Development of a Lilliput Multimedia System to Enhance Students’ Learning Motivation

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This paper developed and evaluated a Lilliput Multimedia (LM) system to enhance students’ learning motivation by bringing them personally onto the scene to explore the world without having to leave the classroom. The LM system integrates of digital multimedia exhibition content, remote-controlled toy cars, and toy models of the buildings to motivate the students and engage them to learn as if they were touring a Lilliputian museum. With the help of the LM system, students are able to enjoy touring experiences from within the classroom without having to physically walk through them. In the current study, the theme of “world-famous buildings” was selected as the learning topic to illustrate how the LM system can be used to assist students’ learning. The potential of the LM system was evaluated. The participants were 30 fifth-grade elementary-school students. Questionnaires, interviews and video records were utilized to study the students’ acceptance of using the LM system and to assess students’ attitude towards learning about world-famous buildings. The findings show that the students responded very positively to learning using this multimedia learning system.

Keywords: mobile learning, context awareness, learning system, wireless sensor network, user acceptance

1. INTRODUCTION

The use of mobile devices in students’ learning process is becoming an interesting approach because of many introduced benefits, for instance the ease of learning and increasing students’ learning engagement. E-learning is changing to a new mobile learning era and adapts to new possibilities and demands. Many researchers have given definitions of mobile learning from different points of view. In the literatures, mobile learning can be understood by people learning through mobile terminals and mobile content while peoples are on the move [1]. Studies in [2-4] defined mobile learning as a ubiquitous learning activity by using a mobile device that implemented with mobile technologies, user interfaces and pedagogical contents. Although mobile learning can provide various potential applications, such as miniaturized portable learning, classroom connected learning,
and individual personalized learning. Some researches [5, 6] indicated that mobile learning is currently still experimental. There are several major advantages and disadvantages related to mobile learning. With using smart phones, tablet computers or personal digital assistant (PDA) devices in the classrooms, students can easily access numerous online multimedia teaching contents. Teachers can also communicate and interact with students in time. Furthermore, mobile devices with various applications can benefit peoples having physical disabilities and learning difficulties. The cost of mobile devices, small size of device and low battery life are principal disadvantages of current mobile devices, which may hinder the widespread scale of mobile learning.

Due to the growing importance of mobile learning, many projects have been carried on in worldwide to explore how to use suitable mobile technologies in peoples’ learning. On the other hand, the popularity of context-aware ubiquitous technologies had made a growing number of schools and universities to help students improving reading, writing and oral skills. The use of mobile devices for out-of-school visiting museum and historical places is a well-known example. Many of the issues associated with the application of wireless mobile and context-aware ubiquitous technologies or the interaction between the learner, mobile device and exhibition have been explored, and many useful recommendations for instructional design of the learning or teaching contents of mobile guide system have been proposed to enhance learning in the museum context [7-10]. However, even people can improve communications, enjoy situated and personalized learning everywhere and anytime with the assistance of wireless mobile devices, people must still actually visit the museum or art library in person. They often have to travel long distances to visit different themes of an exhibition. If there is no exhibition with an appropriate or desired theme, then people must wait until the exhibition theme that they would like to visit becomes available. Although teachers may enrich the education curriculum by implementing field trips, it is often difficult for them to design the curriculum with specific exhibitions in mind in an out-of-school context, thus reducing the usefulness of the field trip. These problems motivated us to consider the possibility of providing students with the similar museum sightseeing experience, as they would have if they personally toured a museum, but without actually leaving their classroom.

The purposes of this study were thus twofold. First, a Lilliput multimedia (LM) system was designed and developed based on the combination of ubiquitous wireless mobile and context-aware technologies. The embryonic form of this system was awarded a silver medal at the 2009 Taipei International Show and Technomart. Second, the potential of the LM system to assist learning was evaluated by inviting 30 fifth-grade elementary-school students to use it to learn about “world-famous buildings”. The students’ acceptance of using the LM system was assessed, four aspects of which were studied by questionnaire, interview and video records: (1) perceived ease of use, (2) perceived usefulness, (3) students’ attitude towards joining in the learning activity with the LM system and (4) the value of toy models.

The remainder of this paper is organized as follows: system analysis and design are introduced in Section 2. In Section 3, the system implementation is described. Methods of evaluating the LM system and the results thereof are presented in Section 4. Conclusions are drawn in Section 5.
2. SYSTEM ANALYSIS AND DESIGN

The system concepts and design are described herein, along with our motivation underlying the development of the system concepts and illustrations of the complete system architecture.

