Introducing Podcast for Ubiquitous Learning: Take Campus Plant Identification as an Example

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ABSTRACT

In recent years, the popularization of wireless network and advancement in mobile computation technology have improved the efficacy of hand-held devices such as smart phones. The wide variety of applications of smart phones has realized the idea of ubiquitous learning. In this study, the researchers chose teaching campus plant identification to elementary school students as an example to build a digital podcast-based U-Learning system. The aim here was to help students learn about plant ecology through close observation and in the absence of instruction from teachers. The study adopted a quasi-experimental design. Both the experimental group and the control group learned about campus plant identification, but the experimental group learned it via a podcast-based learning system while the control group learned it via a handout-based learning system. The investigators tested whether the type of learning system can affect learning outcomes in students. The study demonstrated that the podcast-based learning system was more effective than the handout-based one for learning plant identification.

Keywords: U-Learning, Smartphone, Podcast, Campus plants

1. INTRODUCTION

The most significant difference between mobile computing and ubiquitous computing technology lies in the use of context aware, a feature of wireless network enabling people to use information at any time and at any place. Meanwhile, depending on the location of an individual, information about the surrounding environment and
the condition of an individual and the task, mobile computing can provide an environment with best efficacy. Therefore, in recent years, countries worldwide have treated mobile computing seriously for developing their information technological strategies.

The rise of ubiquitous computing has substantially changed the mode of digital learning. Learners now can acquire knowledge using hand-held devices equipped with wireless network function and have access to learning contents at any time and at any place (Lan, 2009). This type of learning is termed as ubiquitous learning (U-learning). U-learning has been widely promoted by many countries; For example, IT839 Project of the Korean government in 2004, U-Japan Project of the Japanese government in 2005, and U-Taiwan Project of the Executive Yuan of Taiwan in 2006. All these projects are about integrating various wireless communication devices or mobile devices into everyday context learning and switching the existing wired network environment to a wireless telecommunication environment. As a result, wireless transmission technology and various applications of wireless devices will become more pluralistic in the future. The major reason that the wireless learning environment of U-learning has received so much attention is that it enables learners to carry out suitable learning at suitable time and suitable place using light and convenient mobile devices and wireless network. In other words, a ubiquitous learning environment can be created.

The study took elementary school grade 5 students’ learning about campus plant identification as an example and developed a podcast-based digital learning system based on available campus plants for teaching students plant identification and discrimination. The aim is to use the system to help students observe and learn about plant ecology and features through close observation. To assess the effect of the system, the researchers compared the use of podcast-based learning system with handout-based one in terms of their efficacy in plant identification learning and checked if there is any significant difference between the two systems.

2. LITERATURE REVIEW

(1). Podcast Production

Rossell (2007) categorized the current podcast implementations in K-12 and higher education. The broadcasting of podcasts was divided into two parts: creating
your own podcasts and use the existing podcast resources. For creating your own podcasts, the creator of a podcast can be teachers or students. The websites for accessing the existing resources through internet downloads include: CNN, BBC, academic institutions, and websites for music and sport lovers.

The required teaching platform for podcasting consists of: a system for teachers to produce learning materials, a curriculum broadcasting system in charged by a network information center, and a diversified learning platform for students. Additionally, the application procedure of podcasting is clearly and completely defined to simplify user operation and system maintenance. Teachers can use Podcast Producer to record the teaching contents, automatically upload the curriculum to servers, and convert it to a podcast teaching resource. The system will then automatically e-mail students the notifications. (igt intelligent global technology Ltd, 2013)

In the study of “Introduction of Podcast, A Personalized Broadcasting Media,” Lee (2005) mentioned the 4 steps of producing a podcast program: Step 1: Record the program into an audio file. Step 2: Upload the audio file to server over internet. Step 3: Generate the podcast RSS. Step 4: Publish the podcast RSS. Gong (2010) pointed out that podcasting enables students to get familiar with computer software skills and inspires their creative thinking. More importantly, students can learn the related concept of communication technology of broadcasting and reflect the impacts of broadcasting technology on human and societies.

