

Design and Development of Intelligent Learning Companion for Primary School Students Based on the Tour of Well-Known Scenic Spots in Beijing

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Abstract. Nowadays intelligent phones can realize more and more functions, and the multi-point touch screen multiplies the interactions between user and phone. With the development and spread of intelligent phones, mobile learning has enjoyed an ever-increasing popularity. In the process of educational reform, the concepts of learning by playing and self-study have been encouraged. Meanwhile it is discovered that primary schools students in China have a great demand in travelling every year to the extent that travelling, has been recognized as a means of informal learning. For it can offer a new way of learning by playing and edutainment, especially when it is related to textbook knowledge. Based on the situation above, the article argues about the feasibility and necessity of designing an intelligent learning companion app to help primary school students study through the process of travelling, and give a set of design scheme of the app.

Keywords: Mobile learning · Intelligent learning companion · Travelling · Primary school students · Scenic spots in Beijing

1 Introduction

Plenty of fields have been influenced by the great and rapid development of technology, and education is among the fields being influenced most. Through the last decade different scientific disciplines, including pedagogy, have explored the educational possibilities of technologies such as elearning [1] and iPad in classroom [2]. Under this context, ICT in education has appeared much more frequently. With people's in-depth studies of elearning, the notion of elearning has also been branching out, giving rise to new methodologies that try to get the most of certain technologies [3], and concepts like mlearning, which is the short for "mobile learning", emerge.

The existing definitions of mobile learning very much. One closest definition to the meaning of mlearning in this article is "*mLearning can be understood as an evolution of eLearning which allows students to take advantage of the advantages afforded by*

mobile technologies to support their learning process and constitutes the first step towards the creation of ubiquitous learning" [4], which means studying anywhere and anytime. Mlearning constitutes one of the most popular fields and it is becoming a new and efficient way for knowledge accumulation and transmission. Mobile terminals offer many possibilities to students regarding communication and autonomous work, being an important resource when it comes to develop Personal Learning Environments [5]. Mobile terminals mentioned above mainly include smartphone and tablet, and smartphone owns a larger number of users and is more suitable for people of all ages, so this article will consider smartphone only.

Smartphones are small size devices that combine the features of the conventional mobile phones and extra advantages like flexibility, a wide range of functionalities and Internet connectivity. When it comes to the use in learning, smartphones can be used in a broad set of mobile learning experiences, from game based learning activities [6] to the distribution of eLearning content [7]. The ways of utilizing smartphone to study are various and the applicable age is also quite extensive. Parnell and Bartlett [8] point out their use as a tool to prepare eportfolios with Pre-primary students' works. The work of Mandula, Meda, Muralidharam and Parupalli [9] explores the possibilities of sending lesson videos to the student's terminals, and that of Kamaruzaman and Zainol [10] about the possibilities of the M-Language application for smartphones. Both articles prove that studying by smartphones is suitable for secondary education students. Jarvela, Naykki, Laru together with Luokkanen [11] and Lum [12] find that an increasing number of universities integrate smartphones in everyday activities, whether they are used as a communication tool, a content delivering tool or a basis for collaborative learning activities.

One most obvious advantage of studying by smartphones is the individualization, no matter in ways of study or study contents. Traxler said that the individual nature of the devices contributes to the customization of the contents and their adaptation to the needs of the individuals and their environment [13].

And another concept-intelligent learning companion, is also pretty important. "Intelligent learning companion" is a creative combination of artificial intelligence technology and learning companion. It can be understood as, through algorithms in artificial intelligence and computer simulation, designing and developing a virtual learning companion in system, which can communicate and interact with learners. It can also help and lead learners to study and record their study process as well as growth process [14]. As we all know, peers play a quite essential role in a person's school-days. They can provide assistance and affect his or her study efficiency, effectiveness, motivation and so on. Interestingly, researchers find that virtual learning companions can do the same. Bailenson and Yee [15] have shown that non-verbal mirroring in the form of behavioral mimicry can increase the likeability and persuasive effect of a virtual agent. Bickmore and Picard [16] have developed interaction and evaluation strategies to increase empathetic and caring relationships between agents and participants. Providing the participants a choice, in terms of the ethnicity and gender of an agent-tutor, has also been shown to have beneficial impacts on learners' impressions of the agent and on their own performance; similarly, matching learners' gender and ethnicity also leads to more positive impressions and performance [17]. Intelligent learning companion is the

improved version of virtual learning companion, because it can remember individual characteristics and provide personalized study contents, plans and assistance.