2.1 System Concepts

The system concept is depicted in Fig. 1. In this system, a real map is deployed on the floor, and the students manipulate a remote-controlled toy car with a computer and navigate toy models of world-famous buildings along the tracks on the map. As the toy car approaches and stops near a toy model of the buildings, the radio frequency identification (RFID) and wireless network transfer the location information of the model to the computer. Multimedia teaching programs on the computer will then automatically display relevant exhibition knowledge about that famous building for the students. This system can be used in the area of education applications, such as e-learning and outdoor teaching. Students are able to obtain knowledge regarding, in this case, world-famous buildings as if they are playing a game with a remote-controlled toy car, which has been modified with wireless sensor nodes, and that travels among the display exhibitions. RFID and infrared location service technologies are used to provide an accurate location discovery. A database is also used to save teaching content to enhance the interactive multimedia guide system.

Fig. 1. System concepts (see text for explanation).

2.2 System Architecture

Fig. 2 shows system architecture. The system comprises five submodules, each with its own specific functions: (1) Scene, comprising a map, RFID tags, tracks and exhibition toy models; (2) Vehicle, comprising RFID readers, toy cars and wireless networks; (3) Backend, comprising a wireless network connection and management servers; (4) Service, which is designed to contain as many different services as possible. The six basic
services designed to assist system users to manipulate the system are position, account, multimedia, browser, database and event log. Wireless control and vehicle behaviour control services are also designed to facilitate the user in the use of the remote-controlled toy car; (5) Application, comprising three categories of application function: management, which includes system setting, command test and system maintenance; learning, which includes self-learning, designing teaching content and learning evaluation function; and add-on, which extends the system function.

We focused on developing a learning function in which the student would be capable of self-learning and evaluating their own learning, thus hopefully providing an interactive and attractive learning environment that would motivate the students to learn. We hope that when using this system, the student can not only independently experience a dramatic learning lesson, but also deepen their learning impression through the interactive learning evaluation function. Teachers can also customize their teaching content with this system.

3. SYSTEM IMPLEMENTATION

We now provide details of the system implementation, beginning with implementation of the learning environment, followed by illustrating some of the important user interfaces, such as self-learning, designing teaching content and the learning evaluation interface.

3.1 Implementation of the Learning Environment

A wireless sensor network is implemented in order to achieve a wireless communi-
cation with the toy car. When implementing the RFID system, a handheld PDA equipped with an RFID reader is attached to the toy car. We chose to use a rewritable RFID tag, which enables users to write data into tags at long range. While setting up the map, we took into account the characteristics of ease implementation and flexible assembly so that users can not only make use of this system in an exhibition hall, but they can also move to and reassemble the entire system at their homes. Therefore, a multilayer map structure was designed and implemented. The bottom layer is an opaque pad, upon which a world map is spread. The third layer is contains the vehicle tracks and RFID tags. A transparent pad is placed as a fourth layer to cover, fix and protect the equipment in the third layer. The various three-dimensional exhibition toy models and remote-controlled toy car are placed on top of this fourth, protective layer.

3.2 Implementation of the Graphical User Interface

In the present study of the LM system, we choose toy models of world-famous buildings in six continents as exhibition pieces. Since natural science is a fundamental course in elementary schools, teachers normally adopt pictures of buildings as major teaching methods to explain building knowledge. There is little museum and art gallery content available that provides exhibitions of such famous buildings. In addition, it is very difficult for teachers to take students to visit these famous buildings in person. Thus, in the present LM system, the exhibition of famous buildings provides teachers with an alternative teaching approach. Using colourful three-dimensional toy models of the buildings, remote-controlled toy car, and abundant picture, video and text programs, the teacher is able to build an attractive learning environment and present an interesting lesson to motivate student learning. We have created a central management interface to assist the LM system user. A front teaching platform and backend management platform inside this central management interface are implemented with various graphical user interfaces to achieve the system functions.

In the front teaching platform, graphical user interfaces of self-learning, designing teaching content and learning evaluation are created to accomplish a learning function. System setting, command testing and system maintenance interfaces are implemented to achieve basic management functions. Students can perform an independent self-study in the self-learning interface, as shown in Fig. 3. The students can choose their favourite views to study as if they are reading a multimedia storybook. In addition, texts, music and photos are displayed in this interface to help students to understand the information provided about the buildings.