(2). A Podcast’s Program Length

Chan & Lee (2005) mentioned that most of the podcast programs are short. Students prefer to listen to the program during the spare time or commuting. Out of the 26 students who participated in the survey, 45% of them felt that 9 to 10 minutes are the right length for a podcast program. Blanche and other researchers (2011) also pointed out that students like to listen to podcasts and like the short length of a podcast program. They think podcasting is a reasonably effective learning tool, and it is very easy to use. Anzai (2007) suggested that students’ preferred listening duration is around 5 minutes. The study by Muppala& Kong (2007) suggested that most students download the podcasts with the program length of 5 to 20 minutes.

Based on the above study results, this study suggests that a podcast should not be too long. The best program length is 5 to 20 minutes.
(3). Learning effectiveness of using podcast

Jiang (2009) pointed out in the study that students show great willingness to use new technology of podcasting for learning. It is because students can arrange their time and repeatedly listen to podcasts to correct their mistakes or focus on the unclear contents. Additionally, teachers are also satisfied of using podcasting, because through podcasting, student can learn anywhere at any time, students also have many opportunities to interact with curriculum and therefore learn more from it. Ciao-Ling Chen (2006) suggested instructors and students to produce podcast programs together, which will foster students’ learning motivation and performance. Teachers can use their lectures to produce podcast audio files. Student can review them after school to improve their learning performance. Bongey et al. (2006) surveyed 246 biology students who used podcasts. The results show that using podcasts can improve their performance. Williams (2007) pointed out that using podcasting has no restriction on time or space, which is more attractive than classroom activities in schools. It improves the listening capability when learning a language. Students like to download and use podcasts because podcasts have diversified contents and are easy to produce and publish.

Evans (2008) pointed out that students thought podcast is an effective reviewing tool, which is more helpful than their own notes and improves their learning effectiveness. They also said that they are more acceptable to the learning material in podcasts, compared to the traditional lectures or textbooks. For higher education, podcasts seem to have great potential as an innovative learning tool. The study result by Lane (2006) shows that out of the 41 health science students who used podcasts, 70% felt podcasts helped them to review before the exam. Students can also repeatedly listen to podcasts to correct their mistakes and focus on the unclear contents. Anzai (2007) used podcasts as a supplemental teaching tool in English classes for Japanese students. The results of the study show that most of the students felt that using podcast improves their achievements. The study of Clark and other researchers (2007) mentioned that out of the 30 marketing graduate school students, 96% expressed that using podcasts is very helpful. Dlott (2007) suggested that renovating and producing podcasts motivates students to learn, boosts students’ confidence, and broaden their view of peer communication. In the study of “Replacing Traditional Lectures By Podcasts,” Kurtz, Fenwick & Ellsworth (2007) pointed out that students scored better in the exam.
Students with teaching by podcasts scored 9.5% higher in average than those with the traditional teaching in the previous semester. McCombs and Liu (2007) also pointed out in the study that when teaching the same course in two semesters with different methods, two thirds of the students found podcasts helped them to achieve better grades.

Based on the application of podcasts mentioned above, it shows that podcasts can be used in many areas. The potential applications for education and learning are as follows: 1. Prepare the related information before the class, review the course, create weekly classroom activities, feedback or peer evaluation. 2. Before the class, prepare the learning materials, list the sections which are more difficult to learn, collect the background information related to the subject, send out questions for students to think of in advance. 3. Students can create their own podcasts, which can be summarized notes, reflections, comments, opinions, or conclusions. The objective is to let students share their experiences and opinions through podcasts. Through this process, students’ complete independent learning experiences, performance evaluation, or homework scores can be recorded. The process will continue after school to achieve a multi-dimensional learning.

(4). Ubiquitous Learning

Our learning environment has changed as the society evolves; from the conventional classroom learning to online learning. Learning now is no longer restricted by time or location. A consequence to the booming of wireless network is the replacement of e-learning by ubiquitous-learning. Harris (2001) considered that ubiquitous learning is achieved through wireless network and communication devices, and learners in ubiquitous learning interact with real world learning objects through the use of mobile devices, wireless network, and sensing technology.

