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An Innovative Design Using ICT on Outdoor Education – AR-Integrated Learning Map (ARILM) Applied in Barclay Community Park

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Abstract

This study designs an AR-Integrated Learning Map (ARILM) applied in Barclay Community Park that incorporates information communication technology (ICT) into outdoor education, by employing smartphones, tablet PCs, and wireless communication devices, students can use the audiovisual navigation to learning climate change in outdoor environments. Technology Acceptance Model (TAM) was used to addressing the usefulness and ease of use in ARILM; the results indicated that all of the various paths were significant which means the ICT integration is successful.

Key words: ICT, Augment Reality (AR), Technology Acceptance Model (TAM), AR-Integrated Learning Map (ARILM)

Introduction

The learning characteristics of the digital era are, ICT in everywhere, ICT in everything. Not only students are using mobile technologies to learning knowledge in classes, but also the government and schools are working on improving ICT environment for new extra learning in setting ICT.

Nowadays with the progression of science and technology, students are supported by these advantages to develop their critique capability and problem-solving competence [13] [10], hence in the era, it is essential to prepare students to educate themselves by bounteous resources [14]. Information and communication technologies (ICTs) needs to be integrated into teachers' curriculum to help students have a fully new literacy in 21st-century, mentioned by International Reading Association, that stand the milestone for education to developing the application of ICTs [8].

This trend pushes digital learning to the world stage all around corners. With a wireless network, communication equipment, and mobile devices, U-learning environment could project education from classroom to outdoor fields, providing a boundless learning assistance. High-resolution tablets improve the learning experience of students on sharing texts, images, as well as videos, that is Non-replaceable by other devices [9]. Now there are many mobile devices deployed by researchers outdoors for ecological education and scientific discovery educational activities; those studies obtain good expectations [2] [3] [4] [5].

Abundant ICT such as wireless environment, virtual reality (VR), augmented reality (AR), as well as artificial intelligent (AI) now are applying into the courses and class. In Taiwan, a creativity number of primary schools introducing many ICT into creative design courses for years, for example, A ubiquitous learning concept was conducted successfully in a butterfly observation activities [2], and created a three-dimensional Virtual Reality Learning Environment for Field Trip (3DVLE(ft)) system for geographic studies[11].

Nevertheless, even built the fruitful results, they are improving the creative design adopting new ICT continuously. Recently, some scholars developed a highly interactive cloud-classroom (HIC) system to estimate the crossing effectivities on knowledge, comprehension, and application in a materials science class compared with a traditional teaching methods [12]. In addition, users can use AR to create near-real 3D scenes by loading virtual text, images, video, or even tracking the 3D scenes by touching the screen. AR allows users to explore the limitation of textbook, time-trapped picture or 2D images.

However, many teachers have no enough skill of using ICTs; in another side, ICTs developers are not familiar with education area, which makes obstruct on new teaching and learning. In particular, outdoor education is limited to knowledge extension in the past, ICT such as AR is an excellent tool to improve this weakness.

Integrated ARILM in Outdoor Education

This study designs an AR-Integrated Learning Map (ARILM) applied in Barclay Community Park that incorporates information communication into outdoor education, by employing smartphones, tablet PCs and wireless communication devices, students can use the audiovisual navigation to create an educational setting that includes 3D models, images, and audio elements, even in outdoor environments. Associated with increasing advantage of cloud technology, Internet and smart devices are performed in the various tasks. This study evaluated the performance of primary students who learned ARILM by using, ICT including 3D models, images, audio elements, map and AR software as shown in Fig. 1 and Fig. 2. The characteristics of ARILM are present in the following:

A. Five learning topics in ARILM

(1) The first person in science education in Taiwan ---The life story of Dr. Barclay and the establishment of Barclay Community Park;

(2) Seeing the wilderness, the law is natural;

(3) Uninvited guest in the park---exotic species;
(4) Biological myths---insects and spiders; frogs and dragonflies;
(5) The climate change impact on life.

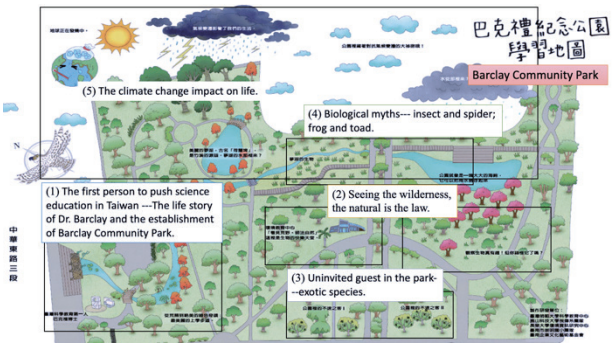

Fig. 1 Five learning topics in ARILM applied in Barclay Community Park.