In the designing teaching content modes, the teacher can freely choose famous buildings from the six continents as the preferred teaching content, according to their teaching requirements or their students’ preferences. They can also alternate the sequence of view explanations in this mode. For instance, the teacher may choose the pyramids in Africa as the first stop, the Great Wall in Asia as the second stage and Sydney Opera House in Oceania as the third. At a later stage, the instructor might alternate the teaching sequence to avoid a rigid teaching style. After setting up a learning sequence, the student can start the learning procedure without the teacher’s instructions in the same interface. In contrast to the self-learning interface introduced above, in the designing teaching content interface the student must follow the learning sequence they
made and they cannot freely choose scenes during their learning. The unique learning
feature of the LM system is the remote-controlled toy car, which moves towards the toy
model of the world-famous building on the map and stop near it when the student clicks
next to the building in this interface. Therefore, students can not only acquire abundant
knowledge, but they can also obtain geographic information on the map with the help of
multimedia programs and the guided toy car. Furthermore, students are personally “on
the scene” while taking in knowledge of natural science in depth, as if they are playing in
the remote-controlled toy car to explore the world, but within the classroom.

The most important feature of the LM system is its learning evaluation function.
The teacher is capable of examining the student with questions about the exhibition to
see whether or not they have learned well. After teaching the content of the exhibition,
the teacher can immediately choose the learning evaluation mode to examine the stu-
dents’ learning state. As shown in Fig. 4, in this mode the system randomly asks ques-
tions regarding the famous buildings visited during the learning period and asks the pupil
to click the continent by mouse on the map where the world great building is located. In addition, the toy car will move towards the corresponding continent and stop near it to deepen students’ impression once they give the correct answer. If the student gets the answer wrong, the system will ask him or her to try again. The system will then ask the student the next question, and so on until they have answered them all.

4. EVALUATION AND DISCUSSION

The potential of the LM system for use in education was assessed by conducting a learning evaluation in an elementary school. We chose “world-famous buildings” as the learning topic for this evaluation. We prepared toy models of four of the world’s great architectural structures: the Great Wall in Asia, the Statue of Liberty in North America, the Leaning Tower of Pisa in Europe and the Pyramids in Africa. Questionnaires, observations and interviews were adopted to evaluate the students’ real learning attitudes and viewpoints on studying world-famous buildings using the LM system. The evaluation participants, procedures, results and discussion, as well as limitations of LM system are discussed in this section.

4.1 Participants

The participants in this study comprised 30 fifth-grade elementary-school students who had some knowledge about world geography. Fourteen of the participants were males and 16 were females, and they were aged between 11 and 12 years. All of the participants had some prior knowledge about the four architectural structures, but they had not visited them.

4.2 Procedures

The LM system evaluation procedure comprised four phases: preparation, student independent learning, interactive evaluation, and interview. Fig. 5 shows the system experiment flowchart. Thirty students individually participated in this learning activity in sequence. In the preparation phase, before joining in the learning activity, each student was asked to freely decide which learning sequence they wanted to follow depending upon their individual levels of interest in the four world-famous buildings. In this phase, an instructor listed the names and located the continents of the four buildings on a whiteboard. The instructor also explained the objectives of this learning activity and requested that the students write their learning sequence on a notepad. After receiving the student’s decision, the instructor configured the specific teaching contents in the designing teaching content mode of the LM system.

Before instructors and students begin to use this LM system, it must first be initialized and prepared. System preparation can be divided into four stages, as shown in Fig. 6, which involve different routines and purposes. In the first stage, the teacher should establish the theme of the exhibition scene before implementing the system. The appropriate guide map is chosen in this stage. The next stage is to set the scene, which comprises two tasks involving the guided track layout and implementation of the RFID tags. The users need to disperse the guided tracks along the map according to the required envi-
Moreover, they should make a decision about the number of RFID tags required and their location. In stage three, the users decide where and how to place the exhibition toy models on the map according to their actual locations and the positions of the RFID tags. Furthermore, they should set up the exhibition content, such as pictures, texts, music, videos and animation on the database on the server. Once these first three stages are complete, the user must set up and test the wireless network connection, the remote-controlled toy car, the RFID tag, and the RFID tag connections. Thus, in stage four, the teacher can regulate all of the system components based on the current conditions. All of these stages may be revisited at any time until this system is ready.