2 Demand Analysis

First, we conducted a questionnaire survey in order to make sure whether an Intelligent Learning Companion app is needed by primary school students when they visit famous scenic spots in Beijing. We divided primary education students into three groups according to their grades. Junior group (Grade 1 and Grade 2), intermediate group (Grade 3 and Grade 4), and senior group (Grade 5 and Grade 6). Then, we chose The Forbidden City as an example. We went there, randomly picked families with primary education students on the spot, and requested parents and their children to finish our questionnaire on their phone (the first ten students of each age group become our samples, so thirty samples in total; if a family has more than one child, it is still regarded as one sample).

Question 1 to 3 are for parents. Question 1 is “How often do you take your child/children to travel every year?” As in shown in Fig. 1, among thirty samples, half of parents say they take child/children to travel about 1 to 3 times a year; 40% do that more than 4 times; only 10% do not do that at all. Question 2 asks about whether parents will consider taking children to educational scenic spots. 76.7% of the parents usually will consider that, 20% hardly think about that, and only one sample says it won’t give it a shot as Fig. 2. Question 3 is “Will you intend to teach your child/children knowledge or principles?” As is shown in Fig. 3, 73.3% give a positive answer, 26.7% consider less, no parents do not think about that at all. From above, we can conclude that most parents take their children out for travelling and have the will to provide children opportunities to obtain something during the processes.