B. The system design flow

(1) According to ARIML, which integrated the collective perception, professionals, tutors, and the community development association, teachers can use ARILM to build up the design process;
(2) Teachers can transform their ICTs materials such as audiovisual records (M1-8) or 3D model (3D 1-8) which Implied the information of the learning highlight spots in the map;
(3) The audiovisual materials can be saved in a public streaming playing platform like YouTube or personal server, after the linkage teachers can generate the corresponding AR which was linked with the platform(server);
(4) Following the step 3, locate the AR in correct position on the ARILM, complete the scanning setting range, then AR-Integrated Learning Map (ARILM) Applied in Barclay Community Park was completed.

C. System usage procedure

(1) Before operating the ARILM, users need to download the AR decoding software(APP) and installed in the mobile device; then start from opening the camera function of the decoding software;
(2) Scanning the AR areas on the map to decode the AR information, user's mobile device will obtain the corresponding web address of the e-learning platform (or server), and links to the specific learning content automatically;
(3) Browsing the audiovisual material or 3D model through the interface, user can navigate the particular learning content associated with the guide from teacher;
(4) After the reviewing and guiding procedures, teacher can using group discussion, question/answer, or personal presentation to examine the learning benefit of ARIML. Teacher also could check their curriculum from the feedback of students, and then to modify the original design of suing ICTs and the specific learning content.

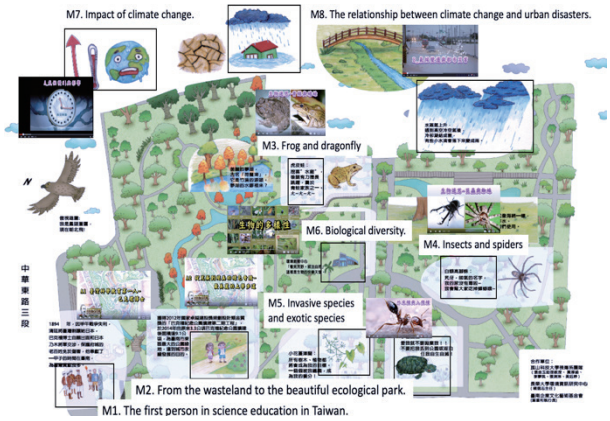

Fig. 2 Simultaneous Learning Via Mobile Devices as Digital Content Transformation.

A Scenario of ARILM Applied in Barclay Community Park

At first, one teacher should participate in a training workshop which could enhance their ability on using ICTs, in particular the mobile device setting, audiovisual materials making, AR generating, and internet linking. Practice on ICTs incorporate into outdoor education is also the key issue in the training course, it could prepare a teacher who have well understanding on using the system, design a suitable curriculum, and gained a unique perspective and experience to apply ARILM. After the training, teacher should arrange their teaching schedule and paths based on ARIML, especially setting the wireless internet access facilities well in outdoor environment.

students were taking to an outdoor education trip and equipped with the AR maps and mobile devices. During the outdoor trip, students were assigned to select one target they have interesting, such as an animal they wanted to study on the AR MAP, they can explore the target by scanning the map and navigating the audiovisual materials and 3D models. Students will gain the relevant knowledge, for example, why the animals need to be conserved, which biological characteristics among the bio-system by themselves. Teacher play an assistant role when the students had trouble on using ICTs but no answer about the learning contents.

In the end of the class, learning assessment was taking by group discussion, question/answer, or presentation as teacher's design, teacher could answer questions, present the knowledge of the learning contents, demonstrate the other information of ARILM which students did not browsed, and the usefulness of ICTs applied in ARILM. The Videos and 3D models in-depth study as shown in figure 3.