![System experiment flowchart](image1)

![System preparation flowchart](image2)
Before student independent learning phase, the instructor first introduced each student user to the interface manipulation of the LM system, as shown in Fig. 7 (a). All learning functions of the multimedia learning materials, such as texts, photographs, videos, toy car and toy models of the buildings, were explained before proceeding to the learning activities. After confirming the student’s understanding, the student was asked to continue their independent learning activities, as shown in Fig. 7 (b). An interactive learning evaluation activity was subsequently conducted after the completion of this independent learning, by asking questions about those four world-famous buildings that the student had just learned about, as shown in Figs. 7 (c) and (d) based on our previous pilot study. Each student’s learning and evaluation activity in this phase was limited to within 31 minutes, based on our previous pilot study. The learning and evaluation procedures of all of the students were recorded with a video camera to allow assessment of the acceptance of the LM system for teaching students about world-famous buildings. With the video records, it is observed that all participated students remained alert and motivated after sustained use of our designed the LM system.

In the interview phase, each student was first asked to individually fill in a questionnaire after completing the aforementioned activities. The questionnaire was used to investigate each student’s acceptance of using the LM system to learn about world-fa-
mous buildings. The instructor subsequently interviewed each student with filling content. The questionnaire used to explore students' perceptions towards the LM system was developed by a research group according to notable features of the LM system. There are 4 categories contained in the questionnaire, with 17 items, which were scored by each student on a 5-point Likert-type scale, from 1 (“strongly disagree”) to 5 (“strongly agree”). The LM system was assessed by examining the perceived ease of use of the system with three items, and the perceived usefulness of the system for learning with four items. We also examined the students’ learning attitude with seven items and the value of the toy models when applied to learning about world-famous buildings with four items. The subsequent interview questions were based on students’ responses to further explore the reasons for their attitudes towards LM-system-assisted learning about famous buildings.

4.3 Results and Discussion

A one sample t-test measures used in this study is to examine whether a sample value significantly differs from a hypothesized value (3.5). This method is wildly used in many studies [11, 12] which used questionnaire to explore students’ learning acceptance. Table 1 presents the findings of the questionnaire. Overall the students expressed an extremely positive response to learning about world-famous buildings using the LM system (mean score = 4.28). When the examination value was set at 3.5, a series of one-sample t-tests was conducted to analyze the 17 items. The findings showed that all mean values were significantly greater than 3.5 ($p < 0.01$), which indicates that the students were inclined to either agree or strongly agree with the LM-system-assisted learning about world-famous buildings. There now follows a detailed analysis of the results, as assessed by observation and interview.

4.3.1 Perceived ease of use

We now discuss further three items of perceived ease of use of the LM system. As indicated in Table 1, we found that students tended to agree or strongly agree that they can easily operate the interactive learning and evaluation user interfaces of the LM system, and experienced very smooth learning and evaluation processes (mean score = 4.13). We also observed that most of the students were able to individually complete the whole learning and evaluation work smoothly, with only three students requiring the instructor to remind them about the operation methods during the early stages of the activity. In addition, the learning sequences about world-famous buildings on the computer were the same as the students’ predefined choices. The texts, videos and photos presented to the students on the computer were automatically and sequentially switched along with the toy models of the buildings when the guided toy car stopped near them. The high scores of perceived ease of use of LM system may reflect the potential of applying this system in the learning.

4.3.2 Perceived usefulness

Four items in the questionnaire were utilized to investigate students’ attitudes to perceived usefulness of the LM system when using it to learn about world-famous
buildings. The result was notable (mean score = 4.31), suggesting that the student either agreed or strongly agreed that it was useful to their learning about world-famous buildings. The students tended to agree that the LM system facilitated their learning. Furthermore, most of the students strongly approved of the LM system as an aid to their in-depth study of world-famous buildings. They mostly accepted that the guided toy car combined with the multimedia teaching contents shown by the computer and the toy models of the buildings helped them a lot with their study. Most of the students also admitted that the interactive evaluation activity strengthened their learning. The aforementioned analyses show that the students universally acknowledged that the LM system efficiently assisted them in their learning.

Table 1. Questionnaire results about LM-system-assisted learning about world-famous building.

