ENGAGEMENT FOR LEARNERS WITH MULTIPLE INTELLIGENCE USING LOCATION-BASED TECHNOLOGY

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Abstract
Generation Z university learners show a variety of talents and cannot feel satisfied in a traditional classroom. To match the needs of learners' multiple intelligence in the learning environment, educators can consider creating a discovery approach by learners using mobile devices in a classroom with location-based technology. With iBeacon transmitters, students can receive learning materials in the format of augmented reality with smartphones; they can also experience individual discovery through exploring virtual scenarios in which hot spots are plotted in their mobile phones mounted with Google cardboard boxes so that they are totally immersed in the virtual environment. Alternatively, they can learn collaboratively using tablets at different locations in the learning space, so that they can use different senses in the discovery, including a combination of visual, hearing and tactile stimulations. While the iBeacon transmitters emit signals, a platform has captured duration of individuals working on different stations. In addition, it has logged student performance on quizzes so that educators can review the outcome of learners’ performance in the classroom. This kind of data will enable educators to review the duration of learning for individuals and the progress diverse learners make individually. Ultimately, they can provide just-in-time feedback and give good guidance for at-risk students. This paper reports a case study in a university in Hong Kong and how the educator, from the Faculty of Education, adopted location-based technology in her teaching, from design to implementation.

Keywords: location-based technology, emerging technology, virtual reality, higher education.

1 INTRODUCTION
A classroom in a university is a space where different types of learning activity can be arranged. Traditionally, students have the same experience when they attend lectures. Learners can retrieve the same set of learning materials before class and may work on the same case for discussion in class. However, when educators want to create a classroom as a knowledge community in which students explore contextual resources and learn collaboratively in breakout activities, they can use iBeacon technology, which sends low-energy Bluetooth emissions that allow students to receive just-in-time information and resources with smartphones in the physical environment.

iBeacon location-based technology has been used in informal education, such as sending relevant resources for visitors so that they are guided to explore further static exhibits in a museum [1] [2]. Adopting innovative pedagogies, university educators have also redesigned the learning space with the integration of iBeacon technology [3]. More importantly, 21st-century learners’ curiosity and interests may be further triggered by this discovery mode of learning [4]. WiFi allows learners to access resources that educators provide, but iBeacon technology can be more specific to locate positions of user performance than WiFi [5]. In addition, it can provide dynamic and just-in-time access to information for onsite scenarios [6]. Forty-four students from the Faculty of Education in a university in Hong Kong participated in the group task in the classroom, with no control group as a pilot. Students could view a virtual scenario using smart phones with or without mounting them to Google cardboard boxes when they received signals from the iBeacon technology. This study examines stay-time in the virtual scenario and how learners perform in the learning tasks. Implication for the application of beacons in traditional learning spaces is discussed.

2 BACKGROUND OF THE STUDY
Differentiated instruction is the major concern in school-based curriculum development and implementation in Hong Kong school curriculum reform. To embrace a learner-centred approach to teaching, teaching faculty in university need to create a learning environment so that “a model of differentiation should reflect the interdependence between environment, curriculum, assessment and instruction” [7: 324]. This paper explores how student teachers are prepared as future educators, in
particular how they experience differentiated instruction in the three-credit compulsory course ‘Principles and Implementation of Curriculum and Instructional Design’ in a teacher education bachelor program on early childhood education in a university in Hong Kong. Although the majority of students had as their major Early Childhood Education, there was a good mix of other majors, including Physical Education, Exercise Science and Health, Geography, Chemistry, Psychology, English, and Biology. Students had not had a practicum or made visits to kindergartens. However, they are instructed about Howard Gardener’s theory of multiple intelligences (M.I.) and how children can have their ways of learning as visual, auditory or kinaesthetic, or a blend of all the styles, using different ways to express what they learn in mixed-ability classrooms.

Students experienced differentiated instruction in class so that they could acquire the skills required to make changes to the curriculum in schools when they have graduated from the program. In the formal learning space installed with beacons, student teachers had completed learning about children with multiple intelligence and they were exposed to non-traditional modes of learning. Before the teaching session, the teacher educator uploaded materials with three scenes of a kindergarten to an Augmented Teaching and Learning Advancement System (ATLAS) (https://www.atlas-learn.com/) a platform that allows students to explore the virtual scenario when their smartphones detect signals from different locations in the classroom. After discovering the situation, they were required to respond to the hot spots with quiz questions in the virtual setting (Fig. 1; Fig. 2). Afterwards, they were given time to discuss and respond to open questions with reference to application of multiple intelligence for teaching young children in the virtual setting and reflect on how they could learn better with their own multiple intelligence as dispositions. Students completed the quiz items, and having got all correct answers could go to the bonus task, a self-assessment tool developed by Dr Terry Armstrong in which students could check the intelligences that they used most often (https://www.literacynet.org/mi/assessment/findyourstrengths.html).
3 METHODOLOGY