Chabra and Figueiredo (2002) considered that U-learning enables users to be involved in learning activities at any time and place and with any mobile device. Bekkestua (2003) pointed out that U-learning allows learners to learn at any time and at any place, and mobile devices are used to display learning contents for learners. Bekkestua (2003) suggested that such learning contents can promote learners’ interaction with the learning environment or a bi-directional communication between learners and their instructors. Tsai and Yang (2008) proposed that features of mobile learning and needs from mobile devices should cover urgency of learning, initiative in
knowledge acquisition, mobility of learning environment, interaction during learning process, contextualization of teaching activities, and comprehensiveness of teaching contents. Through integrating sensing technology and techniques, a learning system should be able to detect the state of learning of students at all time and offer immediacy and adaptive feedbacks. After integrating all the above-mentioned components, one can come up with a new type of learning called context-aware ubiquitous learning.

In recent years, many scholars have tried to establish an environment for context-aware ubiquitous learning and to apply it for learning activities. Nevertheless, when encountering both real context and digital resources in a ubiquitous learning environment, one would require effective learning strategies and tools, in addition to a novel learning environment technology. If not, what is created for students is only a sense of novelty instead of a good learning effect (Chu, Hwang and Tsai, 2010).

Integrating above information from the literature review, the researchers established a podcast-based digital learning system and compared the effect of this podcast-based learning system with the handout-based learning system.

3. RESEARCH DESIGN AND IMPLEMENTATION

(1). Research Framework

The objective of the study is to explore the learning effect of a podcast-based plant identification learning system. The study variables are described below:

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Plant identification capability test</td>
<td>Podcast-based learning system</td>
<td>Plant identification capability test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plant</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Plant identification capability test</td>
<td>Podcast-based learning system</td>
<td>Plant identification capability test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plant</td>
<td></td>
</tr>
</tbody>
</table>

It can be found from the experimental design presented in Table 1 that the study examined three variables, and each variable is described below:
A. Independent Variable:

The independent variable of the study is teaching methods. Experiment subjects were divided into two groups, experimental and control groups, and different teaching methods were adopted. For the experimental group, a podcast-based plant identification learning system was used for outdoor plant identification teaching. For the control group, a handout-based plant identification learning system was used for outdoor teaching.

B. Dependent Variables:

Subjects’ score from the plant identification capability post-test.

C. Control Variables:

To reduce experimental error but increase internal validity, the study had worked on controlling factors that may affect experiment results, such as the nature of learning materials, the nature of students, characteristics of teachers, and teaching time.

(A). Teachers:

The two groups were taught by the same natural science teacher of the school, and because the teacher has extensive teaching experience and professional background, he or she can well understand the level of students, the nature of learning materials, and the practical aspect of teaching. In order to attain better experiment accuracy, the teacher was asked to treat students of the two groups equal when giving lectures.

(B). Statistical Control:

Students from the experimental group and the control group were of the same school. In order to test whether the experiment was affected by sampling of subjects, a pre-test, plant identification capability test, was given, and the score was treated as the covariant for eliminating between-group differences before the experiment.

(C). Both

Groups received lectures on plant identification in their natural science class, but the experimental group used a podcast-based learning system, while the control group used a handout-based learning system.

(D). Time:
Both the experimental and the control groups received four lectures, and each lecture lasted for 40 minutes, making a total of 160 minutes.

(2). Experiment Hypotheses

Hypothesis 1: There were significant differences on plant identification capability between students taught by podcast and those by handouts.

Hypothesis 2: Podcast-based teaching can significantly enhance students’ plant identification capability.

(3). Research Subjects

The study subjects were two classes of grade 5 students from an elementary school at Taichung City. They were divided into two groups. One was the experimental group (28 people; 14 boys and 14 girls), in which a podcast-based learning system was adopted for plant identification teaching. The other group was the control group (29 people; 15 boys and 14 girls), in which paper handouts were adopted for plant identification learning.

