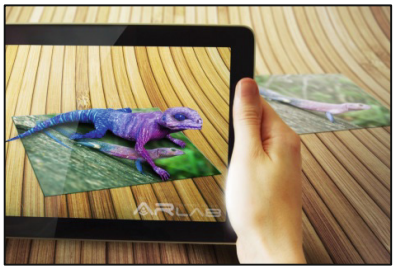

Fig. 2. Image-based AR [1]

Fig. 3. Location-based AR [2]

Due to the advancement of technology especially in the field of mobile technology, AR is now available for everyone who has a smart phones or tablets. Up to now, there are many applications of AR for education available in the market, but most of them just display 3D objects or animations when look through mobile phones with suitable software.

2 Related Work

Augmented Reality Technology has been applied to many areas in education such as medical sciences, engineering, arts, and languages. The example of applying AR in medical science is used as a tool for studying human anatomy [3]. This tool provides visualization of bones and important organs in the abdomen. While the use of AR in environmental studying can be done outside the classroom [4], the students can investigate the real environment together with the use of virtual media.

AR can be used for helping children developing their skills and understanding the lessons. Many researchers have investigated about the challenge and how to use augmented in Education. Fan et al. [5] pointed out the significance of AR based experiment in education and mentioned that AR technology will bring lots of new features for experimental education. The paper also summarized the AR based experiments in many subjects ranging from Medicine to Arts and Humanity. To apply AR in language learning, Meda et al. [6] has developed a mobile based augmented reality application that can detect English text and translate into Telugu language in real time. Students can use this application for translating English text available in text books and get appropriate Telugu meaning instantly. Barreira et al. [7] conducted the experiment in comparing the use of Augmented Reality games (MOW: Matching Objects and Words) and traditional teaching methods, for learning words in different languages. The results indicate that children who used the Augmented Reality games had a superior learning progress than those who used only traditional methods. For the motivation in learning, the result from Serio et al. [8] has shown that the use of augmented reality technology in learning environments had a positive effect on the motivation of middle-school students in visual arts course. In our experiment, we will design the AR games for English language learning to encourage Thai students to learn the language.

3 Experimental Setup

In language learning, there are three areas that children have to conquer; namely writing, reading and speaking. To motivate children in these three areas, designing suitable augmented reality experiments have to be examined. Since we have decided to use marker-based techniques, all these three experiments will be designed based on markers.

In this experiment, Unity 3D game engine is used on Qualcomm's Vuforia platform. Unity is a fully integrated development engine which is used for creating games and other interactive 3D content and Vuforia platform makes it possible to write a

(a) (b)

Fig. 4. (a) Frame marker [9] and (b) User defined target [10]

single native application that runs on almost all smartphones and tablets. In Vulforia, marker can be defined into two categories: "frame markers" and "user-defined target" (see Fig. 4). "Frame markers" are black and white squares with a code embedded around the edge and "user-defined target" is the images or objects for things that can be tracked by the software. In our experiment, markers in both categories will be used.

In the first experiment, motivate writing; we have designed the children to create their own user-defined target i.e. an alphabet. If they write the alphabet correctly, then that alphabet will become the "marker" that will display 3D object related to that alphabet. In the second and third experiment, we have used the marker-marker interaction technique to help children enjoy reading and conversation. In reading experiment, all the alphabets are markers, so when children put these alphabets together, if the combinations mean something, then 3D animation of the thing related to that meaning will appear above the markers. Same as in the third experiment except that in this experiment, only two markers interact with each other and conversation related to that interaction will appear.

4 Testing the Concept

We have made 3 experiments with different techniques to investigate how to motivate children in early age i.e. primary school, Grade 1-5, in English learning. The first one deals with how to improve children handwriting. The second experiment is about using the techniques of marker combination to improve skill in word. And the last one is about using AR in motivating English conversation. Details on each experiment are as follow.

