A STUDY OF LEARNING OUTCOMES OF A MOBILE TRAVEL
APPLICATION IN TOURISM GEOGRAPHIC COURSE

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Mobile technologies have been adopted into education more and more. New hardware, such as smart phones and tablets, has increased the popularity of mobile technology. There are also many applications created for the fields of education and tourism. This research chose a travel application from Taiwan to apply into a tourism geographic course at the Taiwan Hospitality and Tourism College (THTC). A quasi-experiment design was applied to this study. Two classes/groups participated in the study. One class was the treatment group which used the travel app through teaching scenarios. The other group was the contrast group which used a lecture format with handouts. Both groups were given a pre-test to determine knowledge of Danongdafu Forest Park (DFP), and Taiwan tourism geography. A post-test was administered after eight weeks of teaching activities. Post intervention scores were compared to pre-intervention scores between the two groups. The results of ANOVA showed that there was no statistically significant learning difference between the treatment group and the contrast group. A paired-sample t-test analysis revealed that after eight weeks of teaching DFP content, both groups gained significantly in knowledge. Furthermore, the learning attitudes and interviews of the treatment group students indicated positive responses utilizing m-learning in teaching scenarios. Students indicated a desire to receive m-learning opportunities for future courses.
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CHAPTER 1

INTRODUCTION

There are four waves in the evolution of educational technologies (Crescente & Lee, 2011). In the 1970s, the computer was launched, and many people had to share one single machine. This was the first wave. The second wave began in the 1980s with the developing technologies of personal computer and desktop publishing. Internet and telecommunications technologies were developed in the 1990s, comprising the third wave of educational evolution. Pownell and Bailey (2000) stated that mobile learning (m-learning) would be the fourth wave for educational technologies. Shih and Mill (2007) also stated that mobile technologies could be a new evolution for learning and teaching.

Educators are adopting mobile technologies such as smart phones, tablets, wireless technology, and long-term evolution (LTE) technology. According to Brink (2011), mobile technology can provide many of benefits for learning such as supplying current information for learners, enhancing training courses and strategies, motivating people who may not be eager to participate in coursework, increasing learning likelihood anytime-anywhere, and saving time for increasing productivity.

Tourism educators must understand the trend of wireless technological features so that they can utilize the features in instructional design. Moreover, the tourist market has rapidly developed and divided into numerous sub-markets that include personal or business travel. World-wide tourism is both an enjoyable and pleasurable activity for most people and of enormous significance to the global economy. According to the United Nations World Tourism Organization (UNWTO, 2013), international tourists’ visits reached 1.035 billion in 2012, and the rate is expected to increase by roughly three to four percent in 2013. The tourist market demands more experienced and skilled people to provide quality services. Therefore, students of the tourism department are expected to maximize information within
technological capacities so that they can deal with mass information and provide the best suggestions and services for tourists.

A goal of the tourism field’s programs in higher education is to ensure that students graduate with the kinds of skills, knowledge, and wisdom needed to succeed. Thus, one area of research is the investigation of m-learning outcomes which is using a mobile travel application (app) with a location-based services (LBS) feature in a mandatory course. This learning goal is addressed in the Taiwan Tourism Geographic class provided at the Taiwan Hospitality and Tourism College (THTC).

At THTC, tourism geography is an important mandatory core course for the Department of Tourism and Travel Management (DTTM). Also, information technology skills are a major issue for the students in the DTTM. Currently, there are many travel applications created for the tourism fields in Taiwan including Tour Taiwan, Taiwan Go, Show Taiwan, and Danongdafu Forest Park. Therefore, research on the effect of adopting new technologies into course scenarios is an interesting and significant issue for instructors, the department, and the college. This paper focuses on the effectiveness of utilizing a travel app for Taiwan in the Taiwan Tourism Geographic course at the THTC to examine students’ learning and attitudes towards using the smartphone app. This dissertation uses a quasi-experimental design employing two classes of tourism students in a geography class at the THTC.

Purpose of the Study

There are two main purposes of this m-learning outcome study. The first purpose is to investigate the attitudes of the DTTM students in the THTC who use mobile technologies, smart phones, and the travel app in the Taiwan Tourism Geographic course. This line of research evaluated the learners’ ideas, thoughts, feelings, and experiences in regards to using
the travel app during class activities and a field trip. The second research goal is to compare the m-learning activities to more traditional classroom activities. The m-learning scenarios use the smartphone with the LBS featured travel app in the treatment group; while, the traditional classroom scenarios use paper materials in the contrast group.

This study had several benefits. The research provided information which allowed teachers to determine the effectiveness of using m-learning to provide needed information to complete an informational fieldtrips. Educators could design or create better m-learning objects and scenarios based on the results. It was hypothesized that new m-learning models and strategies increased students’ motivation, and m-learning curriculum provided a higher level of learning.

Need for the Study

Many papers focus on adopting mobile technologies in education for m-learning development, the attitudes of students and faculty concerning m-learning, the features of m-learning and m-learning design and procession. For instance, Shih and Mill (2007) and Koole (2009) built instructional design models of m-learning; Cao, Tin, McGreal, Ally, and Coffey (2006) provided convenient m-learning methods and paths for a mobile library system for students; Crescents and Lee (2011) set up a contextual-awareness strategy to develop a useful user interface for learners. In addition, many articles illustrate m-learning outcomes and learners’ attitudes toward using the smartphone app. More limited but still available are studies on m-learning using a smartphone with a travel app in higher education tourism. Park, Nam, and Cha (2012) and Marwan, Madar, and Fuad (2013) indicate that students have positive attitudes towards using smartphones in learning activities. This view is contested when Molina, Redondo, Lacave, and Ortega, (2013) indicate that learners prefer to use
desktops or tablets for learning rather than using smartphones because of the limitation of visualization.

Thus, the outcome of this study in tourism higher education provided needed information on the efficacy of using mobile apps to train students for positions in the travel industry. This study was an important resource for developing m-learning strategies, travel apps, and mobile service training for the DTTM of THTC, and therefore, was also a contribution for m-learning outcomes in future tourism studies.

Research Framework

The research is based on mixed methods research which creates a framework for this study using quasi-experimental design theory. Among the different types of experimental design, two categories are true experimental design and quasi-experimental design. Gribbons and Herman (1997) indicated that true experiment designs assign subjects randomly whereas quasi-experimental designs often work with existing groups. In this study, only two classes were involved in the research: one class was a treatment group, and the other was a contrast group. The quasi-experimental design was chosen to compare the learning outcome between two classes because the classes which were studied were intact and not randomly assigned

Quasi-experimental design has several categories such as nonequivalent group-posttest only, nonequivalent group-pretest-posttest, and time series design (Gribbons and Herman, 1997). Because the research intends to compare m-learning with a face-to-face delivery model, the nonequivalent group-pretest-posttest design was selected. The framework for the research of this investigation is shown below as Figure 1-1.
Research Questions and Research Hypotheses

Research Questions

The research questions had four major parts. One part was focusing on the students’ attitudes towards using smartphones with the travel app or handout in the tourism geographic class. Only the treatment group needs this set of questions because this was the only group that utilizes the m-learning scenarios with the travel app. The contrast group needed to fill out the questionnaire covering the handout scenarios. The thoughts and attitudes of the participants were important aspects of this study. Hence, the first question of this study was focused on the strategies of the m-learning outcomes for operating smartphones with the travel app in the TTG course. Using quasi-experimental research design, two freshman’s classes of the Department of Tourism and Travel Management (DTTM) at the Taiwan
Hospitality and Tourism College (THTC) were the participants. The achievement scores of the treatment and contrast groups were compared to determine m-learning differences between two groups. It was determined if there was a significant difference in m-learning outcomes between the treatment and contrast group after providing the smartphones with travel app activities.

A related research question examined if there was a significant increase in learning outcomes after eight weeks of teaching scenarios for both the treatment group and the contrast group. Since I am an instructor of the TTG course, it was anticipated that students would master the curriculum and learn what they needed from this mandatory course. The instructor created 50 multiple choice questions for the pretest and posttest so that the learning outcomes of two groups could be examined by a paired-samples \( t \)-test.

The third part of this research was what the students’ attitudes were towards using m-learning with the travel app in the treatment group and using handout learning in the contrast group in the Taiwan Tourism Geographic (TTG) course. The research question was to explore the learning attitudes of utilizing mobile travel app and the handout learning by adopting interviews with two groups’ students. The purpose of the research question was to understand if the treatment group had more positive attitudes when using smartphones in the teaching scenarios.

Research Hypotheses and Null Hypotheses

There were four research hypotheses in this quasi-experimental study, and the null hypotheses were following after each research hypothesis.

\[
H_1: \text{There was a statistically significant difference in learning outcomes between the treatment and the contrast group after eight weeks of teaching activities.}
\]

\[
H_{01}: \text{There was no statistically significant difference in learning outcomes in the learning objectives between the treatment group and the contrast group after eight weeks of teaching activities.}
\]
H2: There was a statistically significant increase in the mastery of learning objectives between the pretest and posttest of the treatment group after eight weeks of m-learning teaching activities.

H02: There was no statistically significant increase in the mastery of learning objectives between the pretest and posttest of the treatment group after eight weeks of m-learning activities.

H3: There was a statistically significant increase in learning objects between the pretest and posttest of the contrast group after eight weeks of participating in learning activities within the Taiwan Tourism Geographic course.

H03: There was no statistically significant increase in the mastery of learning objectives between the pretest and posttest of the contrast group after eight weeks of m-learning activities.

H4: Students in the treatment group had positive attitudes towards using smartphones in the teaching scenarios than the contrast group.

H04: Students in treatment group did not have positive attitudes towards using smartphones in the teaching scenarios than the contrast group.

Limitations

Several research limitations might affect this study, such as a lack of smartphones, unfamiliarity with the mobile travel app, and the social network between the treatment and contrast group. This section clarifies those research limitations in two parts: the factors which jeopardize internal validity, and the factors which jeopardize external validity.

Factors Jeopardizing Internal Validity

Several issues might affect internal validity.

A. The students’ attitudes towards using new technologies in class activities were a potential research limitation. If most learners had positive attitudes, they would participate in more learning scenarios so that the learning outcomes would be higher than if they had negative attitudes.

B. The learners’ capacities to deal with mobile devices and the smartphone travel app were the second research limitation. When students had difficulty dealing with devices or
apps, they had to spend more time learning those features and functions. These factors would force students to spend time learning the functions of devices and apps while perhaps decreasing the amount of time spent in learning the course material.

C. A third factor that might affect the research was the functions and features of the mobile travel app. The smartphone travel app of the Danongdifu Forest Park is created for tourists, not students, who have knowledge of the use of smartphones. Thus, the materials from the app are created for tourists to understand and gain knowledge concerning the attractions of the park rather than to learn how to use smartphones. The app does not include all the materials necessary to teach new users how the app works, which might affect the learning outcomes.

D. A fourth factor that might affect the study was the social interaction between the treatment group and the contrast group. Since the members of two groups were all freshmen in the DTTM of THTC, the students’ college activities such as the extracurricular activities, coursework communications, and in-group interactions within this or other courses all might impact the treatment in this quasi-experimental study. For instance, the contrast group’s students might hear about the travel app of Danongdifu Forest Park from the treatment group students, download the app to fulfill their curiosity, and share the app with other classmates. This situation might influence the research. Hence, the teaching scenarios would not tell the students about the research in order to diminish the students’ curious about the difference of teaching scenarios.

Factors Jeopardizing External Validity

The external validity might also be influenced by several elements.

A. The capacities of wireless broadband from some carriers’ services were challenges to external validity. The travel app with LBS features would need a wide broadband to
download the video and audio materials and locate the users’ position. If the download process took a long time due to the carriers’ services, it would impact the learning process and affect m-learning outcomes.

B. The characteristics and functions of mobile devices that were owned by students in the treatment group was a second threat to internal validity. The mobile devices, mostly smartphones, were provided by the students. The functions, data processing speed, and screen size were all variable. This factor might impact each individual learner’s m-learning ability to access the app, thus becoming a threat to external validity.

C. Among the students who own smartphones or tablets there was a third external factor that might impact research results. Although smartphones are more and more common for college students, some students still could not afford the monthly bills and high price of mobile devices. This situation might be another factor impacting the validity both on the internal and external fields.

Definition of Terms

- Treatment group – The treatment group was one of the freshman classes in DTTM of the THTC. The group utilized the eight weeks of m-learning scenarios, which was the smartphone with the Danongdafu Forest Park app, in the TTG course. Before the class activities, the pretest of the knowledge of the forest park was applied in order to test the difference with that of the contrast group. The posttest was given in the eighth week to examine the m-learning outcomes compared to the contrast group. A survey of using m-learning attitudes also was issued to know the thoughts and progression of the treatment group.