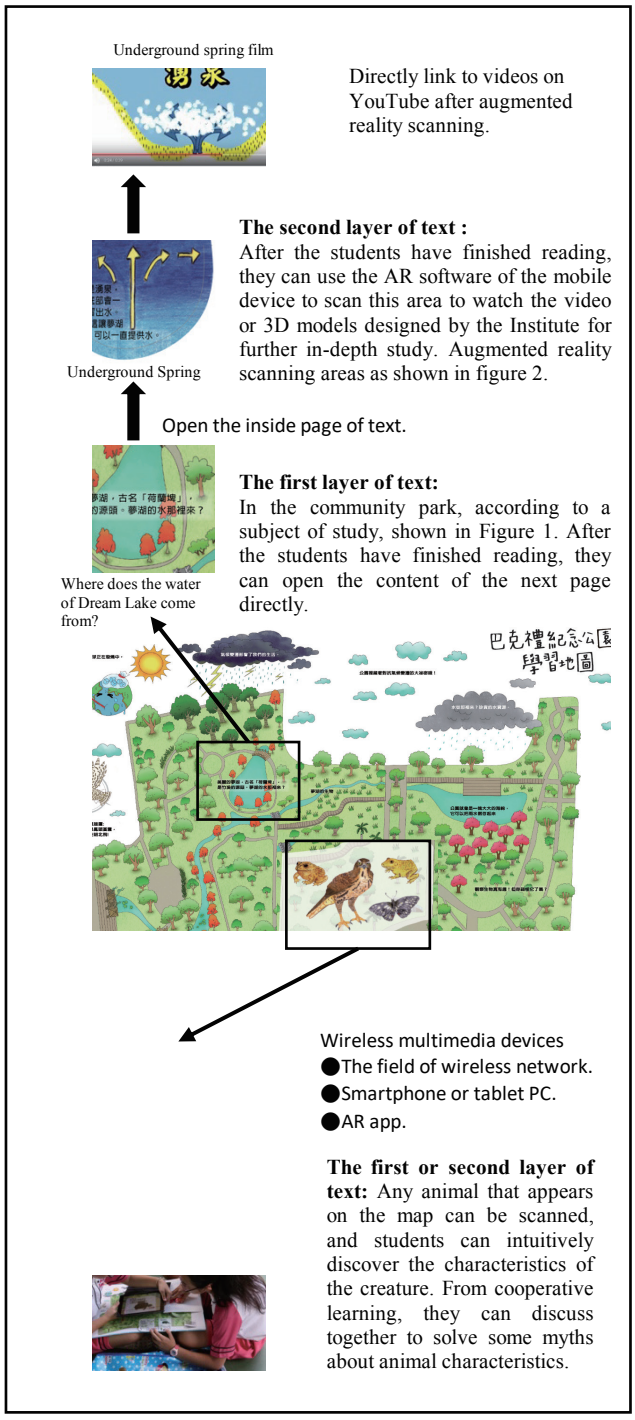

Fig. 3 AR-Integrated Learning Map (ARILM) Applied in Barclay Community Park Scenario.

Discussion

A new ICT application should be examined in its system performance, as well as the users' experience, Technology Acceptance Model (TAM) was used in this study for addressing the ICT design and integration is successful. The evaluation questionnaire we referred is developed by Davis [1], three items are set for external variables: system performance, material quality, and interaction operation. The characteristics of 190 students and their achievements and attitudes toward 8 weeks' science courses were analyzed. The analysis results are shown in Fig. 4.

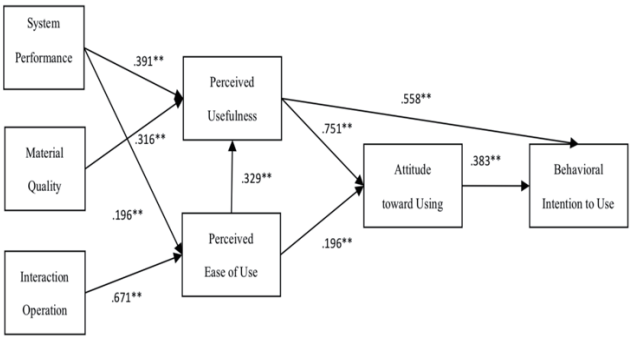

Fig. 4 Technology Acceptance Model for AR-Integrated Learning Map (ARILM) applied in Barclay Community Park.

The analysis results indicated that all of the various paths in the TAM model were significant, the external variables of this study (system performance, material quality, and interaction operation) have good significance for ease of use and usefulness. To discuss the external variables, the regression effect reached a significant level of F (3,186) = 946.107 (P < .00), it showing system performance, the material quality and ease of use had a significant impact on usefulness. The overall R2 is 0.938, and the adjusted R2 is 0.938, indicating that this regression model can explain the 93.8% variation of usefulness. System performance has the best explanatory power for usefulness (β = 0.391, p = 0.000), followed by ease of use (β = 0.329, p = 0.000), material quality (β =0.316, p=0.000). The results of the model verification pointed out that the three variables: system performance, material quality, and interaction operation had a positive and significant impact on usefulness.

To examine the relationship between the effect of the ease of use with usefulness of the ARILM, the correlation coefficient calculated from TAM analysis was 0.329**. It shows if the students are highly perceived ease of using the ARILM, their attitudes will toward to more positive in the perceived usefulness of the ARILM. Another important issue in TAM theory is checking the relationship between the usefulness with willingness on new ICTs, from analysis of this study, the correlation coefficient of the effect of usefulness on the willingness to adopt the ARILM was 0.558**. The high correlation presents that if students are highly perceived the usefulness of the ARILM, they will adopt the ARILM more in the future. Our evaluation indicated that students' satisfaction with and willingness to adopt the ARILM have a significant positive influence on the system. The results also demonstrate that the better students' ability to apply ICTs, the higher their satisfaction and willingness to adopt the ARILM.

Summary

This study initiates an innovative outdoor education method called ARILM that integrates ICTs such as mobile device, AR contents and wireless internet environment within a map, it aims to helping outdoor education expand the diversity of practical use. There were 190 elementary students participated in this study and their feedback were collected and analyzed. These students expressed significant interest in using the ARILM to conduct outdoor educational activities. Our research shows that the design of outdoor education could be adjusted to integrate new ICTs, it also showed the ARILM applied in Barclay community park is highly acceptable for students, the future study should be extended to evaluate the learning achievement of learners.

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