4.1 Improve English Handwriting

In this experiment, children are encouraged to make their own marker by using their own handwriting. If they write them nicely as an example, then it will become the marker and 3D animation related to that alphabet will pop up on the screen of an iPad or any smart phones which have suitable software. For this purpose, we have designed

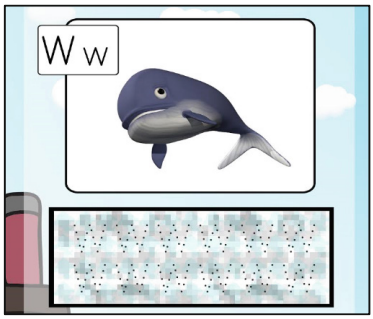

Fig. 5. Alphabets writing guideline

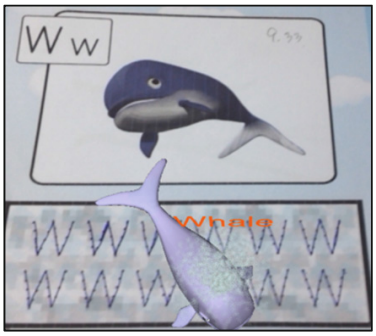

Fig. 6. User defined target with AR effect

a pattern with alphabets writing guideline (Fig. 5), so that children can practice writing an alphabet. For example, if a series of "W" or "w" is written nicely then a whale will pop up and swim around (Fig. 6).

4.2 Improve Ability to Assemble Word

For this second experiment, we try to motivate English learning for children by using the techniques of marker combination to form words. Children can mix any alphabet they want and if it matches the name of any animal, that animal will pop up and start doing some activity. For this experiment, we have made an alphabet card with the picture of the alphabet as a marker (Fig. 7).

Using the marker-marker interaction techniques as a combination of marker in proper order, we can get the new marker composed up to four alphabet markers (Fig. 8). This new makers can display virtual object such as animal on top of the markers. For example, if they put four markers representing b, e, a, r in this order, then a 3D bear will pop up and start growling (Fig. 9).

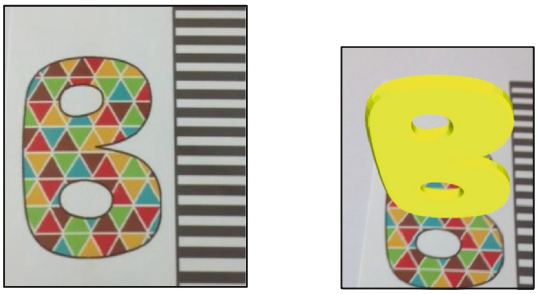

Fig. 7. Alphabet card as a marker

Fig. 8. A new marker composed of four individual markers

Fig. 9. AR effect caused by combination of markers

4.3 Motivating English Pronunciation and Conversation

The third experiment is for children in higher grade, a marker-marker interaction technique is used to form a conversation game. Markers can represent people or object of interests such as food, place or household equipment. If one marker represents a person, when we using a smart phone or a tablet to activate AR activity, then that person will talk about himself or herself. If we put another marker that represents another person, then they will start talking to each other. If we take the marker apart, they will say goodbye to each other (see Fig. 10). If one marker represents a person and

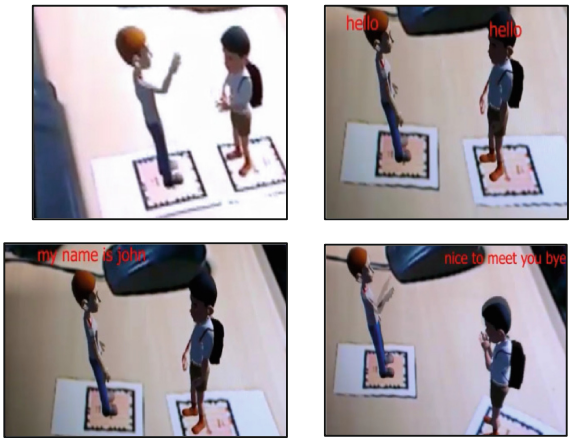

Fig. 10. Conversation between two students

the other marker represents an object such as a microwave oven, then that person will tell something that related to a microwave oven.

Children can learn English conversation or how to elaborate and even how to pronounce words.

The idea of these experiments is to let the children interact with activities so that motivation in learning will occurred. These activities can run on any smart phone or tablet or PC, making them suitable for learning in class or at home.

5 Results and Discussion

We have selected a primary school in Nakorn si Thammarat province which located in the southern part of Thailand for testing this concept. The participating children are students in Grade four and five (Figs. 11 and 12).