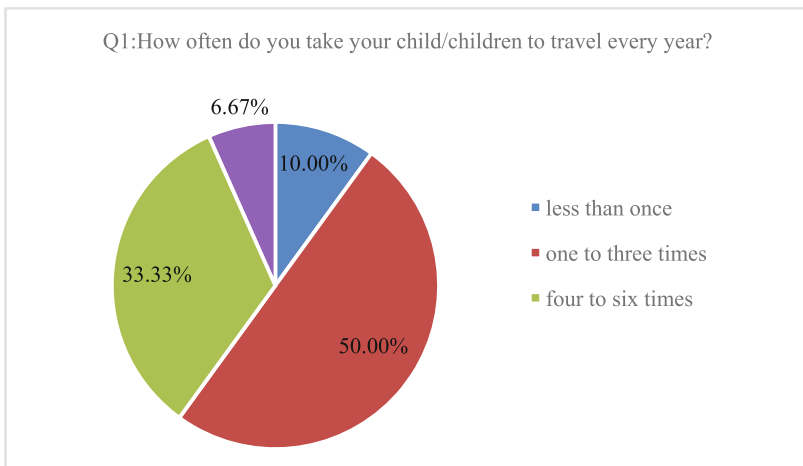


Fig. 1. Result of Question 1 in the questionnaire

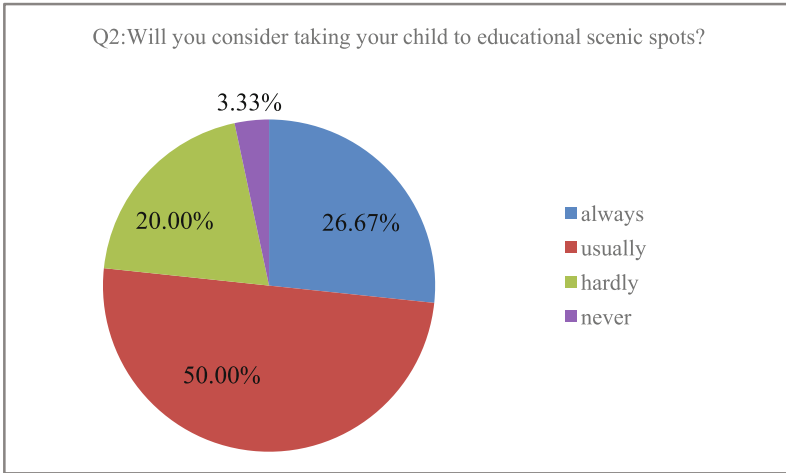


Fig. 2. Result of Question 2 in the questionnaire

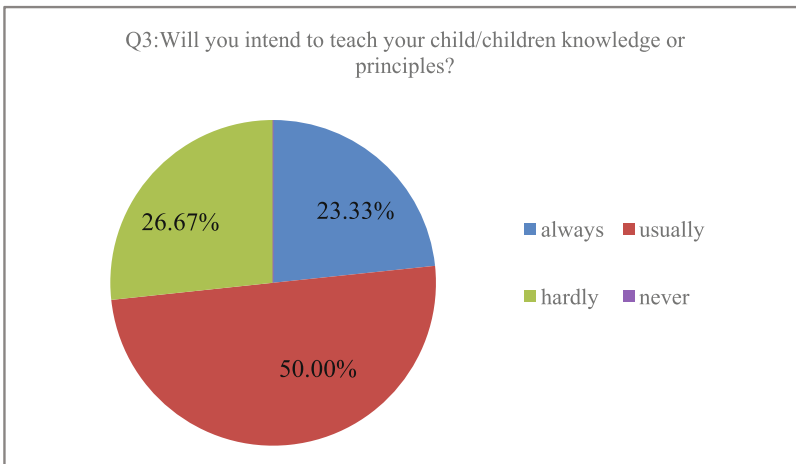


Fig. 3. Result of Question 3 in the questionnaire

Question 4 and 5 are for primary education students, as the following Figs. 4 and 5. The fourth one is about if they have the habit to use mobile terminals, including smartphone and tablets. Positive answers account for 93.3%, which shows that an overwhelming majority of students are familiar with operations of mobile terminals. And this result can guarantee the feasibility of our intelligent learning companion APP. Question 5 is “If there’s an educational APP designed for primary school students when they’re travelling, are you interested in trying it?” 30% students give absolute positive answers, 43.3% say they may have a try. This result means our APP does appeal to our objective users, so it has implications.