Ethics clearance from the university was received first, and students participating in the study were given consent forms because their actions were to be collected for research purposes. However, all aggregated results will be reported without disclosure of individual identities, and the performance of individual students in the pilot would not affect the results of summative assessment in the course. Students were instructed to install the ATLAS app so that their Android or iOS phones could receive signals from beacons in the classroom (Android app for students: https://play.google.com/store/apps/details?id=hk.edu.polyu.atlas; iOS app for students: https://itunes.apple.com/hk/app/atlas-for-student/id1450907363?l=en&mt=8). In class, students had to set the Bluetooth connection. Beacons dynamically released materials in the formal learning space, and the platform captured the results of student actions, such as the responses of close-ended quizzes and open responses. The teacher educator could show a summary of student responses immediately. At the backend of the platform, individual student responses on quiz items, open-ended questions and time spent were logged. The data were exported as Excel and consolidated for the study.

4 RESULTS

Forty-seven records were logged in the system; 44 students completed the quiz questions; and 43 students made responses to the open-ended questions. The rate of voluntary participation in the activities in the pilot study was 94% (three students made no attempts to do any of the tasks). Forty-four students made correct responses to the three closed-ended questions, and 43 students responded to the open questions. Stay-time and open-ended responses are discussed as follows.

4.1 Stay-time

Log time is summed to 0.5 minutes when processing the duration of stay-time of individuals. The total length of time spent viewing and responding to the activities was 473 minutes, ranging from 0.5 to 22 minutes. Therefore, the average time spent on the activities was 10.28 minutes.

4.2 Open-ended responses

The first two open-ended questions were ‘Question 1. Please suggest one learning task that helps to develop students’ spatial intelligence’ and ‘Question 2. Please suggest one teaching strategy that helps to develop students’ linguistic intelligence’. Word count for question 1 ranged from one to 19, with a total of 225 words; responses in question 2 ranged from one to 32, summing to 287 words. The word count by individuals on the two questions ranged from two to 51 with an average of 11.9 words by the 43 students.

4.2.1 Question 1

Thirteen students responded by suggesting that pupils “play Lego” as a learning task to facilitate the development of spatial intelligence. The second highest response, made by nine students, was suggestions relating to “3D”, from exploring the physical world in three dimensions, such as hiking and going on field trips, playing a block-building game, using visual aids such as virtual reality videos and construction of 3D figures, and producing models using 3D printing.

4.2.2 Question 2

In considering teaching strategies to enable children to develop M.I., the most popular responses to this question was “storytelling”. A few students suggested different writing activities, including writing a daily journal, creative writing and composing poetry. Two responded by elaborating that “teacher can prepare some readings for the students, and students are required to write about their feelings about the readings. Students could read aloud what they had written in front of the class: 1. require students to record their pronunciation and compare to the suggested one and help them to evaluate themselves; 2. Have role play between different groups, such that students can speak more and learn from others”.

5 DISCUSSION AND CONCLUSIONS

iBeacon technology serves as an indoor transmitter with low energy through external databases and can cover areas with limited access to WiFi [8]. It works particularly well in the university because many lecture halls and teaching classrooms can serve just users. Therefore, it can offer a seamless solution
to courses with large class sizes. Moreover, it is an unprecedented experience for students, allowing them to discover in the formal learning space using beacons in the university. In this case, students were invited to exercise their M.I. (spatial, body-kinaesthetic, interpersonal, intrapersonal, linguistic intelligence) to explore and experience ways to educate in a kindergarten, because M.I. has been practised for the benefits of inclusion of students with diverse talents and varying levels of ability [9]. More importantly, discovery through pushing the signals from a distance by beacons without visual identification, like QR codes, can raise student interest in the subject [3][10]. This means that students coming to the same classroom will be set different scenarios for case study, crime investigation or crisis management, and materials can be presented in the mode of augmented reality or virtual reality with beacons.

In the case study, there was a high percentage of participation in the tasks assigned, with quality output from students responding to consideration of M.I. in the course while experiencing virtual reality with scenarios. They were engaged, with an average stay-time of 10.28 minutes. Having explored the virtual scenario at learner's location, they actively interacted with one another as a knowledge community to discuss what they had explored while integrating M.I. [11].

Conclusively, a teacher can examine how students perform in quiz activity collectively through ATLAS, students having difficulties in concepts can be quickly identified. Beacons have converted a formal classroom into a seamless, dynamic learning space in which more enhanced learning opportunities can be created and experienced.

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REFERENCES