- Contrast group- The contrast group was the class opposite the treatment group. Instead of m-learning, the contrast group was given the objects’ handout to learning the park
so that the study could be compare the different outcomes between the two groups. The contrast group was also taken the pretest and posttest in order to examine the difference with that of the treatment group. A survey of using the handout of the Danongdafu Forest Park app was requested in order to investigate the learning processes and thoughts from the contrast group students.

- **Learning outcomes** – Learning outcomes mean the learning result, effectiveness, or success on the learning objects of Danongdafu Forest Park. Posttest scores of the two groups were the effective learning outcomes and were the quantitative data to examine the research hypotheses. The researcher created 50 multiple choice questions from the teaching materials to examine the learning outcomes both for the treatment and the contrast groups.

- **M-learning** – Mobile learning (m-learning) is operating new wireless technologies like third generation (3G) or fourth generation (4G) wireless technologies with portable devices such as smartphones and tablets (Shih and Mill, 2007). This study was using the smartphone as a platform and installing Location-Based Services (LBS) features’ travel apps for m-learning in the treatment group.

- **Mobile devices/smartphone** – According to Dictionary.com (2013), mobile devices are referred to as a handheld, small computer. Those devices usually come with a miniature keyboard and a touch or non-touch display screen. These types of mobile devices commonly include personal navigation devices, personal digital assistances (PDA), mobile phones, smartphones, and tablets. The smartphone had been adopted as an m-learning tool in this study since the smartphone was the most common mobile device used by students in DTTM at THTC.

- **Location-based services (LBS)** – According to Vrček, Bubaš, and Bosilj (2008), there are two definitions of the LBS.

  **Definition A:** LBSs are the information services available via the mobile devices. The use of mobile networks is based on the capability of the location of mobile device.
Definition B: LBSs are the wireless IP services using the geographical information system (GIS) for the mobile user, e.g., each application service using the position of a mobile device.

In this study, the LBS features of the Danongdafu Forest Park travel app were designed in course activities, scenarios, and a field trip of the treatment group.

- Danongdafu Forest Park - The Danongdafu Forest Park in Hualien has various travel resources including domestic species of trees and animals, aboriginal culture, the local Hakka culture, sugar farming and factory history. The office also invited international artists to use driftwood to create carvings for the park. These artistic carvings are the new travel attractions in the Danongdafu Forest Park.

  Before this area became a forest park, for almost 100 years it was a huge area for farming sugar cane. However, since the country joined the World Trade Organization in 2002, sugar production in Taiwan is more expensive than importing it. Therefore, the Agriculture Bureau decided to create the forest park, taking up approximately 1250 hectares of land.

  After ten years of effort involving planting trees and creating traveling facilities, the Danongdafu Forest Park is now becoming a beautiful travel spot, providing various tourism attractions.

- Danongdafu Forest Park travel app – The Danongdafu Forest Park Travel app was created by the Agriculture Bureau of Taiwan, Republic of China, when the park was opened to the public in 2012. This app is designed for tourists to view, understand, and experience the history and current state of the forest park. The six major functions are the event activities providing event information, the introduction of DFP illustrating the history, features, and development of the park, the transport information providing several transportation data for travelers, the vocal tour guide adopting LBS features and telling the stories for visitors in their physical position, the hot travel spots telling tourists the popular travel attractions; and
final one, video travel guide, enriching LBS features and showing the video connecting to the YouTube films for tourists when they are near the spot. Hence, tourists can also study the geographic, ecological, cultural, and industrial history of the site while learning about events and activities. When travelers, for instance, visit the tourist spots in the forest park, the functions of the mobile LBS will not only show their position, but also provide voice guidance specific to the location of the tourist. This LBS feature can provide accurate information to coincide with the correct time and place.

*Figure 1-2. The travel app of Danongdafu Forest Park.*

The app provided this feature to facilitate planning a field trip in the forest park. The treatment group students were asked to download this travel app so that they could engage in an enriched m-learning experience.

**Overview of the Research**

A smartphone with LBS featured travel apps is becoming more and more popular for tourists. In order to help students have specific capacities and skills for success, m-learning
with smartphones installed with the travel app becomes essential for the students’ careers. This m-learning opportunity with the travel app will provide students with the opportunity to figure out the way to build, create, and deal with the m-learning app in higher education courses dealing with tourism. This pilot study could be a trigger the higher education in this field of travel to enter the 4th generation of education revolution.
CHAPTER 2
LITERATURE REVIEW

Introduction

In this chapter, the literature review is divided into two sections. The first section is a review investigating the literature surrounding m-learning instructional system design and the m-learning strategies from previous researchers’ works. This section of the review provides a framework for the current study. A case is developed for the use of an action research strategy for exploring the m-learning outcome and m-learning attitude of students. The second literature review section focuses on the development of mobile technologies, especially on the LBS feature, since LBS is important for tourism and tourism education. The Danongdafa Forest Park (DFP) travel app merges LBS features, so the study adopted the DFP travel app as m-learning material for the Taiwan Tourism Geographic course.

According to Brink (2011), m-learning has benefits and limitations. The benefits of m-learning include providing easy methods to obtain current and updated information, accelerating the reinforcement of training courses, accessing a population, enhancing outcome of learning, and providing increased productivity and revenue. However, mobile devices in learning also have limitations: tiny screen size, low computational power, small battery capacity, limited input interface, and narrow network bandwidth (Kukulska-Hulme, 2009). Currently, many scholars and educators are contributing to the development of learning theories and instructional designs that use m-learning. This literature review explores some of the advantages and disadvantages of m-learning, and analyzes instructional design models and strategies that are being developed.
Instructional Design Models of m-Learning

According to Piskurich (2000), the goal of instructional design is to assist instructors in teaching their content and to assist trainees in learning what they need to know. Instructional design not only can make decisions more systematic and accurate but also more effective in cost, time, learning, and evaluation. In 2006, Winters indicated that there were generally four broad perspectives of m-learning:

A. Techno centric: M-learning devices will include PDAs, mobile phones, iPods, PlayStation Portables etc.

B. Relationship to e-learning: M-learning is as an extension of e-learning. These definitions are often all-inclusive and do not help in characterizing the unique nature of m-learning.

C. Augmenting formal education: M-learning includes all forms of formal learning not only learning in the physical classroom.

D. Learner-centered: The concept of m-learning is strongly linked to the mobility of learners so that a theory concerning m-learning is also an Activity Theory. This relationship results in m-learning being considered from the learner’s perspective, and perpetuates the definition of m-learning as: Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies. (Sharples, Ed., 2006)

Based on this definition, m-learning needs specific instructional design models and strategies, so educators can provide learners a better experience within an effective learning framework.

Two main models for instructional design for m-learning are prevalent in the literature. One is Shih’s theoretical model called scenario, message, synchronization, and evaluation (SMSE) mobile learning model (2005) and Shih’s mobile learning model (Shih, 2005; Shih, 2007). Another model is the Framework for Rational Analysis of Mobile Education (FRAME) of Koole (2006). Both experimental articles and theoretical papers for these two models were investigated. An illustration and discussion of these two models and some supporting articles are described below.
Shih’s Mobile Learning Model

SMSE instructional design model (2005). Shih (2005) indicates that two challenges of today’s online e-learning are how to motivate to actively participate in online learning environments and how to facilitate and sustain collaborative learning in an online environment. He believes applying mobile technologies would be the solution for those issues. Shih created SMSE as a ubiquitous educational environment by relying on his experience with m-learning and philosophy of student-centered learning. This model features modulators of communication in m-learning situations and includes four crucial parts: scenario, message, synchronization, and evaluation (Figure 2-1).

![Figure 2-1. SMSE instructional design model (Shih, 2005).](image)

Shih defines scenario as creating suitable learning material for m-learning activities. The convenience of learning anytime and anywhere can motivate students’ learning. The term message refers to activities such as texting, instant messaging, or sending an audio/video file to inform the students; which Shih asserts can also encourage interactivity and collaboration between students and instructor. Synchronization occurs when students collaborate in real-time, whether the interactions are face to face or online. The evaluation stage promotes students’ self-reflection and transformative learning. The evaluation stage not only enhances students’ learning efficiency from m-learning but also improve scenario design. The evaluation stage also focuses on creating authentic learning and knowledge construction. The SMSE instructional design model emphasizes designing small coherent
segments of material and splitting the segments into multi-step job tasks providing an enhanced learning experience.

**Shih’s Mobile Learning Model, Revised (Shih & Mills, 2007)**

Two years later, Shih and Mills (2007) integrated Keller’s (1987) attention, relevance, confidence, and satisfaction (ARCS) model of motivational design into their model to create a new instructional model for the m-learning environment. The learning circle used in ARCS motivational design model circle includes attention, relevance, confidence, and satisfaction. In Keller’s idea, human interactions are the most important contributor to learning motivation that results in good learning performance. The combination of the ARCS Model and SMSE resulted in Shih’s mobile learning model (Figure 2-2).

![Shih's Mobile Learning Model](image)

*Figure 2-2. Shih’s mobile learning model (Shih & Mills, 2007).*

This new m-learning model is rooted in the philosophy of social constructivism and Vygotsky learning theory. The first step in the learning cycle is to get the learner’s attention by sending a multimedia message intended to motivate the learner’s interest. The second phase is relevance, which involves searching the web site of instructional information through hyperlinks of messages. The third step consists of a blending of relevance and
confidence where learners can communicate through discussion via text, voice, picture, and/or voice message. In the fourth phase, confidence, learners utilize video and audio to share stories and lessons learned. The final stage is the satisfaction of the learners with the instructional design process in simulated environment such as integrating educational games in to course activities. This learning model relies on mobile infrastructure. Shih expects that because learner interactions involved mobile devices, the model would be suitable in either pure m-learning or blended learning environments (Shih, 2005).

Enhanced Shih Model for Effective m-Learning (Moses, 2008)

Interested in m-learning instructional design, Moses (2008) inspected Shih’s mobile learning model and proposed an enhanced model. Moses indicated that Shih’s model is based on graphical user interface (GUI). The enhanced model incorporates the use of voice user interface (VUI), and includes online library for searching for both e-books and audio books. This model enhances and encourages learners’ positive outcomes by using a collaborative filtering algorithm to aid the search posting and reading of testimonials. Figure 2-3 is Moses’s enhanced instructional design model. Compare to Shih’s mobile learning model, Moses’s model adds two more stages. One is searching the online library for e-books and audio books in the relevance phase. The other added stage is the posting and reading of testimonials about positive learning outcomes in the satisfaction phase.

Framework for the Rational Analysis of Mobile Education Model (Koole, 2009)

The purpose of the framework for the rational analysis of mobile education (FRAME) model is to guide the development of future mobile devices, learning materials, and design instructional strategies for m-learning (Koole, 2009). This model is based on both social and personal aspects of learning. The model incorporates some of the advances in the activity
theory of Vygotsky (Kaptelinin and Nardi, 2006) but also places more emphasis on the role of the technologies used placing as much significance on the mobile devices as the social and learning activities they are used to complete. The FRAME model also uses the philosophy of the learning theory of constructivism (Smith & Ragan, 1999). Consequently, the model is shown in a Venn Diagram to demonstrate its three aspects: the device aspect, the learner aspect, and the social aspect (Figure 2-4).

![Venn Diagram](image)

**Figure 2-3.** Enhanced Shih’s m-learning model (Moses, 2008).

In Figure 2-4, the device aspect (D) refers to the characteristics of mobile devices. The learner aspect (L) refers to the learners’ cognitive capacities, emotions, and motivations. The social aspect (S) emphasizes the social interaction and cooperation. The intersection of device and learner aspects (DL) is called device usability. The intersection of device and social aspects (DS) is called social technology and represents affordable mobile technologies. The interaction learning (LS) is the connection of learner and social aspects, with an emphasis on social constructivism from instructional and learning theory fields. The primary intersection from all three aspects is mobile learning (DLS). This model identifies region of
m-learning that integrates the collaboration among learners, access to information, and a deeper contextualization of learning.

**Figure 2-4.** The FRAME model (Koole, 2009).

An Experimental Study of Applying FRAME Model

Kenny, Neste-Kenny, Park, Burton, and Meiers presented their research paper, mobile learning in nursing practice education, in 2009. This experimental study included seventeen students from a Western Canadian college nursing program in a real-life nursing practice education course in April to May, 2007. The 17 participants were divided into two groups, 12 students were given personal data assistants (PDAs) to complete the study and were defined as the m-learning group. Five other students who did not use PDAs during the study served as a comparison group.