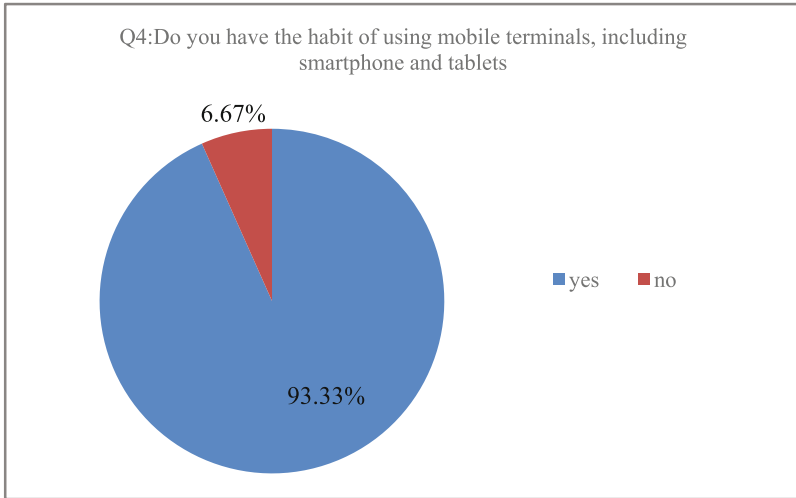


Fig. 4. Result of Question 4 in the questionnaire

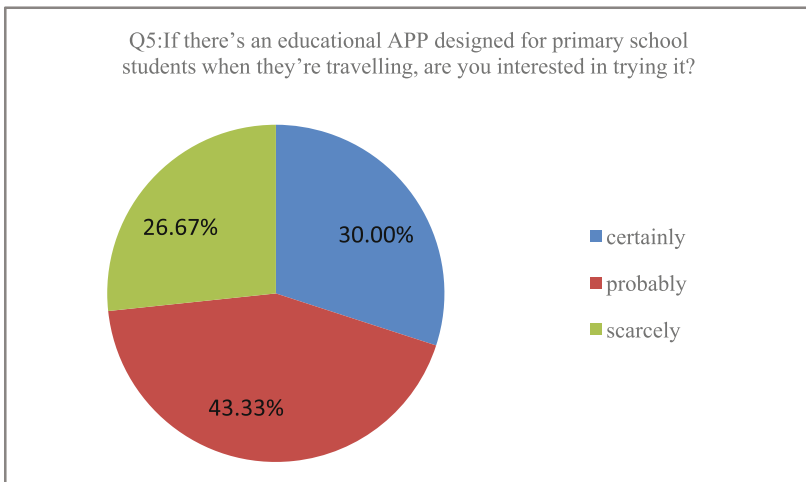


Fig. 5. Result of Question 1 in the questionnaire

Question 6 is about expectations for this APP. It's an open-ended question for both parents and students and we got 22 answers for this question. After we review these answers, expectations in descending order are: helpful for obtaining knowledge and senses, easy-to-use, both educational and entertaining, appealing to children, with delighting interfaces and route planning function, free of charge, interactive, innovative and power-saving. All these expectations will be taken in to consideration when we develop this APP.

3 Learner Analysis

3.1 Necessity

Learner analysis, also known as the analysis of teaching objects, is in the process of teaching design to understand learners learning preparation and learning style analysis. It is helpful for us to understand the learners' learning preparation and learning style so as to provide the necessary basis for the analysis of learning content, learning goal and the design of teaching methods.

On one hand, our app is aimed at primary school students. The mental development of the age group has its characteristics, so they must be separated from other age levels when being considered on the other hand, the learner analysis for us to better arrange the courses involved in the app Content, improve learning efficiency. To sum up, it is necessary to carry out learner analysis.

3.2 Analysis of Learners' General

3.2.1 Age

The age group of the learners is 6–12 years old. According to Piaget's theory of cognitive development, it is in the concrete operation stage. The cognitive structure of the learner has been reorganized and improved, with the concept of abstraction, logical reasoning, logical thinking and clustering. However, children's thinking at this stage still need specific things to support, therefore, at this stage children should do more practical skills training. Our app is based on field travel which learning and entertaining, in line with the characteristics of this age-group learners.

3.2.2 Personality Differences

Pupils are more lively in personality. They usually lack a focus of attention but they process a high degree of interest and imagination, energetic and lively. This requires that the education of primary school students is not be conducted in a rigid way, but rather with a consideration of their interests, to cater to their physical and mental development. In the app design process, we take into account the factor of concentration of the learner's attention, and choose the appropriate content of teaching according to the different interests of students.

4 Research Objective and Content

4.1 Research Objective

- Design an app based on the constructivism learning theory and the theory of psychological theory such as partnership theory.
- Conduct case study on the effect of primary students learning through travelling with the help of mobile application software.
- Explore the feasibility and validity of mobile learning terminal assisting primary school students in gaining knowledge during the journey.

4.2 App Function

Based on the result of demand analysis and learner analysis above, we would like to design an app, which can assist primary school students in Beijing in learning through the whole travelling process. The whole travelling process includes the period before visiting a scenic spot, during visiting a scenic spot and after visiting a scenic spot. Before travelling, the app can recommend the tourist attractions or tourist routes that are more convenient for users. During the journey the app can guide the user and offer some information about the scenic spot they are visiting which is related to textbook knowledge, while after the journey it can provide with extensive information about the scenic spot as well as some games and tests to make sure that the users grasp the textbook knowledge.