(4). Designing Teaching Activities

To effectively deliver the features of U-learning and to appropriately integrate campus plants into the course, students were asked to observe the plants and then used the facilitative tool assigned to them to search for relevant information. As a result, the first step of the study was to prepare teaching contents for plants from aspects of natural science, life technology and other areas.

Before carrying out U-learning, the teacher has to waken students’ prior knowledge and motivate them for learning. As a result, an overview on campus plants was given in the first class. The learning materials were arranged based on campus plants of the school, and those more easily observed plants were chosen. The key points for teaching are 1) types of woody stems, 2) types of leaves, 3) types of flowers, and 4) types of fruits. Teaching methods adopted included giving guidance, making observation, and offering descriptions. The used learning materials included pictorial presentation, guide to action, and observation of real objects. The contents of learning materials covered description of whole plants, leaf development (leaf arrangement) and types (leaf shapes and veins), and close-up pictures of flowers and fruits. For text descriptions, features of difference species were explained. Here are the teaching goals
for students:

A. The students will recognize the science name (in Chinese) of twenty most frequently seen campus plants as well as their other commonly used Chinese names.

B. The students will recognize the stems, leaves, flowers, fruits, and seeds of twenty frequently observed campus plants.

C. The students will recognize special usage of twenty frequently observed campus plants.

D. The students will recognize the habitual and growth patterns, growth environment, and reproduction of twenty frequently observed campus plants.

(5). Self-developed Plant Identification Capability Test

The investigators used some published textbooks, practice books, teacher’s manuals and test banks on natural science for references when developing the test for this study. The investigators also collected and took comments from experts and scholars into consideration. The scope of the test was centered on twenty most commonly observed plants on campus, and the researchers had made sure that the test items well matched the teaching contents. The test was held twice; once before the experiment and once after the experiment.

A. Test Content Validity:

The test covered twenty different plants. To ensure that the test questions are suitable for average students and of an average level of difficulty, the teaching contents were treated as the X axis while the concept of the test (twenty different plants) were treated as the Y axis for developing a bi-directional detailed listing table for plant identification capability test. This detailed listing table was used as a reference for formulating the pre- and post-test of plant identification capability.

B. Test reliability:

After developing the test, a pilot test was conducted. The pilot test contained fifteen question items, consisting of ten multiple choice questions (accounts for 50 out of 100 points), and five matching questions (account for 50 out of 100 points). Each
matching question had five items. Each multiple-choice question was five points, while each matching test item was two points. The total score was 100 points. The test had a Cronbach $\alpha$ of 0.705, and this value is also the reliability coefficient.

4. DATA ANALYSIS AND DISCUSSION

Table 2 Mean and SD of Pre- and Post-Plant Identification Capability Tests

<table>
<thead>
<tr>
<th>Item</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>Experimental</td>
<td>28</td>
<td>72.3829</td>
<td>5.51321</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>29</td>
<td>72.3793</td>
<td>5.87010</td>
</tr>
<tr>
<td>Post-test</td>
<td>Experimental</td>
<td>28</td>
<td>89.0714</td>
<td>3.90563</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>29</td>
<td>81.1034</td>
<td>3.26611</td>
</tr>
</tbody>
</table>

Table 3 T-test for Pre- and Post-Plant Identification Capability Tests

<table>
<thead>
<tr>
<th>Item</th>
<th>Levene test</th>
<th>t-test for equal mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$F$</td>
<td>$p$</td>
</tr>
<tr>
<td>Pre-test</td>
<td>Assuming equal variance</td>
<td>.206</td>
</tr>
<tr>
<td></td>
<td>Without assuming equal variance</td>
<td>.01</td>
</tr>
<tr>
<td>Post-test</td>
<td>Assuming equal variance</td>
<td>.108</td>
</tr>
<tr>
<td></td>
<td>Without assuming equal variance</td>
<td>8.34***</td>
</tr>
</tbody>
</table>