The article described the study’s outcomes using the FRAME model. The device aspect (D) focused on PDA’s functional and physical components, the learner aspect (L) was
about students’ cognitive abilities and prior knowledge, and the social aspect (S) referred to the social context for this learning. In the device usability (DL) field, the students reported a positive attitude about mobile devices being used. Students especially liked these features: easy to learn, readily portable, and sufficient screen size for mobile specific program. However, in the intersection of social technology (DS), the wireless was difficult to connect and participants had no time to learn the devices. As a result, the experiment could not clearly show that students could have effective interaction learning (LS) with instructors and classmates. According to their study, Kenny et al. (2009) indicated that m-learning was feasible for nursing practice education and suggested m-learning for communication and interactive fields for future studies.

*Instructional Design Strategies for m-Learning*

Besides the ISD models discussed in last section, there is also research and theories being tested that focus on strategies and frameworks for m-learning. According to Brink (2011), mobile technology can provide lots of benefits for learning such as supplying newest or current information for learners, enhancing training courses and strategies, motivating people who may not as eager to participate in the courses, increasing learning likelihood anytime-anywhere, and saving time for increasing productivity. Surely, mobile devices have their shortcomings. The typical drawbacks include small screen size, short battery life, limited input interface, narrow wireless bandwidth, and low computational capacities (Ally, 2004; Ting, 2012).

In 2002, Sharples took the ubiquity advantage of mobile devices to design an experiment on conversational learning in the United Kingdom and created a framework for mobile networked technology with conversational learning design (Figure 2-5.)
Figure 2-5. Computers and conversation in the classroom (Sharples, 2002).

The dark area includes in-class activities, which the white area includes the learning activities outside the classroom. Since the author thought carrying the mobile devices into the classroom would affect the order in the learning environment, the strategy for this research was to design a custom-designed software system for portable devices and implement m-learning activities for ten to eleven years old students outside of the classroom. The results show that the mobile hardware, with properly designed software and technologies, does allow people to learn anywhere, anytime, thus challenging the traditional system of education.

In Taiwan, Chang, and Sheu (2002) created and presented an eSchoolbag system. Those systems take the advantages of wireless and location-aware technologies for a new ad hoc m-learning environment for K-12 students. The eSchoolbag system can access electronic books, web information, and teaching material, while enabling interaction between learners and instructors. Students can also download announcements from the instructors and do their assignments or exercises anywhere they choose. The systems also allow instructors to design four kinds of learning activities. For example, indoor individual or group activities could use
learning activity designs in the classroom and museum. The outdoor scenarios included field trips and natural science learning for individual or group learners. The participating students indicated a high interest in m-learning devices and increased interactive opportunities for their learning environment.

Schwabe and Goth (2005) adopted the features of a real world learning environment for mobile technologies and created a mobile game for the University of Zurich in Switzerland for use in freshman orientation training. Participants were assigned various place, people, and event tasks through their mobile devices. Participants then adapted features such as map-navigation and hunting and hiding from existing mobile games to their real campus environment. The game motivated students, who enjoyed the game, both in the physical and social spaces.

In another study, the Athabasca University in Canada implemented a new strategy of extending the service boundaries of their library. They based their strategy on increasing interest in lifelong learning and continuing education and called the strategy the mobile library (m-library) system. The m-library system can automatically connect mobile devices. Once users log in through their mobile device, the system will directly link user to the appropriate interfaces. The library can thus provide convenient methods and paths to access the library system anytime-anywhere for students (Cao, Tin, McGreal, Ally, & Coffey 2006).

At the conference for Big Issues in Mobile Learning (Sharples, 2006 Ed.), Mirlad (2006) mentioned the possibility of using mobile technologies to design learning activities for innovative education. Mirlad describes three steps:

A. Pick a learning related domain in a specific context and define a relevant problem

B. Develop an educational scenario and activities that incorporate mobile technologies around this problem

C. Illustrate and define all the components of this scenario
Scenario-based design is intended to deal with these tasks (Mirlad, 2006). This design uses a skill seeking complexity and fluidity of design to help students understand more structured and dynamic problems (Carroll, 2000; Mirlad, 2006). Scenarios should provide an interactional description is a significant purpose of this scenario. Enhancing teaching practice with ubiquitous technologies in teacher education, collaborating in m-learning games in corporate settings, and moving in a dynamic environment are the three suggested guidelines for designing learning activities.

Activity theory was created by Vygotsky and Leontev in 1978, and focuses on illustrating human activities and work practices. The theory has been applied in analyzing many topics, such as human computer interaction, information systems interface design, communities of practice, and education (Kuutti, 1996; Bødker, 1991; Bødker, 1990; Engeström, 1993; Engeström, 1987; & Uden, 2007). Uden (2007) discussed activity theory as a framework for designing a context-aware mobile application and sees advantages in utilizing activity theory in the design of a m-learning environment. He concludes that this environment should include interaction with peers, which will help the learner’s performance by identifying the gap between what the students know and what they need to know.

When applying activity theory in designing context awareness for m-learning, there are two main barriers: input techniques and cognitive load. Uden also showed that activity theory is a superior theoretical framework with regard to structure, development, and practice. The framework for designing m-learning is as follows:

Step 1: Clarify the purpose of the activity and deal with the interface design
Step 2: Analyze the context for learning and use
  • Clarify the relevant context within with the activities occur
  • Analyze the activity system using Engeström’s activity diagram
  • Analyse the activity structure
  • Externalization/internalization with interface issues
Step 3: Historically analyze the activity and its constituent components and actions
Step 4:

- Search for internal contradictions as the driving forces behind disturbances, innovations, and change of activity system
- Analyze the contradictions

Another framework for m-learning was created by Motiwalla from the University of Massachusetts in 2007. According to Motiwalla (2007), a solid framework must have two distinctive aspects (Figure 2-6), a PUSH mechanism and a PULL mechanism. Motiwalla also created a prototype m-learning application based on this framework.

<table>
<thead>
<tr>
<th>PUSH Mechanism</th>
<th>Personalized Content</th>
<th>Collaborative Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedagogical Agents &amp; Mentors</td>
<td>Communication Aids</td>
<td>SMS, IM, Alerts, Scheduling Calendars</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PULL Mechanism</th>
<th>Personalized Content</th>
<th>Collaborative Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Tools &amp; Resources</td>
<td>Simulated Classrooms</td>
<td>WML websites, Discussion Boards &amp; Chat Forums</td>
</tr>
<tr>
<td>Alerts, Scheduling Calendars, WML websites</td>
<td>SMS, IM, Discussion Boards &amp; Chat Forums</td>
<td>M-learning Applications</td>
</tr>
</tbody>
</table>

![Figure 2-6. An m-learning framework (Motiwalla, 2007).](image)

In 2009, Zurita and Nussbaum developed a constructivist learning environment with mobile technologies in Chile. They adopted the features of collaboration from handheld devices to an experimental study for first grade children. The results showed a significant learning effect through m-learning, compared to the control group.

In 2010, Chen and Huang (2010) designed an m-learning framework named Mobile Knowledge Management Learning System (MKMLS, see figure 2-7). This framework has three dimensions: interaction, learner, and connectivity. The system encourages learners to acquire, store, share, apply, and create knowledge through wireless technologies to support various mobile devices. The paper of Chen and Huang (2010) showed that larger screen size devices could have provided better task performance, and that ease of use and usefulness were important for m-learning system.
Shih, Chuang, and Hwang (2010) designed a social science activity for elementary students, using wireless communication through mobile devices to extend students’ learning experience. Their study also considered the students’ cognitive abilities so that the activity would provide a suitable context for the learners. After pre and post evaluation, the results showed a significant positive outcome from their study.

Sung, Hou, Liu, and Chang (2010) did a study involving a problem solving strategy used in museum learning. The study divided 65 elementary students into three groups to participate in library field trip activities. The first group was equipped with a mobile guide to the problem solving strategy; the second group was given an audio-visual mobile guide; and the third group was given a paper-based learning sheet. The study indicated that the first group with problem solving mobile devices had more two-way interactions with classmates.

Huang, Yang, Huang, and Hsiao (2010) studied building m-learning networks through collaborative services in order to enhance learning. They called this Mobile Computer-Supported Collaborative Learning (MCSCL). This network and system was based on web 2.0 technology connecting to popular sites such as Facebook, blogs, Twitter, and so on.
authors hypothesized that students would use this mobile collaborative strategy to support their learning. Their results also support the hypothesis that the collaborative use of mobile technology provides a positive influence on knowledge-sharing attitudes, system quality, information quality, and service quality.

Male (2011) presented a scenario using mobile technology to support the social and culture aspects of e-learning. This scenario had parents involved in the socio-culture education environment of their children. The parents were aware of the daily learning objectives, thus enhancing the quality of their children’s learning experience. Male also indicated that a better interface design would increase the quality of the m-learning environment. Therefore, handheld devices with good human factors are a significant element in promoting productive result.

Hwang and Chang (2011) developed an experimental study using a local culture course in Taiwan. The research strategy was to use a formative assessment-based m-learning approach to improve learning motivation and outcome. The authors used a wireless mobile technology providing unlimited learning time and space to develop methodologies and learning tools. Their scenario was a formative assessment-based m-learning approach in a culture field trip in southern Taiwan. The study results showed not only success in promoting the students’ learning attitude but also in their learning achievement.

Another research paper utilizing ubiquity features of mobile technologies was published by Stoyanava-Petrova (2011) from Bulgaria. Their strategy exploited the authentic features of mobile technologies into fieldwork education for engineering courses. Since mobile devices could provide sufficient information just in time for students, the fieldwork education could be provided both in virtual and real world environments. Two case studies were discussed in their paper. In the first one, students were provided with a mobile device
while participating in course activities outside of the city of Plovdiv. The other case involved students visiting a power factory and inspecting the production processes there.

Several other practical field cases were presented by Keskin (2011). A faculty member at the University of Central Florida, Keskin has been involved with the Mixed Emerging Technology Integration Lab (METIL), which is renowned for its work in interactive and virtual systems that simulate operational environments. Keskin showed several practical examples in the paper including Johnson and Johnson PRD 3D University, Microsoft Mobile Course and IVR Sales Materials, My Sports Pulse, Dream Corp Alternate Reality Game, and Go for the Green. Those applications and games used the features of mobile technologies for trainees or players learning in anytime anywhere within suitable contextual designs.

Park (2011) reviewed and analyzed several articles and papers, then created another pedagogical framework for m-learning (Figure 2-8). This 2X2 matrix provides a method to understand the interaction between transactional distance and social natural activity. This framework recognized four types of m-learning, based on the nature of the previous studies. The four types of m-learning are (A) high transactional distance socialized m-learning, (B) high transactional distance individualized m-learning, (C) low transactional distance socialized m-learning, and (D) low transactional distance individualized m-learning. Park expects the framework to be an effective tool for instructional designers of m-learning.

In 2012, Yu-Ling Ting described the shortcomings of mobile devices in education, which include: small screen, limited input options, and low computational power. Accordingly, Ting (2012) created a pedagogical design strategy that contextualizes instructional design for mobile devices to deal with those disadvantages. He also said the design should consider the user’s physical location and previous experience using mobile devices.
In nursing education, Kenny et al. (2009) adopted the FRAME mobile instructional model to practical nursing training courses at a hospital in Canada, and Wu, Hwang, Su, and Huang (2012) applied a context-aware mobile learning system in nursing skills training in Taiwan. There is a significant gap between in-class theoretical knowledge and clinical skills. Hence, Wu et al. selected a context-aware m-learning system for nursing training courses. M-learning devices provide instant, accurate information of operations and they give students means to communicate with instructors and co-workers. Thus, the system can provide accurate information from databases and get instant feedback and supplementary materials from social-networks.

Discussion of m-Learning Models and Strategies

Mobile technologies are developing rapidly, with the potential to support education in many settings. Many educators have already found ways to use mobile technologies in their classrooms. However, researchers have shown that m-learning is effective only when developers understand the strengths and weaknesses of the technology and integrate
technology into appropriate pedagogical practices (Salomon, 1990; Welch & Brownell, 2000; and Motiwalla, 2007).

*m-Learning Instructional Design Models*

There are two main instructional design models for m-learning: Shih’s mobile learning model of 2007, and FRAME model of 2009. Shih (2005) presented a preliminary model in 2005 named SMSE instructional design model. Two years later, an advanced version of the model was published. The Shih model is based on the ARCS model of Keller (1987) and merged the theories of social constructivism, learning styles theory, and learning theory of Vygotsky. The features of this model focus on enhancing mobile communication design and graphical user interface (GUI) for applications. Consequently, the model should be suitable for pure and blended m-learning environments (Shih, 2005).

Based on the activity learning theory similar to Shih’s model, the FRAME model also emphasis constructivism and the idea that knowledge is constructed from reason reality. As a result, the FRAME model says that learners can learn anytime, anywhere, within different physical and virtual places and can interact with other people, systems, or information. For an m-learning instructional designer, the use of a model created by experts would help in creating ideal learning objects and projects for learners. More frameworks for using mobile technologies in the learning environment are being developed. It can be expected to see more and more useful instructional design models that use m-learning in coming years. Crescents and Lee (2011) suggested that as m-learning become more popular in education, the design of more appropriate models and templates will be available for designers.