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
<th>SD</th>
<th>t(29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived ease of use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manipulating the learning interfaces of the LM system is easy.</td>
<td>4.17</td>
<td>0.70</td>
<td>5.22**</td>
</tr>
<tr>
<td>Manipulating the interactive evaluation interface of the LM system is</td>
<td>4.13</td>
<td>0.68</td>
<td>5.00**</td>
</tr>
<tr>
<td>easy.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I found the use of the LM system during my learning and evaluation</td>
<td>4.10</td>
<td>1.09</td>
<td>3.00**</td>
</tr>
<tr>
<td>process to be effective.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived usefulness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using the LM system allowed me to learn about world-famous buildings</td>
<td>4.57</td>
<td>0.63</td>
<td>9.33**</td>
</tr>
<tr>
<td>in depth.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Following the multimedia guide and the toy car to explore world-famous</td>
<td>4.13</td>
<td>0.86</td>
<td>4.03**</td>
</tr>
<tr>
<td>buildings allowed me to improve my understanding of the continent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>where the building is located.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The texts, videos and photos shown by the computer helped me to learn</td>
<td>4.40</td>
<td>0.50</td>
<td>9.89**</td>
</tr>
<tr>
<td>more about world-famous buildings.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The interactive learning evaluation activity emphasized my learning</td>
<td>4.13</td>
<td>0.82</td>
<td>4.23**</td>
</tr>
<tr>
<td>about world-famous buildings.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoyed using the LM system to learn.</td>
<td>4.47</td>
<td>0.68</td>
<td>7.77**</td>
</tr>
<tr>
<td>It is interesting to explore the world with a multimedia-guided toy car.</td>
<td>4.43</td>
<td>0.77</td>
<td>6.61**</td>
</tr>
<tr>
<td>I intend to continue to use the LM system to gain new knowledge.</td>
<td>4.47</td>
<td>0.78</td>
<td>6.82**</td>
</tr>
<tr>
<td>I intend to recommend the LM system to classmates for study.</td>
<td>4.37</td>
<td>0.72</td>
<td>6.61**</td>
</tr>
<tr>
<td>I wish I could use the LM system to learn about other subjects</td>
<td>4.37</td>
<td>0.89</td>
<td>5.33**</td>
</tr>
<tr>
<td>Compared with common textbooks, I prefer to use the LM system to study.</td>
<td>4.70</td>
<td>0.65</td>
<td>10.09**</td>
</tr>
<tr>
<td>Compared with common learning software, I prefer to use the LM system</td>
<td>4.03</td>
<td>1.03</td>
<td>2.83**</td>
</tr>
<tr>
<td>to study.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The value of the toy models</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observing toy models of the LM system emphasized my learning about</td>
<td>4.13</td>
<td>0.90</td>
<td>3.86**</td>
</tr>
<tr>
<td>the appearance of world famous buildings.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In addition to the texts, video and photos shown by the computer, the</td>
<td>4.17</td>
<td>0.70</td>
<td>5.22**</td>
</tr>
<tr>
<td>toy model of the LM system helped me a lot.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The toy models on the map allow me to have an immersion experience.</td>
<td>4.00</td>
<td>0.95</td>
<td>2.89**</td>
</tr>
<tr>
<td>(Where 5 = Strongly Agree, 1 = Strongly Disagree)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>** Mean response significantly differs from 3.5 (p &lt; 0.01, one-sample t-test).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3.3 Attitude

Analysis of the students’ responses to the seven items pertaining to attitude revealed that most of the students conveyed markedly positive attitudes to using the LM system to learn about world-famous buildings, indicating that they liked to use the system in their
learning. We further analyzed the interview data to summarize the reasons why the students favored using the LM system to study. First, they (e.g., students 1, 15 and 23) found the learning process with the LM system to be very interesting and amusing. Second, they (e.g., students 7 and 10) were amazed that the remote-controlled car was capable of moving and stopping nearby the toy models of the buildings that they were learning about. Furthermore, some of the students (e.g., students 2 and 20) were impressed with the ability of the LM system to offer multiple studying materials and abundant teaching contents. In contrast to other common class methods, the students (e.g., students 4 and 28) found that it was helpful to be able to immediately view the buildings in the LM system. Numerous students also indicated it would be fun if they were able to explore the world by following the remote-controlled toy car, as this is an attractive way of learning. In addition to showing their eagerness to study other subjects using the LM system, several students presented a few interesting and active ideas, and advice for applying the LM system to course learning. Thus, students who joined in these learning activities were able to understand the importance of using the LM system, and they became very involved in the learning experience.

The students stated that they preferred using the LM system to study rather than ordinary textbooks and computer teaching software. The interviews showed that the major reasons for this preference were as follows. The teaching content of the LM system is more “alive” and interesting than that in ordinary textbooks. Also, students learn in the LM system as if they are playing a game, which is always perceived as being “fun”. The LM system contains toy models of the buildings, which textbooks and computer software lack. In particular, ordinary textbooks and computer software are unable to supply a movable, remotely guided toy car, which is an important learning tool. The aforementioned analysis thus demonstrates that students who participated in the LM system to learn about famous buildings were highly satisfied with their experience. They also expected to be able to attend other similar learning activities with the LM system in the future. The students’ attitude towards digitally assisted learning tools is an important factor that will impact greatly on the success of using the tool. Consequently, students’ positive attitudes towards the LM system will contribute to the increased likelihood of the system being applied for teaching and education applications in the future.