*** $p < .001$ Data from different teaching methods are summarized in Table 2 and 3.

(1). Pre-test:

Results from the plant identification capability test conducted before the experiment are presented in Table 2 and 3. The mean of the experiment group was 72.3929 and of the control group was 72.3793. Results from the Levene test for variance homogeneity was not significant ($F = .206$, $p=.652>.05$), indicating no significant difference between the dispersion of the two groups. The $t$ value and the level of significance for the assumption of equal variance suggested insignificance, indicating no significant difference in terms of the plant identification capability.
between the two groups before the experiment \((t = .009, p = .993 > .05)\).

(2). Post-test:

Results from the plant identification capability test conducted after the experiment are presented in Table 2 and 3. The mean of the experiment group was 89.0714 and of the control group was 81.1034. Results from the Levene test for variance homogeneity was not significant \((F = .108, p = .744 > .001)\). The t value and significance level for assuming equal variance suggested a significant test result, indicating the two group differed significantly in terms of their plant identification capability after the experiment \((t = 8.367, p = .000 < .001)\).

### Table 4 Test for Regression Coefficient Homogeneity of the Control and the Experimental Groups

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F-value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>.01</td>
<td>1</td>
<td>.01</td>
<td>.001</td>
<td>.97</td>
</tr>
<tr>
<td>(Regression coefficient)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within-group</td>
<td>511.54</td>
<td>53</td>
<td>9.65</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4 presents results from testing within-group regression coefficient homogeneity. The F value was .001. The p was .973, which was not statistically significant, and the null hypothesis cannot be rejected. In other words, the regression lines of the two groups had same slope. This finding indicates that the relation between the covariate (pre-test score) and the dependent variable (post-test score) does not differ because of the treatment level of the independent variable. Moreover, the regression coefficients of regression lines obtained from using covariate (pre-test score) for predicting the dependent variable (post-test score) do not differ, and this result met the assumption of a homogenous within-group regression coefficient for the analysis of covariance. As a result, the researchers conducted a covariance analysis afterward.

### Table 5 Covariance Analysis of Pre-test and Post-test of the Control and the Experimental Groups

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between-group</td>
<td>903.41</td>
<td>1</td>
<td>903.41</td>
<td>95.37***</td>
<td>.000</td>
</tr>
<tr>
<td>(Regression coefficient)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within-group</td>
<td>511.55</td>
<td>4</td>
<td>9.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It can be found from Table 5 that after eliminating impacts from the covariate (pre-test score) on the dependent variable (post-test score), the treatment effect of the independent variable on the dependent variable became significant (F = 95.365, p < .001). In other words, test subjects’ post-test score was affected by the type of treatment they had received, and the effect of treatment was significant.

5. DISCUSSION

(1). Conclusion

The study used podcast-based plant identification learning system to facilitate plant identification learning activities. The investigators explored differences between podcast-based and printout-based plant identifying learning outcomes, and the statistical results showed that in terms of context awareness, the use of podcast plant identification learning system can lead to a learning outcome better than that of the conventional outdoor handout-based learning system.

(2). Suggestions

A. Simple screen for presenting course contents: Smart phones were used in this experiment, and due to a limited screen size, the presentation of course contents on the screen requires extra attention. In short, one should avoid putting too much information on the screen and keep only the current state of the learner, target for the learning, and required tools on the screen.

B. Sharing learning outcomes: There should be a platform for students to share their learning outcomes. This measure can encourage students to actively search for information and create new ideas. The existing online learning platform can be used to display students’ learning outcomes, and students can interact with each other through evaluating the works of others. The platform can also record students’ learning process and stimulate a sense of competitiveness and honor, which can elicit creativity.

C. Enhancing the system guiding function or including explorative learning in the teaching contents: For mobile learning to duly deliver its facilitative features, it is recommended to integrate real context into the learning materials and to include more interactive learning modes to direct the attention of learners to real situations for explorative and experiential learning.
REFERENCES