*m-Learning Instructional Design Strategies*

Based on the review of articles about instructional strategies on m-learning described
in the previous section, it seems that the strategies for m-learning can be organized into five domains: authentic learning environment, ubiquitous learning environment, contextual-aware design strategy, framework design, systems and applications design. These strategies, or dimensions, are discussed next.

The Authentic Strategies

This strategy enables users to move and respond to the physics of the real world (Learning Circuits, 2011). Learners take the portable devices connecting with wireless into real world environments that serve as their classrooms. Chang et al. (2003) developed an eSchoolbag system with location-based services (LBS) that could be used in fieldtrips for students system; Schwabe and Goth (2005) created a mobile game for freshman orientation at a university; Sung et al. (2010) showed a strategy of m-learning in the field trip activities at a museum; Huang et al. (2010) presented MCSCL activity for a m-learning environment; Shih et al. (2010) designed a social science activity in the real world; Hwang and Chang (2011) discussed a formative assessment-based mobile learning approach; and Stoyanova-Petrova (2011) used performance-centered m-learning to enhance fieldwork education. Brink (2011) suggested that LBS might be another trend for m-learning since it can provide teaching in the moment or on demand. Many of the studies highlighted in this paper used an authentic environment as their strategy for m-learning and received positive feedback from participants.

The Ubiquitous Strategies

The ubiquitous feature supports not only students learning anytime anywhere, but also the collaborative and social network aspects of m-learning. The instances of using this strategy into m-learning include Sharples’s (2002) experimental design on conversational
learning in the United Kingdom, the eSchoolbag system design for K-12 of Chang et al. (2003), the M-library project of Cao et al. in 2006, Mirlad’s (2006), suggestion of designing learning activities for innovative education, and Zurita and Miguel (2009) constructivist learning environment.

The Contextual-Aware Strategies

The contextual-aware strategy takes into account the need to develop a useful user interface using context design principles for a limited screen size.

According to Ally (2004), methods to overcome limited screen size and limited time in learning include to organize materials into small units, to generate a learner’s concept map, to contain the intelligent agents, to design a suitable interface, and so on. Examples that utilize this strategy include Uden’s (2007) Activity Theory for designing mobile learning, Huang’s (2010) experimental study showing a larger screen resulting in better outcomes, and the mobile guided museum learning of Sung (2010). Those cases also show the potential for increased positive learning experiences for learners. Learners will have means to create their own knowledge, share knowledge, and allow a deeper contextualization of the learning through this strategy (Crescents and Lee, 2011).

The Strategies of Creating a Framework for m-Learning

The purpose of creating a framework is mostly for designing or guiding the learning strategies, and learning applications of m-learning. Examples include Uden’s (2007) a framework for design m-learning for designing a context-aware m-learning application. An m-learning framework of Motiwalla (2007) provides the requirements to create m-learning applications. Chen and Huang’s (2010) MKMLS framework illustrates interaction, learner, and connectivity three dimensions of m-learning system. A pedagogical framework of Park
(2011) is to help instructional designers incorporate learning concepts and into an m-learning environment.

The Strategies of Designing -Learning Systems or Applications

In the m-learning strategy section, three articles were noted that illustrate people designing their own m-learning systems. Based on the literature search presented above, a course designer who is going to provide for m-learning should do two things.

- Understand the models of m-learning to make good use of the features of mobile device and learning theories.
- Become familiar with the strategies of m-learning to create good learning projects, materials, and integration between technologies, learners, and social networks.

Locational-Based Services (LBS)

Tourism is both an enjoyable and pleasurable activity for most people globally and is of enormous significance for world economics. According to the World Tourism Organization (WTO) of the United Nations, the number of international tourist visits reached 922 million in 2008, and that is a 2 percent increase over 2007. However, tourists usually encountered problems when they are traveling in a strange destination, area, or city because of the lack of travel information. In Brown and Chalmers’s (2003) study in tourism and mobile technology, they identified several problems that travelers usually face. The first situation is what to do followed by how they are going to do it. The last problem is finding where things are. All of those situations irritate them deeply while they are visiting a new place. Although finding and figuring out those problems, organizing and planning itineraries before trips, and traveling at destinations are part of the pleasure of tourism, tourists need better services and methods to resolve such problems. Those problems sometimes frustrate travelers, especially when the itinerary information is not practical or a lack of information
about attractions or events. Therefore, could mobile technology provide solutions for those travel problems?

Since the Federal Communications Commission (FCC) of United States took action to improve the quality and reliability of 911 emergency services for wireless phone users in 1996 called Enhanced 911 rules (E911), wireless network operators must identify at least 95% of all cell phone calls’ location by December 31, 2005 (cited from Wikipedia). This action provides the technological foundation for the Location-Based Services (LBS) (Junglas & Watson, 2008). Moreover, lots of projects, applications, and mobile carriers provide LBS for tourism in order to provide better information services. Could those LBS provide better travel problem solutions? There are some articles and researches relating to LBS and tourism that have been published globally. The following paragraphs review developments in those sectors, including what the LBS are, LBS features in tourism, tourism LBS applications, users’ experience in LBS, and tourists’ attitude of LBS.

After reviewing articles and discussions in those sectors, the features, capacities, and services of LBS could be clearer for tourism industry. The general image about LBS for travel problems and tourism can be presented through this article review.

What the LBS Are

As mentioned in the introduction, the creation of LBS was stimulated by the E911 rules enacted by the (USA) FCC. But we need to also identify the features of LBS other than those related to security.

According to Junglas and Watson (2008), LBS have four geographic location entity principles. The first principle indicates the object having location information services. It can be human or non-human. Second, there are always at least two entities involved in a Location-Based Service request- just like there are at least two people on a phone
conversation. Third, one of the entities is always the object of LBS. In other words, it is the entity about which location information is recorded. Fourth, one of the entities is always a recipient of the location information.

LBS researchers distinguish between location-tracking services and position-aware services. Location-tracking services provided information about a user’s whereabouts to entities other than the user, while location-aware services supply the user (the information requester) with personal location data.

Vrček, Bubaš, and Bosilj (2008) in the article of user acceptance of location-based services give two definitions of the LBS:

Definition 1: LBS are information services available via mobile devices and use of mobile networks and are based on the capability of definition of location of mobile device.

Definition 2: LBS are wireless IP services using the geographical information systems (GIS) for the mobile user, i.e., each application service uses the position of a mobile device. This definition describes LBS as an intersection of three technologies (Figure 2-9).

![Figure 2-9. LBS as three intersection of the technologies (Vrček, Bubaš, & Bosilj, 2008).](image-url)
Two technologies can provide LBS functions, such as signal measurements, and the location estimate computation based on the measurements (Mitchell and Whitmore, 2003). In order words, there are two techniques to approach the mobile device users. One is using radiolocation from a cellular network, and the other one is a Global Positioning System (GPS). Both of them can provide LBS. By using GPS techniques, the end users also need caller or handset with Global Positioning System receiver such as GPS Navigator, cell phone with GPS function and so forth. Subsequently, positioning techniques can be categorized into several varieties, each category with its own advantages and disadvantages. Those types are cell-location, advanced network-based, and satellite-based positioning (Barnes, 2003). Table 2-1 displays the advantages and disadvantages of the three different technique types.

Table 2-1

<table>
<thead>
<tr>
<th>Technique Type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell of Origin (COO) or Cell-ID,</td>
<td>Very Fast speed. Typically around 3 seconds. Low cost. No modifications needed to networks or handsets</td>
<td>Very limited accuracy in areas with low cell radius</td>
</tr>
<tr>
<td>Estimated Time of Arrival (ETOD) for GSM,</td>
<td>Fast speed. ETOD takes around 5 seconds. Moderate cost. Software modified handsets needed for positioning</td>
<td>Accuracy depend on the station of signal measurement and number of Location Measuring Units (LMUs) Accuracy around 50m to 125m (table continues)</td>
</tr>
<tr>
<td>Global Positioning System (GPS) and Assisted Global Positioning System (A-GPS)</td>
<td>High accuracy (Outside of the buildings, approx. 10-20m; Inside of the buildings, approx. 50m A-GPS has high speed about 5 seconds.</td>
<td>High cost. New handsets needed for positioning Variable. GPS takes around 10-60 seconds to locate position and Signal degradation and reduced accuracy in certain environments, e.g., inside of the buildings or urban canyons</td>
</tr>
</tbody>
</table>
The first type of LBS technique is cell of origin (COO), or Cell-ID which includes service area identity (SAI), and Loc WAP and enhanced Cell-ID. It may also include enhancements with propagation time measurements. The advantages of COO are fast speed with low cost. It generally takes about three seconds to locate the position, and it does not need to be modified the networks or handsets so it turns out to be the most economical type. The disadvantage of the COO is low accuracy if the area has low cell radius.

The second type is estimated time of arrival (ETA) for GSM. The related techniques are advanced forward like triangulation (AF-LT), idle period downlink (IP-DL) for CDMA and WCDMA. Fast speed and moderate cost are the advantages of ETA. It takes about five seconds to relocate the position and the software needs to modify the handset position. The accuracy is about 50 meters to 125 meters depending on the visibility of base stations of signal measurement and number of location measuring units (LMUs).

The last technique is global positioning system (GPS) and assisted global positioning system (A-GPS). The advantage of GPS is accuracy positioning that could locate objects about 10 to 20 meters outside of the building and around 50 meters inside of the building. The disadvantages are high cost and slower response time. Since it needs a new handset for positioning, the cost is higher than others; the performance time are various from 10 to 60 seconds relying on applying environment.

Consequently, from the end users’ point of view, mobile devices or mobile handsets such as personal digital devices (PDA), mobile phone (Google’s Android smart phones, iPhone, and so forth), and the global positioning systems (GPS) can provide not only security issues but also have lots of other functions, such as navigation services, and tracking services.

LBS Features in Tourism

No matter which technique is applied, LBS architecture consists of five basic
components: mobile devices, positioning, communication network, service providers and content providers (Steiniger et al., 2006). With those five components, LBS can provide more functions and features for end users. Van de Kar and Bouwman (2001) figured out three types of services related to LBS which were emergency services, services of mobile operators and value added services, and focusing on the last category as a primary opportunity for development of m-business.

In a paper of “Foundations of Location Based Services, Steinger, Neun, and Edwardes (2008) found that LBS has several possible applications and can provide added value. The possible applications and added value of LBS are illustrated in Table 2-2.

Table 2-2

**Possible Applications and Added Value of LBS**

<table>
<thead>
<tr>
<th>LBS possible applications</th>
<th>Examples of LBS Added Value to Carrier by Enabling Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requesting the nearest business or service, such as an ATM or restaurant</td>
<td>Resource tracking. Objects without privacy controls, using passive sensors or Radio-Frequency Identification (RFID) tags, such as packages and train boxcars</td>
</tr>
<tr>
<td>Turn by turn navigation to any address</td>
<td>Resource tracking with dynamic distribution</td>
</tr>
<tr>
<td>Locating people on a map displayed on the mobile phone</td>
<td>Equipment, doctors, fleet scheduling</td>
</tr>
<tr>
<td>Receiving alerts, such as notification of a sale on gas or warning of a traffic jam</td>
<td>Finding someone or something, such as person by skill (doctor), business directory, navigation, weather, traffic, room schedules, stolen phone, emergency calls, etc.</td>
</tr>
<tr>
<td>LBS possible applications:</td>
<td>For the carrier, LBS provide added value by enabling services such as:</td>
</tr>
<tr>
<td>Location-based mobile advertising</td>
<td>Proximity-based notification (push or pull). Targeted advertising, buddy list, common profile matching (dating), automatic airport check-in, etc.</td>
</tr>
<tr>
<td>Asset recovery combined with active RF to find, for example, stolen assets in containers where GPS wouldn't work</td>
<td>Proximity-based actuations (push or pull). Payment based upon proximity (EZ pass, toll watch)</td>
</tr>
</tbody>
</table>

Also, in the article review of research from Vrček, Bubaš, and Bosilj (2008), they summarize the possibilities, features, and capacities from other papers into two fields which
are services for business between company and end users (B2C) and services for business between companies (B2B). Table 2-3 is classification of LBS modified from a paper written by Vrček, Bubaš, and Bosilj (2008).