With our designed LM system, the students just simply click their favorite touring scenes by mouse on computer, the remote-controlled toy car will automatically move to the real toy models on the map. The students do not need to manually operate toy car. They only observe the toy car’s location and watch the corresponding videos and texts that explain the scene on the computer. According to the observations of students’ experiment with our system, high cognitive load on students’ learning is not produced. Furthermore, the students can freely control their learning scene and learning speed, which can reduce their cognitive load.

4.3.4 The value of toy models

Most ordinary computer-assisted learning software offer abundant multimedia information, but the additional use of exhibitions of toy models by the LM system renders the user able to imagine themselves to be actually on the scene. The value of toy exhibitions was assessed by including three items in the questionnaire to investigate students’
opinion as to how the toy models affected their learning with the LM system. It was found that most of the students considered that the toy exhibitions helped them to appreciate the appearances of the buildings that they were studying (mean score = 4.10). Indeed, student 3 mentioned that although he had heard the names of these four great buildings before, he had only a “blurry” impression of what they actually looked like. The toy models of the buildings with the LM system deepened his understanding of the buildings’ appearances. Student 8 stated that when compared with the teaching content of textbooks, the toy models of the buildings were capable of providing a more specific and realistic learning experience. In particular, the guided toy car moving sequentially toward appointed toy models of the buildings helped the students to focus on the specific toy models being studied at any one time. It seems that most of the students kept their eyes on the guided toy car as it moved about the map, carefully observing the toy models of the buildings next to which it stopped. Several students even left their chair to take a closer look at the toy models of the buildings.

5. CONCLUSIONS

While the features of ubiquitous wireless mobile and context-aware technologies have the potential to solve some of the problems associated with taking students on field trips and can benefit situated learning, visiting in the out-of-school context remains problematic. The present study thus developed and implemented a Lilliput Multimedia system to conquer the intrinsic deficiencies associated with existing learning solutions. The LM system can bring museum exhibitions into the classroom, utilizing various advanced scientific technologies, abundant multimedia programs, attractive remote-controlled toy cars and three-dimensional building toy models to create a fantastic learning environment in which students are personally on the scene to learn as if they are touring in a Lilliputian museum. This new learning system also provides teachers with an alternative way of teaching students natural scientific knowledge with dramatic and colourful exhibition toy models. It enables students to enjoy the same sightseeing experience as if they were personally touring a museum, but without having to leave the classroom. In addition, teachers can establish their own custom-built exhibitions by simply designing the teaching content as appropriate and changing the themes of the exhibition toy models, which represents a significant and economic solution to having to organize several different field trips away from the classroom.

The most important feature of the LM system is that students are afforded the chance to participate in assembling the exhibitions. They are attracted to actively learning the exhibition knowledge provided as if they are playing a game. Various research methods, including questionnaires, observations and interviews, were used to establish how the students perceived the ease of use and perceived usefulness of the LM system. Students’ attitudes towards learning with the system were analysed. The findings revealed that students had an extremely positive response to learning about the chosen theme using the LM system. They agreed that the system is not only easy to operate, but also helped them to learn efficiently from the information provided. The students expressed an expectation that they would use the LM system to study in the future.

The designed Lilliput Multimedia system is a new type learning system because the
LM system adopts a new learning model, which is rarely applied in previous teaching scenarios. In current work, we are focusing on studying the students’ acceptance on this new learning system and learning model before conducting a large scale of evaluation and experiments. Thus, only 30 students were included in the evaluation of LM system in this work. This research mainly utilized questionnaires, observations and interviews to study the potential of the LM system for teaching and education activities; we did not examine whether there was any resulting improvement in knowledge about the chosen theme by testing the students before completing the learning activity and again after completing it, nor did we compare the LM system with other learning tools to explore whether it is an improvement over those other systems. Future studies should involve larger numbers of subjects in order to objectively determine the acceptance of applying the LM system to learning in schools. We have designed some new experiments based on this study. We plan to design a control group in the system evaluation and evaluate the students’ learning performance, such as effectiveness of learning. Moreover, how to solve the need of learning in our designed LM system is another important research issue in the future works.

REFERENCES


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