Considering the interactivity, we expect to design a learning companion. Users can choose the image of the companion according to their preference. Besides providing information, the learning companion can also make daily communication and simple interaction with the users based on the feature information reserved when the users register.

4.3 Research Content

Selection of attractions. In our app, we hope to design several tourist routes that contain three or four scenic spots each. During the app concept design phase, we decided to choose one route for instance to test the efficiency of the app. The tourist route we choose is the historical route, which consists of the Forbidden City, the Great Wall and Yuanmingyuan Imperial Garden (the Old Summer Palace). Among the above three spots we prepare to choose the Forbidden City as a sample. We will collect the data based on the Forbidden City.

Find the relation between the scenic spots and textbook knowledge. We classify the textbook knowledge by subjects and grades, and find the relationship between the scenic spots. Take the historical route as a sample, we list the textbook knowledge related to the scenic spots as the following Table 1.

Table 1. Relative textbook knowledge about the scenic spots in the historical route

Historical route	Relative textbook knowledge	Text version	Function of intelligent learning companion
The Great Wall	1. Common sense: history of the Great Wall 2. Culture :function of the Great Wall	People's education press The national primary school Chinese (S version) Shandong education press	Phonetic explanation, text introduce, stories

(continued)

Table 1. (continued)

Historical route	Relative textbook knowledge	Text version	Function of intelligent learning companion
The Forbidden City	1. Common sense: history of the Forbidden City 2. Culture :anecdote of the Forbidden City 3. Technology : palace architecture	People’s education press The national primary school Chinese (S version) Shandong education press	Phonetic explanation, text introduce, stories, videos
Yuanmingyuan Imperial Garden(the Old Summer Palace)	1. Common sense: history of Yuanmingyuan Imperial Garden 2. Culture:Chinese modern history	People’s education press The national primary school Chinese (S version)	Phonetic explanation, text introduce, stories, instructional games

Design UI. After completing data collection and finding relative textbook knowledge of scenic spots, we need to design the image of the intelligent learning companion and software interface. The intelligent learning companion will appear in the middle of the main interface. During the learning process the intelligent learning companion will interact with the user from time to time, reminding the user of the remaining learning tasks, instructing the user to start a new scenic spot, or helping the user to complete travel diary or take a rest properly. Figure 6 has shown an example of our ideal interface. The four buttons at the bottom of the interface will lead user to the main interface, to choose travelling route or spot, to continue studying tasks and to check personal data on after another. The sample image shows the process of choosing travelling route and spots.

Survey and Evaluation

(1) Questionnaire survey

After completing the prototype of the app, we need to compile questionnaire and scale, and choose some students in our experimental primary school. Evaluate the learning effect of the examinees through the questionnaire and scale to find out whether the app has aroused students interest in learning during travelling and improve students’ mastery of the corresponding knowledge.

(2) Behavior observation

After obtaining the permission of students, parents, and teachers, we will record the using procedure of some students by video, and analyze the video under the guidance of psychologist and educational experts to find the efficiency of the app from the perspective of behavioral science.

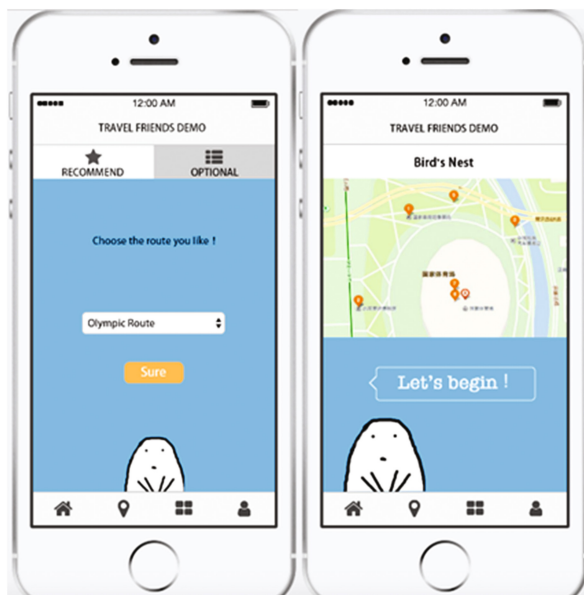


Fig. 6. Sample interface image

5 Technical Route

The Fig. 7 shows the process of design a phone app. It's explained that all the steps in this figure are not in a strict order. We decided to consult this model and determine our technical route.