Table 2-3

**Classification of LBS**

<table>
<thead>
<tr>
<th>Type of LBS</th>
<th>LBS for business to consumer (B2C)</th>
<th>LBS for business to Business (B2B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functions of LBS</td>
<td>Emergency calls</td>
<td>Vehicle tracking</td>
</tr>
<tr>
<td></td>
<td>Information services, Travel</td>
<td>Product tracking</td>
</tr>
<tr>
<td></td>
<td>services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Navigation, Routing, Automotive</td>
<td>Traffic management</td>
</tr>
<tr>
<td></td>
<td>assistance</td>
<td></td>
</tr>
<tr>
<td>Functions of LBS</td>
<td>People and pet tracking</td>
<td>Product replenishment</td>
</tr>
<tr>
<td></td>
<td>Transactions</td>
<td>Mobile sales</td>
</tr>
<tr>
<td></td>
<td>Intelligent advertising (Banners,</td>
<td>M-customer support</td>
</tr>
<tr>
<td></td>
<td>Alters, Marketing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Entertainment</td>
<td>Field personnel support</td>
</tr>
</tbody>
</table>

Oertel et al. (2002) indicated that Location-Based Services are considered a crucial factor for success of mobile applications. It assumed that location-based services should be an essential component of mobile services. In other words, LBS options on mobile phones and smart phones are becoming an essential part of mobile technology. A number of downloadable applications are increasing in online stores. Commercial providers are encouraging users to use experiment with new services. Using smart phones to share information has become more comfortable for people (Wilson, 2010).

Since LBS use has become popular, LBS have emerged as an option for the tourist industry. The use of LBS in the tourist industry is what this paper will explore. In 2000, OpenGIS Location Service (OpenLS) conducted some possible applications of LBS relevant to tourism are quoted in Table 2-4.
Table 2-4

**Possible Applications of LBS Relevant to Tourism**

<table>
<thead>
<tr>
<th>Possible applications</th>
<th>Examples of case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Information</td>
<td>“There is a traffic queue ahead, turn right on the A3!”</td>
</tr>
<tr>
<td>Emergency Services</td>
<td>“Help, I'm having a heart attack!”</td>
</tr>
<tr>
<td>Roadside Emergency</td>
<td>“Help, my car has broken down!”</td>
</tr>
<tr>
<td>Law Enforcement</td>
<td>“What is the speed limit on this road where I am at?”</td>
</tr>
<tr>
<td>Classified Advertising</td>
<td>“Where are nearby yard-sales featuring antiques?”</td>
</tr>
<tr>
<td>Object visualization</td>
<td>“Where is the historic parcel boundary?”</td>
</tr>
<tr>
<td>Underground Object Visualization</td>
<td>“Where is the water main?”</td>
</tr>
<tr>
<td>Public Safety Vehicle Management</td>
<td>“Who is closest to that emergency?”</td>
</tr>
<tr>
<td>Location-Based Billing</td>
<td>“Free calls on your phone, in a particular location”</td>
</tr>
<tr>
<td>Leisure Information</td>
<td>“How do we get to the Jazz Club tonight from here?”</td>
</tr>
<tr>
<td>Road Service Information</td>
<td>“Where is the nearest petrol station?”</td>
</tr>
<tr>
<td>Directions</td>
<td>“I'm lost, where is nearest Metro station?”</td>
</tr>
<tr>
<td>Vehicle Navigation</td>
<td>“How do I get back to the Interstate from here?”</td>
</tr>
<tr>
<td>Vehicle Theft Detection</td>
<td>“My car has been stolen, where is it?”</td>
</tr>
<tr>
<td>Child Tracking</td>
<td>“Tell me if my child strays beyond the neighborhood.”</td>
</tr>
</tbody>
</table>

*Source: OpenLS, 2000*

Tourism LBS Applications

The tourism industry relies highly on integrated information services. Hinze and Voisard (2003) indicate that tourism information providers (TIP) delivering travel information should base their information on location, time, profile, and past history. LBS and event notification systems (ENS) have joined together to provide accurate and updated information for tourists use.

Yu and Chang (2009) indicate that user profile management, tourism information management, location-aware personalized recommendation of attractions and tour plans, tour plan management, as well as map-based positioning and visualization are all needs of the tourism industry. From data collected in the M-Taiwan project, we know that TIP can deliver richer and targeted information for end users. Mobile learning, for instance, can offer the option of more in-depth information for travelers as they visit museums, and cultural centers.
The next section of the literature review will note the features of several systems in the tourism industry which employ m-learning. Systems reviewed include Cyberguide system in the USA by Abowd et al. (1997), GUIDE system in the UK by Cheverst et al. (2000), CRUMPET in Europe from Zipf et al. (2001), and Dynamic Tour Guide in Germany by Kramer et al. (2006).

Cyberguide---California, USA (Abowd et al., 1997)

Cyberguide is a mobile context-aware tour guide and one of the first mobile tour guides presented by Abowd et al. (1997). It works outdoor with GPS and indoor with infrared to determine context information like users’ position and orientation. The overall system is designed to provide four services for tourists which include a map component, an information component, a positioning component, and a communication component. The map component can provide local information such as tourist attractions, restaurants, and hotel locations. The information component can provide supportive information relating to objects and place in physical world. The navigation component can use positioning to deliver accurate information for locations and orientation. The final communications component creates a channel for tourist sending and receiving messages or information.

GUIDE---Lancaster, UK (Cheverst et al., 2000).

The GUIDE system integrates four features to include the use of personal computing technologies, wireless communications, context awareness and adaptive hypermedia so that the tourists need for the information as well as their navigation needs can be supported (Cheverst et al., 2000). In more detail, GUIDE was created for Lancaster, U.K., and it adopts a mobile wireless communications infrastructure in order to broadcast dynamic information and positioning information to portable GUIDE devices. The location-based navigation and
information retrieval mechanisms are provided by the system. Both features are useful and functional. In the paper by Cheverst et al. (2000) visitors were able to use GUIDE to receive dynamic information, e.g., the specials’ menu of a café.

CRUMPET—European (Zipf et al., 2001)

The creation of user-friendly mobile services personalized for tourism (CRUMPET) is a European information society technologies (European IST) project. The purposes of CRUMPET are to implement tourism-related services for nomadic users across mobile and fixed networks and to evaluate the technology in terms of user-acceptability, performance and best-practices (Zipf et al., 2001).

Functions of CRUMPET:

- Recommendation of services
- Interactive maps
- Information on tourist attractions
- Pro-active tips, giving an unobtrusive tip

The approaches of CRUMPET included:

- Tourism-related service content
- Adaptive nomadic services responding to underlying dynamic characteristics, such as network quality of service and physical location
- A service architecture implementation that will be standard-based
- Suitability for networks that will be those that typical tourist users might be exposed to now and in the near future (like GPRS and UMTS)
- Suitability for a range of terminal types, like next generation mobile phone
- Services that will be trailed and evaluated by mobile service providers (Zipf et al., 2001)
Mobile Tourist Guide Service--- Salamanca, Spain (Pavón et al., 2004)

According to Pavón et al. (2004), the mobile tourist guide service, also called TOURIST GUIDE-USAL, provides a set of option to assist potential tourists with organizing their travel itinerary. The system features planner agent, tracker agent, and performer agent. The planner agent assesses tourists and helps them to identify tourist routes.

The Tracker Agent maintains updated information about attractions, restaurant information, and public transportation conditions. The Performer Agent acts in an association role providing an easy interface for users.

Dynamic Tour Guide (DTG)--- Görlitz, Germany (Kramer et al., 2006)

Dynamic tour guide (DTG) is a mobile agent that selects tourism attractions, plans individual tours, provides navigational guidance, and offers location based interpretation. In contrast to existing tour guides the DTG computes an individual tour in real-time by considering available context information like personal interests and location based services (Kramer et al. 2006). The paper of Kramer et al. (2006) demonstrated that tourists in Görlitz, Germany while using DTG verified the potential of the mobile agent and determined that DTG provided the following options:

- One can predict that if provided better information via a mobile device by the DTG, more tourists would visit attractions appropriate to their interests’ favorite.
- The DTG may help tourists visiting destinations for the first time and enable them to pick up sights that are more interesting by providing information that is invisible or inaccessible for tourists.

Launch of the Smart Phone: USA and Worldwide

Since Apple’s iPhone launched on Jun 26, 2007, the sale of smartphones which can support LBS features has boomed across the world. In 2009, 174.2 million smartphones were sold (ITD, 2010), and a total of 1.75 billion mobile phones were sold to end users (Gartner,
2012). According to a report of Market Intelligence and Consulting Institute (MICI), around 550 thousand smartphones in 2009 and 5.56 million smartphones in 2012 were sold in Taiwan. Moreover, more and more device companies will introduce new smartphone products in the near future.

Farber (2008) reported that Google has opened up LBS with plug-ins for mobile technology. Many businesses have started using LBS from mobile sites using Google tools without having to pay any fees. As a result, lots of mobile carriers can provide LBS through smartphones utilizing Google’s open-source tools. This phenomenon of mobile utilizing LBS has become a strong trend in cell phone services.

LBS usage in Taiwan is increasing. There are five major wireless network providers that can act as a tourism information provider (TIP) in Taiwan. These networks include Chunghwa Telecom Company, Taiwan Mobile Company, Far Eastone Telecommunications Company, Asia Pacific Telecom Company, and Vibo Telecom Company. The Chunghwa Telecom Company launched its LBS in 2003. At first, the target users included logistic industries, security service companies, and broadcast companies. In February 2009, Chunghwa Telecom Company designed a new LBS system for iPhone users named Hami. The Hami provides 500 thousands apps and Google map function through its wireless networks. The Vibo Telecom Company lunched a LBS system began on September 26, 2008 called map daily. The users can utilize the LBS function to record travel trails and post information on the website to share with their friends and families.

According to the literature review of tourism LBS applications, the first tourism LBS application was designed in 1997 by Abowd. It provided merely a mobile context-aware tour guide. The improvement of mobile technologies not only applies to mobile devices but also to wireless technology that makes devices and applications more convenient for travel. After a smartphone was launched in 2007 by the Apple Company, smartphones with applications
provide ideal mobile devices, learning material, and delivery methods for education and tourism. The tourism education can also benefit through utilizing these mobile technologies and features.

The Danongdafa Forest Park (DFP) travel app enriches LBS features for tourists, so it is also a suitable source of learning methods and materials for exploration in this study. What is more, DFP is located near the college attended by the research participants. Convenient access makes it easy to organize the field trips during which the LBS features of the app in this study are used. Moreover, the DFP app was created and is maintained by the DFP Office, so adopting the app as m-learning material provides precise and timely information and data for the students and this study.

Users’ Experience in LBS

The previous section discussed the LBS applications and projects demonstrating services and features for travelers. In this section, the paper will describe, examine, and analyze empirical research papers concerning the users’ experience with LBS as an aide to tourists.

In a survey from Freytag (2003), around 1,500 tourists in Heidelberg, Germany were asked about their activities during their visit to the city in 2003. The first important fact to mention is that most tourists explore the city by walking and on their own. Only 7% of the tourists decided join a group tour. The second finding indicates that most tourists move within a very limited area around the old town. Almost everybody visits the castle while all other sights receive less attention; some sights report even less than 5% of the total number of tourists visited their location. This data implies that most sites do not receive a visit from the majority of tourists. Kramer et al. (2006) made a prediction that when more appropriate information is provided about a potential tourist site, more tourists will visit that site. The
following paragraphs provide an example of the types of information that are available through mobile devices from potential travel sites.

In 2000, Cheverst et al. developed a context-awareness electronic tourist guide called guide and conducted a study to determine the effectiveness of guide. The study findings were separated into five sections: validation of requirements, information presentation, GUIDE unit, visitor profile, and acceptance of the awareness information are shown below.

Validation of Requirements

The majority of users (53/60) valued the flexibility provided by the system such as the ability to use the system as a tour guide, a map, or a guidebook. Two features, location-aware navigation and information retrieval mechanisms, provided by the system were both useful and reassuring. However, the users thought that the system was still not easy to use and wished the interface was simpler. When booking an accommodation through the system, only five participants (5/60) indicated that they would use the system over a phone call to a hotel representative. Most users (48/60) said that they would prefer that the hotel had confirmed that their reservation was approved.

Visitor’s Subjective Opinion on Information Presentation

All visitors appreciated the ability to receive additional information. Most visitors (59/60) enjoyed using GUIDE to explore the city. And yet, they were frustrated because some information was not available on a particular attraction when using the system. The visitors also said that they trusted the information presented by the system, including the navigation instructions.
Visitor’s Subjective Opinion on the GUIDE Unit

Visitors were glad to own a portable GUIDE unit. However, some users said that the GUIDE unit was too large and preferred a thinner device.

Interesting Results based on Visitors Profile

Teenage users seem excited about the technology and accessed more than twice as many links as other users. However, visitors without web experience were still comfortable using the system to follow a tour and retrieve information by navigating hypertext links.

Visitors Acceptance of Awareness Information

Users knew the GUIDE device might not be able to provide consistent information since wireless connections might not be available in some areas. At the same time, visitors appreciated the device (Cheverst et al., 2000). The users’ experiences with the GUIDE system, as documented by Cheverst et al., are analyzed and organized as Table 2-5.