For each experiment, the children were divided into two groups of ten students. One group doing the experiment without knowing about Augmented Reality and the other group were explained about what will happen if they did the experiment

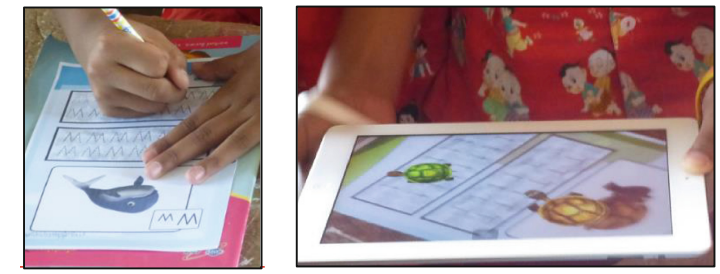

Fig. 11. Students with hand writing experiment

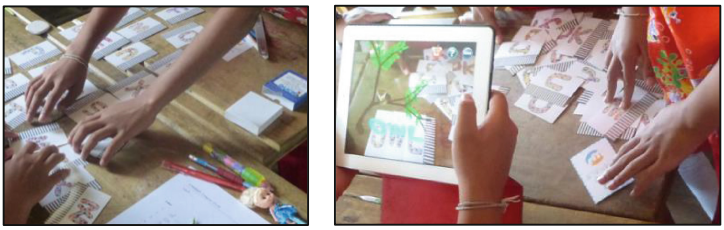

Fig. 12. Students with word assembly experiment

correctly. The students in Grade 4 are selected for the hand writing experiment, a group that knows what will happen seem to concentrate on completing the hand writing exercise nicely while students in the other group want to finish the exercise by using small amount of time. The average time spending on the first group is a little bit higher than the other group but the percentage of perfection is also higher. The same results also applied for the second experiment on word assembly. This indicates that the motivation in learning is increasing. The students enjoy taking more time to study and explore the result. For the third experiment about conversation, we only observe the participation of the students and found that they do not afraid of making a conversation in English. To conclude the results of three experiments, although it may not show significant difference between using AR and non-AR to do the exercises, this may be because hand writing exercise is easy for most of the students. We found that the students who have no experience in using AR can learn to use AR tool very fast and showing their enthusiasm to do the exercise carefully.

References

1. Augment Reality LAB. http://www.arlab.com/blog/markerless-augmented-reality/
2. Brand, R.: Nokia Maps to get augmented reality functionality. Windows Phone News. http://www.windowscentral.com/nokia-maps-get-augmented-reality-functionality
3. Blum, T., Kleeberger, V., Bichlmeier, C., Navab, N.: Mirracle: An augmented reality magic mirror system for anatomy education. In: IEEE Virtual Reality 2012, pp. 115–116. IEEE (2012)
4. Kamarainen, A.M., Metcalf, S., Grotzer, T., Browne, A., Mazzuca, D., Tutwiler, M.S., Dede, C.: EcoMOBILE: Integrating augmented reality and probeware with environmental education field trips. Computers & Education **68**, 545–556 (2013). Elsevier
5. Fan, P., Zhou, M., Wang, X.: The significance and effectiveness of augmented reality in experimental education. In: 2011 International Conference on E -Business and E -Government (ICEE), pp. 1–4. IEEE (2011)
6. Meda, P., Kumar, M., Parupalli, R.: Mobile augmented reality application for telugu language learning. In: 2014 IEEE International Conference on MOOC, Innovation and Technology in Education, pp. 183–186. IEEE (2014)
7. Barreira, J., Bessa, M., Pereira, L.C., Adão, T., Peres, E., Magalhães, L. In: 7th Iberian Conference on Information Systems and Technologies, MOW: Augmented Reality Game to

Learn Words in Different Languages: Case study: Learning English names of animals in elementary school, pp. 1–6. IEEE (2012)
8. Serio, A.D., Ibáñez, M.B., Kloos, C.D.: Impact of an augmented reality system on students' motivation for a visual art course. Computers & Education **68**, 586–596 (2013). Elsevier
9. Qualcomm Vuforia Developer Portal. https://developer.vuforia.com/resources/dev-guide/frame-markers
10. Royal Ontario Museum. http://www.rom.on.ca/en/exhibitions-galleries/exhibitions/past-exhibitions/ultimate-dinos/augmented-reality