5.1 Collect and Clarify the Relationship Between the Knowledge in Secondary School Textbook and Certain Scenic Spots

According to the scenic spots chosen before, we will choose relative knowledge of different subjects and different grades, so we can establish the knowledge database of the app.

5.2 Develop the Incentive Mechanism

In line with the characteristics of secondary school students' attention, develop the incentive mechanism following the law of reinforcement.

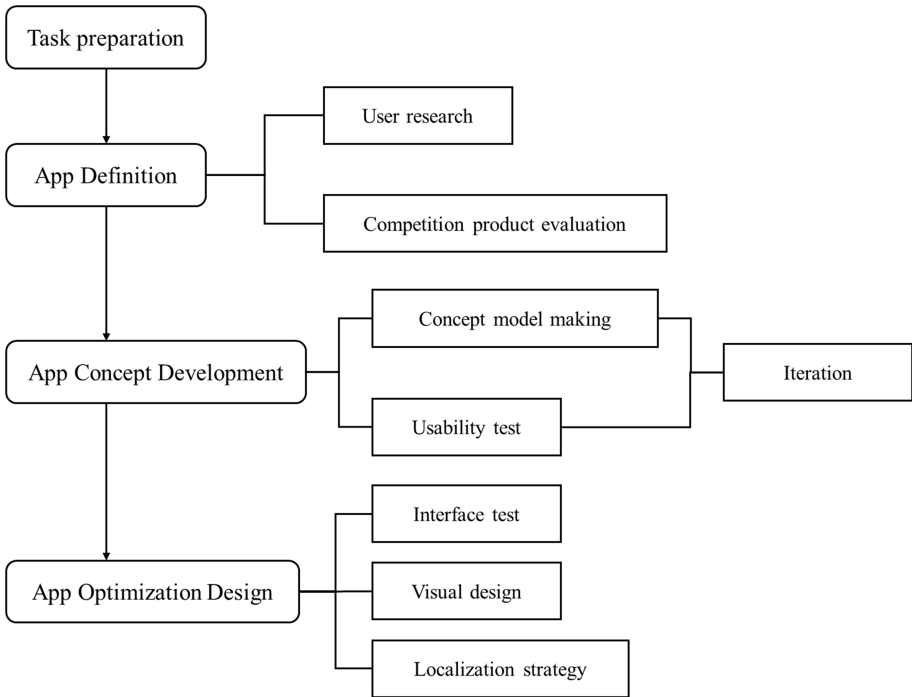


Fig. 7. Design flow

5.3 Making Electronic Resources

This includes designing the image of virtual learning partner, proper UI and other pictures. In some cases, this involves audio and video, we will choose different resources according to the specific topics.

5.4 Program Writing

Write the program of app and pay attention to the interactivity.

5.5 Test and Improve the App

After developing the app, we will test it in the experiment school. We will judge the effect of the app through questionnaire and interview. We will also invite secondary school teachers to use and evaluate the app. After collecting the opinions, we will improve the app.

5.6 Analyze Data and Write Paper

After the whole research process, we will write a paper and promote our research results.

6 Expected Outcomes and Effect

- Strengthen the elementary students' passion for learning and sense of autonomy, which can also help promote the educational reform.
- Offer a form of entertainment, and help students gain the awareness of learning by playing.
- We expect the app can improve student's learning ability and help students form the habit of self-study.
- Increase student's interest in visiting traditional Chinese scenic spots and inheriting traditional culture.

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