From a study performed in Finland with 55 participants, Kaasinen (2003) obtained the following responses from participants:

- The attitudes of the users towards location-aware services were quite positive both in the group interviews and in the user evaluations
- The interviews and user evaluations, turned out to be important to the users
- Yellow Pages service made no distinction between different kinds of restaurants
- The users in the interviews said that location-aware systems should not lead to a predestined location and that the system over-controlled the environment; the user should feel and be in control
- The users appreciated the possibility to generate and store their own information
- Since the contents may come from several separated service providers, consistency becomes very important
- Privacy is important issue
Table 2-5

Finding of Users Experience from GUIDE

<table>
<thead>
<tr>
<th>Component of GUIDE</th>
<th>Positive experience</th>
<th>Negative experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validation of requirements</td>
<td>Location-aware navigation and information retrieval were able to use the system as a tour guide, a map or a guidebook. 1. Users appreciated the idea of being allowed to follow links to receive greater levels of detail on an information topic. 2. Visitors stated that they enjoyed using GUIDE to explore the city. 3. Visitors trust such a system when provided by a reliable source.</td>
<td>GUIDE was still not easy to use and many wished the interface was simpler. 1. Some concern might have missed information on a particular topic. 2. Users were frustrated because information was not available on a particular attraction.</td>
</tr>
<tr>
<td>Information Presentation</td>
<td>1. GUIDE unit was portable. 1. Teenage users seem excited in the technology and visited more than twice as many links. 2. Visitors without web experience also can comfortably using the GUIDE.</td>
<td>1. GUIDE unit was too large. Many preferred a thinner device.</td>
</tr>
<tr>
<td>GUIDE unit. (Device)</td>
<td>1. Function of positioning is good and easy for users knowing their location.</td>
<td>1. Signal connections may be weak/or no signal in some areas.</td>
</tr>
<tr>
<td>Visitor Profile</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Acceptance of Awareness Information</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source. Cheverst et al., 2000

The finding of location-based mobile tourist service-first user experiences (Schmidt-elz et al., 2003) adopted the CRUMPET (creation of user-friendly mobile services personalized for tourism) as the LBS application. There were 77 people involved into this study and they gave the following feedback.

- Transportation information received very high ranks; users from interviews want to receive frequent updates, and reliable and personalized transportation information
- Map functions received high marks, and were judged to be at a very high level
- Location-Based Services (LBS) and transportation information would be a critical concern for the application for a mobile tourism support
In 2004, Pavón et al. reported a study involving mobile tourist guide services (MTGS). The experiment was conducted in the city of Salamanca, Spain in 2003. Participants were 6217 tourists who visited the city during the study. Three groups were studied: one was led by a professional tour guide, another used a mobile tourist guide service (MTGS), and the third traveled by themselves. The findings showed that the travelers using the mobile tourist guide service had the highest level of satisfaction (62.7%) from traveling the city. The group hiring a professional tour guide had a 55.9% level of satisfaction. The group traveling by themselves had a 16.7% level of satisfaction from traveling the city. Consequently, the degree of satisfaction in the tourists using the MTGS was higher than the other groups of tourists.

The users’ experience with the functions and features were mostly pleasurable and enjoyable. The local navigation and information services were well received, such as tour guide, map, and transportation information. Users gave positive feedback to the researchers. For example, the authors of the paper Cheverst et al. (2000) stated that the system retrieved location information, and the map was useful and able to help in their visit. Kaasinen (2003) in his research got significant positive feedback from users on the location-aware information services. In a research of Schmidt-elz et al. (2003) on the CRUMPET project in Europe, the study pointed out that this service was useful for travelers when they need transportation information. The MTGS project from Pavón et al. (2004) demonstrated that 62.7% of the visitors reported high level satisfaction from traveling the city when they used the mobile devices with LBS function. Accordingly, the feature of LBS has been accepted and recognized by participants and travelers.

From the topic information side, two papers, Cheverst et al. (2000) and Kaasinen (2003), showed users were enjoying their trips during traveling with information provided from mobile devices. Kaasinen (2003) and Schmidt-elz et al. (2003) reported that the accuracy of information needed improvement. For instance, the yellow page services could
not provide the information of different kinds of restaurants. The transportation information provided from the CRUMPET needed to be updated in order to give the precise information for travelers. Some particular topics, such as missing information, were also noted by users (Cheverst et al., 2000).

There were also other shortcomings reported from users such as difficult interface of applications, heavy mobile devices, unstable wireless signal, and unprotected personal privacy. The first problem was the difficulty of using the interface. From the feedback of participants of Cheverst et al. (2000), users feel like the interface of application was too complicated and not easy to use. They wished it could be easier in order to enjoy their trips. The second drawback was the weight of the devices. Although, the users appreciated the portable mobile devices they had experienced, they also indicated that the devices were too big and heavy to carry during their trip (Cheverst et al., 2000). The third disadvantage was an unstable wireless signal. The users said that they were frustrated when they could not have a wireless signal. The wireless signal was also weak in some areas, and the reaction and speed was slow (Cheverst et al., 2000). The final shortcoming was the privacy issue. Since LBS can locate an individuals’ position, users sensed that their personal information and position could be exposed openly. The papers of Kaasinen (2003) and Junglas and Watson (2008) implied that the privacy issue was important for LBS users. Their personal information might be gathered from functions of LBS. Therefore, when users experienced the LBS, they worried about revealing their individual information as well.

**Tourists’ Attitudes of LBS**

Users felt that mobile services should be personalized (Short, 2000). In the paper of Schmidt-Belz et al. (2003), when users had first experienced location-based mobile tourist services, they claimed that tourists have various interest profiles leading to the necessity of
personalized interest profiles. In order to improve the tourists’ experiences, computing and simulating from gathered profiles are essential.

Chang et al. (2006) investigated the users’ attitude toward five elements of LBS: perceived usefulness, perceived ease of use, security and privacy, location information and context awareness, and device function. The finding illustrated that perceived usefulness, perceived ease of use, and security and privacy were associated with travelers’ attitude toward using LBS.

In addition, Vrček et al. (2008) presented their study of User acceptance of LBS. This study tested the users’ thoughts of LBS components counting emergency and safety services, navigation, information tracking, entertainment, intelligence, and advertising. The finding results suggested that emergency and safety services and navigation services had a significantly higher rate of acceptance than other services.

In 2008, Junglas and Watson evaluated user perceptions of location-tracking and location-aware services, and the results showed that participants were highly motivated to participate in the experiment, even though they had to spend more than three hours to complete the experiment. The study found that participants’ enjoyment remained high to extremely high (88%) rate. Thus, the authors concluded that people were highly interested in LBS with a technology innovation. Nonetheless, LBS, privacy concerns were expressed. Since LBS could position an individual’s location, it could also grasp information on personal locality. Junglas and Watson (2008) reported in their study that many users have a strong tendency to reject LBS. As a consequence, privacy concerns could likely be a major determinant in the success of LBS.

Discussion of LBS

There are several limitations of this review. The primary limitation is that the LBS
technology and services are new innovations within recent years, so it can be a challenge to find published articles and papers on the newest developments. The second limitation is the language barrier: some LBS papers or articles are presented in languages other than English or Chinese, such as Japanese and Korean. So they are not involved in this review. The third limitation is that this review is focusing on academic papers, not news and magazine media, so the review does not including what is said in the popular press about smart phones or other new hand held devices with LBS.

By reviewing the articles above, this researcher has found an interesting clue. The papers related to using LBS in tourism are mostly presented by European scholars including Cheverst et al. (2000), Zipf et al. (2001), Kaasinen (2003), Pavón et al. (2004), and Kramer et al. (2006). Only one paper is from the United States (Table 2-6). Why have most of the papers been presented by European authors? Does this case relate to LBS services, does this situation correlate with the tourism education or market, or are researchers in Europe more curious about LBS for tourism? This is an interesting issue, and it might need more attention to it in the near future.

Table 2-6

<table>
<thead>
<tr>
<th>Author</th>
<th>Adopted application</th>
<th>Paper retrieved from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abowd et al., 1997</td>
<td>Cyberguide system</td>
<td>California, USA.</td>
</tr>
<tr>
<td>Cheverst et al., 2000</td>
<td>GUIDE system</td>
<td>Lancaster, U.K</td>
</tr>
<tr>
<td>Zipf et al., 2001</td>
<td>CRUMPET project</td>
<td>European</td>
</tr>
<tr>
<td>Kaasinen, 2003</td>
<td>Location-aware mobile services</td>
<td>Finland</td>
</tr>
<tr>
<td>Pavón et al., 2004</td>
<td>Mobile Tourist Guide (MTG) Services</td>
<td>Salamanca, Spain</td>
</tr>
<tr>
<td>Kramer et al., 2006</td>
<td>Dynamic Tour Guide (DTG)</td>
<td>Görlitz, Germany</td>
</tr>
</tbody>
</table>

Most papers about tourists’ experience with LBS are related to European countries. The four main papers of users’ LBS for tourism experience are also retrieved from Europe (Table 2-7). From the tourists’ experience, the finding showed that most users appreciated those devices and were glad to have LBS when they are visiting tourist attractions. Not only
have they got the traveling information, but also the positioning function is helpful for them.

Teenagers and young people seem more excited to explore the functions and features of LBS. The system applied on portable devices helps travelers get LBS services when they need it. However, the shortage and negative experience comprises a weak wireless signal and connection problems, inconvenience of big portable devices, and unfriendly interface.

Table 2-7

Experimental Researches on LBS User Experience

<table>
<thead>
<tr>
<th>Author</th>
<th>Adopted application</th>
<th>Experimental location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheverst et al., 2000</td>
<td>GUIDE system</td>
<td>Lancaster, U.K</td>
</tr>
<tr>
<td>Schmidt-Belz et al., 2001</td>
<td>CRUMPET</td>
<td>European</td>
</tr>
<tr>
<td>Kaasinen, 2003</td>
<td>Location-aware mobile services</td>
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<tr>
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</tr>
</tbody>
</table>

For the attitudes of users in LBS, this review found that there are three primary fields affecting concerned users. The first field is the information usefulness such as the result of a paper from Chang et al. (2006). This concern is related to providing accurate information with right time, right place for travelers from LBS. Since travel information is one of the most important items for tourists, the correct information is a significant issue for users. The paper of Vrček et al. (2008) indicated that the users valued the functions of emergency and safety services, and navigation of LBS is related with providing accurate information and services.

The second field is the ease of use. The interface design is highly important for LBS system designers, but it may not be a concern of users. The users want an easy device for getting LBS (Chang et al., 2006). Thus, the system of LBS needs an easy interface for tourists.

The final concern is a privacy issue. Since the positioning function can be easily known during using, the users’ location is followed by the LBS services (Junglas & Watson,
Thus, to reduce the wariness of users, LBS providers should have consideration on users’ privacy.

By reviewing the articles above, readers can conclude that tourism is an important industry in the world. When tourists visit other countries, cities, or any tourist attractions, they will need to handle the accommodation, restaurants, attractions, and even information of travel destinations. The features and capacities of mobile LBS could be one of the best problem solvers for travelers. Thus, the students who major in the tourism department have to have those LBS technology skills in order to succeed in the career so that they can be the problem solvers. This paper reviews the features of LBS, capacities of LBS for tourism, the users’ experience of mobile LBS, and the attitude of users on LBS. It could be valuable references for who is interested in LBS for tourism and tourism education.

According to the literature review, there are no articles or research focusing on utilizing mobile devices with educational apps in m-learning covering either students’ experiences in LBS or students’ attitudes of LBS. However, smartphones with apps nowadays is the trend of mobile information technologies. The strategy of this study adopts the DFP travel app which contains LBS features, geographic material, DFP history, and multiple cultures around the park. Hence, The experiences and attitudes regarding m-learning with the DFP travel app can be compared and understood. The app is ideally suitable for the research purposes to evaluate the m-learning outcomes and explore m-learning attitudes.
CHAPTER 3
METHODOLOGY

The purpose of this study was to investigate whether or not there was a significant learning difference between students who used a mobile travel application in a geography course when compared to students who did not use the mobile technology application. This study took place in the Department of Tourism and Travel Management (DTTM) at the Taiwan Hospitality and Tourism College (THTC). This chapter discusses the research design, course design, population, instrumentation, data collection, data analysis, and significance of the study.

Research Design

The research design utilized was mixed methods research. Mixed methods research mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language in a single study (Johnson & Onwuegbuzie, 2004). In other words, the indispensable target of mixed methods research is the solution of the research questions from any relevant aspect, making use where appropriate of previous research and more than one type of research technique.

Based on the various types of mixed methods research, the methodology for this study adopted a quasi-experiment design, dividing the population in two groups: one treatment and one contrast group. The treatment group utilized the m-learning scenarios, smartphones with the Danongdafa Forest Park (DFP) travel app, while the contrast group utilized a handout delineating required class activities. Before treatment, the pretests were given to both groups to see if there was difference between them. After eight weeks of treatment, the learning outcomes were measured through posttests of both groups, which were analyzed and compared to evaluate the research questions. The questionnaires investigating students’
attitudes and interviews of five students randomly chosen from each group were also studied to determine the differences among the ideas and thoughts of the m-learning group and handout learning group.

This study focused on four research questions:

1. Did students who used the mobile application have a different achievement level in class when compared to students who did not use the mobile application?

2. Did students have a significant achievement between pretest and posttest after eight weeks teaching scenarios in the treatment group?

3. Did students have a significant achievement between pretest and posttest after eight weeks teaching scenarios in the contrast group?

4. What were the treatment group students’ attitudes towards mobile travel application technology and what were the contrast group students’ attitudes towards handout learning after eight weeks of treatment?

The fourth question reviewed the attitudes of the mobile technology group after its members completed activities associated with the mobile travel application in the course.

Research Questions

The first question utilized a quasi-experimental design and used a quantitative method to investigate the outcome. Two classes of freshman students at DTTM were randomly assigned to either the mobile technology or contrast group. For the proposed study, a group-pretest-posttest design was utilized. The pretest-posttest quasi-experimental design can eliminate the major limitations associated with a posttest only design of nonequivalent groups (Gribbons et al., 1997). The pre-test served as a control for differences between the two groups.

This quasi-experimental design provided a static group comparison; a design in which a group had experience in m-learning was compared with a group that did not use m-learning. After the treatment group completed the m-learning unit, both groups completed the post-test.
The purpose of second question was to check if the m-learning outcomes showed statistical significance after eight weeks of m-learning activities which used a smartphone with the DFP travel app in the treatment group. The pretest was applied in the first week, and the posttest was applied during the eighth week.

The third question focused on the contrast group that used handout learning scenarios for the eight-week training period. This question examined if the contrast group had a statistically significant difference between pretest and posttest. Thus, the handout learning outcomes could be explored.

The fourth question was an investigation of the differences of the learning attitudes of the treatment group using m-learning and the contrast group using a prepared handout. The different instruments (Table 3-2 and Table 3-3) were administered to two groups. The second part of the investigation explored the learning attitude of the experiment group after utilizing the Danongdafi Forest Park mobile travel app in course activities. The instrument of learning attitude, questionnaire for examining the students’ attitudes on DTA (Danongdafi Travel App) and questionnaire for examining the students’ attitudes on the handout, adopted the Likert scales in order to understand the thoughts of both groups of students. The interviews with five students randomly selected from each group were held during week eight in order to learn more about the effectiveness and limitations of the research.

Course Design

The Taiwan Tourism Geographic (TTG) course at THTC was designed as a three credit hours course, which means three hours of classes per week and eighteen weeks for one semester. The intervention for the m-learning group consisted of one-hour scenarios for an eight-week plan to teach the m-learning activities associated with Danongdafi Forest Park (DFP). The specific schedule of the DFP course is listed in Table 3-1. The DFP schedule was
integrated into the TTG course syllabus for the first eight weeks.

Table 3-1

Schedule of the DFP Course Design

<table>
<thead>
<tr>
<th>Schedule</th>
<th>The Scenarios of the Treatment Group</th>
<th>The Scenarios of the Contrast Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Pretest/ Introduce the object and the travel app of park</td>
<td>Pretest/ Introduce the objects with a handout</td>
</tr>
<tr>
<td>Week 2</td>
<td>The project and blueprint of the park through the app</td>
<td>The project and blueprint of the park through a handout</td>
</tr>
<tr>
<td>Week 3</td>
<td>The history of the land and local culture through the app</td>
<td>The history of the land and local culture through a handout</td>
</tr>
<tr>
<td>Week 4</td>
<td>Attractions of the park through the app</td>
<td>Attractions of the park through a handout</td>
</tr>
<tr>
<td>Week 5</td>
<td>Ecosystem of the park through the app</td>
<td>Ecosystem of the park through a handout</td>
</tr>
<tr>
<td>Week 6</td>
<td>DFP field trip with m-learning by using the travel app</td>
<td>DFP field trip with tour guides</td>
</tr>
<tr>
<td>Week 7</td>
<td>Travel resources nearby through the app</td>
<td>Travel resources nearby through a handout</td>
</tr>
<tr>
<td>Week 8</td>
<td>Survey, posttest, and interview</td>
<td>Survey, posttest, and interview</td>
</tr>
</tbody>
</table>

The difference between the treatment (m-learning) and control groups was that the m-learning group utilized the DFP travel app and asked students using the app in class activities to learn the objects, do assignments, and interact with classmates within a small group. On the other hand, the contrast group was taught similar material but used a handout and assignment sheets. Moreover, both groups also experienced the field trips to DFP on different days; the treatment group experienced the park’s attractions and features by using the DFP travel app, and the contrast group learned features of DFP from tour guides. During week eight, the survey of students’ attitudes towards using m-learning and the handouts were given.

Five students from each group were randomly selected for an interview and completed the questionnaires. The questionnaires had five questions for each individual. The questions included five topics. The first topic was the regularity of using the learning materials, the DFP travel application for the treatment group and the handout for the contrast group, after class; the second was the convenience of using the learning materials in course scenarios; the third was related to any research limitation pertaining to whether discussion
between students of the two groups affected the research outcome; the forth was the attractiveness of the learning materials in the scenarios; and the final topic was any advantages, shortages, and other opinions about using the learning materials in teaching. The interviewees were asked individually, and plenty of time was given for them to express their attitudes, thoughts, and feelings.

Population

The sample for the study was two classes at the DTTM of the THTC. Two classes were randomly assigned as a treatment group and a contrast group. Total participants were 99 students, 42 students in the treatment group and 57 participants in the contrast group. Participants were at the freshman level.

Instrumentation Design

Two instruments were used in this study. The first instrument consisted of 50 multiple choice questions which were created to serve as the pretests and posttests instruments for both groups. The content of questions was related to the history, features, attractions, and tourism activities of Danongdafu Forest Park which consisted of the content and course scenarios taught in class. The pretest and posttest used the same 50 questions but the questions were arranged in a different order. (Appendix A is the list of the 50 questions.)

To evaluate the treatment group’s attitude after completing the course scenarios and coursework, a 5-point Likert-style questionnaire was designed. The questionnaire utilized 15 items from an instrument developed by Moore and Benbasat (1991). Since the treatment and contrast groups were using different scenarios, two different instruments were created (Table 3-2 and Table 3-3). Both groups were asked to fill out the questionnaire prior to the multiple-choice, end of class exam.
Table 3-2  
Questionnaire for Examining the Students’ Attitudes on DTA (Danongdafu Travel App) 學生使用DTA (大農大富森林園區App) 態度調查

<table>
<thead>
<tr>
<th>Factor 1: Voluntariness</th>
<th>Questions</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>My use of a DTA is voluntary. 我使用DTA是自願的</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2</td>
<td>Although it might be helpful, using a DTA is certainly not compulsory in my study. 雖然DTA對我有幫助，但是它在我學習中不是必須的</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor 2: Relative Advantage</th>
<th>Questions</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Using a DTA enables me to accomplish tasks more quickly. 使用DTA可以讓我更快地完成學習任務</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4</td>
<td>Using a DTA improves the quality of study I do. 使用DTA提高了我學習的品質</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5</td>
<td>Using a DTA makes it easier to do my study. 使用DTA使我的學習變得更輕鬆。</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6</td>
<td>The disadvantages of my using a DTA far outweigh the advantages. 使用DTA的缺點遠大於它的優點</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7</td>
<td>Overall, I find using a DTA to be advantageous in my study. 總體來說，我發現使用DTA對我學習是有利的</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor 3: Compatibility</th>
<th>Questions</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Using a DTA is compatible with all aspects of my study. 使用DTA能夠和我的所有學習內容相容</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>12</td>
<td>I think that using a DTA fits well with the way I like to study. 我認為使用DTA很適合我自己的學習方法</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>13</td>
<td>Using a DTA fits into my study style. 使用DTA適合我學習的方式</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<table>
<thead>
<tr>
<th>Factor 4: Trial ability</th>
<th>Questions</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>I've had a great deal of opportunity to try various DTA applications. 我有大量的機會去嘗試類似於DTA的行動旅遊應用程式。</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>15</td>
<td>I know where I can go to satisfactorily try out various uses of a DTA. 我知道到哪裡可以滿意地得到體驗不同的行動旅遊應用。</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Factor 1: Voluntariness</td>
<td>Questions</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly agree</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>My use of a DFP handout is voluntary. 我使用DFP講義是自願的</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Although it might be helpful, using a DFP handout is certainly not compulsory in my study. 雖然DFP講義對我有幫助，但是它在我學生中不是必須的</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>Factor 2: Relative Advantage</td>
<td>3</td>
<td>Using a DFP handout enables me to accomplish tasks more quickly. 使用DFP講義可以讓我更快地完成學習任務</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Using a DFP handout improves the quality of study I do. 使用DFP講義提高了我學習的品質</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Using a DFP handout makes it easier to do my study. 使用DFP講義使我的學習變得更輕鬆</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Factor 3: Compatibility</td>
<td>6</td>
<td>The disadvantages of my using a DFP handout far outweigh the advantages. 使用DFP講義的缺點遠大於它的優點</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Using a DFP handout improves my study performance. 使用DFP講義提高了我的學習成績</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Using a DFP handout enhances my effectiveness on the study. 使用DFP講義增強了我的學習效率</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Using a DFP handout gives me greater control over my study. 使用DFP講義使我在學習中有更大的控制權</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Factor 4: Trial ability</td>
<td>10</td>
<td>Overall, I find using a DFP handout to be advantageous in my study. 總體來說，我發現使用DFP講義對我學習是有利的</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Using a handout is compatible with all aspects of my DFP study. 使用DFP講義能夠和我的所有學習內容相容</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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</tr>
<tr>
<td></td>
<td>12</td>
<td>I think that using a DFP handout fits well with the way I like to study. 我認為使用講義是很適合我學習方法</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Using a DFP handout fits into my study style. 使用DFP講義是適合我學習的方式</td>
<td>□</td>
<td>□</td>
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</tr>
</tbody>
</table>
Data Collection

Pretests were administered to both groups. The scores of the pretest were keyed in as SPSS data files and were analyzed with the posttest data.

After eight weeks of teaching and learning activities, both groups completed the posttests. Pretest and posttest data was coded into an SPSS file. To examine students’ attitudes on m-learning using the mobile travel app in the TTG course, questionnaire data was gathered from the treatment group. The contrast group was asked to complete a questionnaire about their attitudes concerning the use of handouts. The questionnaire was given to both groups fifteen minutes before the multiple-choice posttest covering course content. The interviewer in a semi-structured interview normally has a framework of themes to be explored. Therefore, the study precluded the use of a standardized interview schedule in order to better explore students’ attitudes, opinions, and feelings. These interviews provided qualitative information concerning the effectiveness of the curriculum options offered to the treatment and contrast groups. The interview questions focused on the frequency with which students used the DFP travel app or handout, the frequency with which the treatment group used the mobile devices, the problems encountered while using the travel app and mobile devices, the features of the students’ mobile devices, the effectiveness of using a smartphone in the class activities, and the interactions between both groups.

The interviews were held individually, with 15 minutes scheduled for each student interview. The researcher attempted to create an atmosphere without experimental stress, in order for the collected data to more accurately reflect the true feelings of the participants. The interview data was also written by hand on paper during the each interview, and analyzed by the researcher personally. Thus, the data was collected and analyzed according to a consistent standard. The interview data helped the researcher to understand the effects of the limitations
on this research so that the qualitative data gathered could be compared to the quantitative results.

Interview Questions

In order to examine the fourth research question, the study designed five main topics for the interview. These interview topics intended to deeply explore the participant’s thoughts about m-learning with the travel app compared to handout learning.

1. The first topic related to the frequency of using the DFP travel application/handout after class.
2. The second topic related to the convenience of using the DFP travel application/handout in course scenarios.
3. The third topic related to any research limitations pertaining to whether discussion between students of the two groups affected the research outcome.
4. The fourth topic related to the attractiveness of the DFP travel application/handout in the scenarios.
5. The final topic related to any advantages, shortages, and other opinions about using the DFP travel application/handout in teaching.

Data Analysis

When the data was collected, analysis of variance (ANOVA) and paired-samples t-test were used to analyze and determine the differences between the contrast and control groups and if achievement gains occurred in either of the groups. Descriptive data was used to more thoroughly exam the students’ attitudes after eight weeks of participation in either the experimental or contrast group.

Significance of the Study

There were a number of papers focusing on applying mobile technologies in education. These studies investigated variables such as the attitudes of students and faculty,
design, and various learning processes. However, few articles focused specifically on the effects of m-learning, especially in tourism education. Thus, the outcome of this study can provide the needed information on adopting mobile devices for instructional purposes for future employees of the tourism industry.
CHAPTER 4
DATA ANALYSIS AND RESULTS

The primary purpose of this chapter is to analyze the collected data and to discuss the findings. There were 99 participants in total, all freshmen students at the Taiwan Hospitality and Tourism College (THTC). The students were divided into two groups: a treatment group and a contrast group. The experimental group consisted of 42 students using the Danongdafu Forest Park (DFP) travel application on smartphones, and the contrast group consisted of 57 students using only DFP handouts. Prior to the study, the course design and learning objectives had been determined. Both groups took a pretest of DFP knowledge in the first week. After eight weeks of treatment and teaching scenarios, the posttest research data were collected, consisting of posttest scores, learning attitudes about teaching scenarios, and interviews. The following sections discuss the data analysis and findings as learning outcomes, learning attitudes, and interview outcomes of this study.

Learning Outcomes

According to the research design and the first research question, is there a significant difference in m-learning outcomes between the treatment and contrast group after providing the smartphones with travel app activities, a pretest and posttest format (t-tests) compared the gains of the contrast and treatment groups. In addition, achievement changes between groups were compared using ANOVA. Post-intervention surveys for both groups gathered data on learning attitudes. Interviews were conducted with five randomly selected students from each group.

Pretest Examination

Using DFP pretest examination sheets, the students’ understanding of the park before
teaching scenarios was evaluated. In order to determine whether differences existed between the two groups before treatment, one-way analysis of variance (ANOVA) was used to examine the pretest scores. The analysis results showed that there was no statistical significance \( (F(1) = .556, p > .05) \) between the treatment group \( (M = 48.86, SD = 10.37) \) and the contrast group \( (M = 47.19, SD = 11.29) \) in the students’ knowledge of DFP.

Comparison of M-learning with Handout Learning

To test the first research question, H1, there is a statistically significant difference in learning outcomes between the treatment and contrast group after eight weeks of teaching activities, the means of the posttest scores of the treatment group \( (n = 42) \) were compared to the means of the contrast group \( (n = 54) \) to determine whether or not the treatment group had better learning outcomes by using m-learning. The scores were analyzed by SPSS using one-way ANOVA. The null hypothesis is listed below.

\[
H_01: \text{There is no statistically significant difference in learning outcomes in the learning objectives between the treatment group and the contrast group after eight weeks of teaching activities.}
\]

Before examining the \( H_01 \), the pretest scores of the experimental group and the contrast group were inspected to check if there was initial different between the groups. The ANOVA analysis showed that there is no statistically significant difference between the groups \( (F(1) = .556, p > .05) \) (see Table 4-1). The treatment group’s mean was 48.86 \( (SD = 10.37) \) and the mean of the contrast group was 47.19 \( (SD = 11.29) \).

Table 4-1

Pretest Comparison of Two Groups

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>( F )</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>66,042</td>
<td>1</td>
<td>66,042</td>
<td>.556</td>
<td>.458</td>
</tr>
<tr>
<td>Within Groups</td>
<td>1,117,3291</td>
<td>94</td>
<td>118,865</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,123,333</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The ANOVA was used to determine whether the treatment group had learning outcomes which were significantly different when compared to the contrast group. The analysis showed that there is no statistically significant difference between the groups ($F(1) = .032, p > .05$) (see Table 4-2). The treatment group’s mean was 62.17 ($SD = 11.719$) and the mean of the contrast group was 61.74 ($SD = 12.548$). The $H_0$ was not rejected. Thus, the result of ANOVA showed that the learning outcomes of the treatment group were not significantly different from those of the contrast group.

Table 4-2

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>$F$</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>4,778</td>
<td>1</td>
<td>4,778</td>
<td>.032</td>
</tr>
<tr>
<td>Within Groups</td>
<td>13974.847</td>
<td>94</td>
<td>148.669</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13979.625</td>
<td>95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comparison of Each Group

To test Hypothesis $H_2$, there is a statistically significant increase in the mastery of learning objectives between the pretest and posttest of the treatment group after eight weeks of m-learning teaching activities, and $H_3$, there is a statistically significant increase in learning objects between the pretest and posttest of the contrast group after eight weeks of participating in learning activities within the Taiwan Tourism Geographic course, the paired-samples $t$-test was conducted to determine if there were differences in the pretest and the posttest grades of both the treatment group and the contrast group. The analysis results are described below.

Paired-Samples $t$-Test of the Treatment Group

$H_02$: There is no statistically significant increase in the mastery of learning objectives between the pretest and posttest of the treatment group after eight weeks of m-learning
activities.

Table 4-3

Paired-Samples t-Test of the Treatment Group

<table>
<thead>
<tr>
<th>Pair 1</th>
<th>A-pre - A-post</th>
<th>Paired Differences</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Std. Error</td>
<td>95% Confidence Interval of the Difference</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-13.33</td>
<td>11.858</td>
<td>1.830</td>
<td>-17.03 - -9.64</td>
</tr>
</tbody>
</table>

A paired-samples t-test revealed that the treatment group students had statistically significant learning outcome differences between the pretest \( (m = 48.86, \; s = 10.37) \) and the posttest \( (m = 62.19, \; s = 11.719) \), \( t(41) = -7.287, \; p < .05 \) (see Table 4-3). Thus, the null hypothesis, \( H_02 \), was not accepted, and it could be inferred that after eight weeks of teaching activities, the treatment group students had statistically significant increases in m-learning outcomes by using smartphones with the travel application in the TTG course.

Paired-Samples t-Test of the Contrast Group

\( H_03: \) There is no statistically significant increase in the mastery of learning objectives between the pretest and posttest of the contrast group after eight weeks of m-learning activities.

Table 4-4

Paired-Samples t-Test of the Contrast Group

<table>
<thead>
<tr>
<th>Pair 1</th>
<th>B-pre - B-post</th>
<th>Paired Differences</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Std. Error</td>
<td>95% Confidence Interval of the Difference</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-14.56</td>
<td>10.045</td>
<td>1.367</td>
<td>-17.30 - -11.81</td>
</tr>
</tbody>
</table>

A paired-samples t-test revealed that contrast group students had statistically significant learning outcomes between pretest \( (m = 47.19, \; s = 11.297) \) and posttest \( (m = \)
61.74, \(s = 12.548\), \((t(53) = -10.649, p < .05)\) (see Table 4-4). Thus, the null hypothesis, \(H_03\), was not accepted, and it also could be conjectured that after eight weeks of teaching activities, the contrast group students had statistically significant improvements in learning outcomes by using DFP handout learning in the TTG course.

**Findings of M-learning Outcomes**

The results showed there was no statistically significant difference between using m-learning, that is, a smartphone with the travel application, and using handout learning. However, the data analysis outcomes showed that after eight weeks of teaching activities, both groups of students had statistically significant learning outcomes no matter whether they used smartphones with the application or handout learning in class activities.

**Learning Attitudes**

In addition to the m-learning and handout learning outcomes, another research question and research purpose was to investigate the participants’ learning attitudes toward these two different teaching scenarios in the tourism geographic courses. The fourth research question was created to explore the student’s learning attitudes. The fourth hypothesis (H4) was illustrated as “the students in treatment group have more positive attitudes towards using smartphones in the teaching scenarios than the contrast group.” Therefore, the fourth null hypothesis was \(H_04\): “Students in treatment group do not have more positive attitudes towards using smartphones in the teaching scenarios than the contrast group.” The research procession and outcomes are illustrated below.

Two separate questionnaires were used the questionnaire for examining the students’ attitudes on the Danongdafu Travel Application (DTA) was for Group 1, the treatment group.
The questionnaire for examining the students’ learning attitudes on the handout was for Group 2, the contrast group.

A descriptive statistical method was used to process the collected data and to calculate the Mean (M), Standard Deviation (SD), and Standard Error Mean (see Table 4-5 - Descriptive statistical information of learning attitudes).

The questionnaires had four factors: Factor 1, voluntariness, Factor 2, relative advantage, Factor 3, compatibility, and Factor 4, trial ability. The data revealed that most means of the questions from Group 1 (treatment) were greater than those of Group 2 (contrast), except for Questions 2, 3, and 6. In order to identify and explore if the learning attitudes between the two groups were significantly different, the research utilized the independent t-test to compare the means for each question. Hence, the study attempted to determine any differences in the thinking of students between the treatment group and the contrast group.

After running the independent t-test of the 15 questions through SPSS, Questions 2, 3, 10, and 14 did not have statistical significance between the two groups. Independent t-test results of the other questions presented a statistically significant difference between the treatment group and the contrast group (see Table 4-6).
Table 4-5

Descriptive Statistical Information of Learning Attitudes

<table>
<thead>
<tr>
<th>Factor 1: Voluntariness</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. My use of a DTA/handout is voluntary.</td>
<td>1</td>
<td>42</td>
<td>4.19</td>
<td>.505</td>
<td>.078</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.81</td>
<td>.972</td>
<td>.129</td>
</tr>
<tr>
<td>Q2. Although it might be helpful, using a DTA/handout is certainly not compulsory in my study.</td>
<td>1</td>
<td>42</td>
<td>2.60</td>
<td>.767</td>
<td>.118</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>2.84</td>
<td>.882</td>
<td>.117</td>
</tr>
<tr>
<td>Q3. Using a DTA/handout enables me to accomplish tasks more quickly.</td>
<td>1</td>
<td>42</td>
<td>4.02</td>
<td>.715</td>
<td>.110</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>4.05</td>
<td>.548</td>
<td>.073</td>
</tr>
<tr>
<td>Q4. Using a DTA/handout improves the quality of study that I do.</td>
<td>1</td>
<td>42</td>
<td>4.17</td>
<td>.696</td>
<td>.107</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.89</td>
<td>.557</td>
<td>.074</td>
</tr>
<tr>
<td>Q5. Using a DTA/handout makes it easier to do my study.</td>
<td>1</td>
<td>42</td>
<td>4.29</td>
<td>.636</td>
<td>.098</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.95</td>
<td>.610</td>
<td>.081</td>
</tr>
<tr>
<td>Q6. The disadvantages of using a DTA/handout far outweigh the advantages.</td>
<td>1</td>
<td>42</td>
<td>2.24</td>
<td>.906</td>
<td>.140</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>2.67</td>
<td>.913</td>
<td>.121</td>
</tr>
<tr>
<td>Q7. Using a DTA/handout improves my study performance.</td>
<td>1</td>
<td>42</td>
<td>4.43</td>
<td>.590</td>
<td>.091</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.72</td>
<td>.675</td>
<td>.089</td>
</tr>
<tr>
<td>Q8. Using a DTA/handout enhances the effectiveness of my study.</td>
<td>1</td>
<td>42</td>
<td>4.24</td>
<td>.576</td>
<td>.089</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.77</td>
<td>.567</td>
<td>.075</td>
</tr>
<tr>
<td>Q9. Using a DTA/handout gives me greater control over my study.</td>
<td>1</td>
<td>42</td>
<td>4.29</td>
<td>.673</td>
<td>.104</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.37</td>
<td>.747</td>
<td>.099</td>
</tr>
<tr>
<td>Q10. Overall, I find using a DTA/handout to be advantageous in my study.</td>
<td>1</td>
<td>42</td>
<td>4.26</td>
<td>.665</td>
<td>.103</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>4.09</td>
<td>.635</td>
<td>.084</td>
</tr>
<tr>
<td>Factor 2: Relative Advantage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q11. Using a DTA/handout is compatible with all aspects of my study.</td>
<td>1</td>
<td>42</td>
<td>4.36</td>
<td>.533</td>
<td>.082</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.81</td>
<td>.611</td>
<td>.081</td>
</tr>
<tr>
<td>Q12. I think that using a DTA/handout fits well with the way that I like to study.</td>
<td>1</td>
<td>42</td>
<td>4.40</td>
<td>.587</td>
<td>.091</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.88</td>
<td>.683</td>
<td>.090</td>
</tr>
<tr>
<td>Q13. Using a DTA/handout fits into my study style.</td>
<td>1</td>
<td>42</td>
<td>4.33</td>
<td>.612</td>
<td>.094</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.77</td>
<td>.598</td>
<td>.079</td>
</tr>
<tr>
<td>Factor 3: Compatibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q14. I've had a great deal of opportunity to try various DTA/handout applications.</td>
<td>1</td>
<td>42</td>
<td>4.07</td>
<td>.778</td>
<td>.120</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.95</td>
<td>.766</td>
<td>.101</td>
</tr>
<tr>
<td>Q15. I know where I can go to satisfactorily try out various uses of a DTA/handout.</td>
<td>1</td>
<td>42</td>
<td>4.12</td>
<td>.832</td>
<td>.128</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>57</td>
<td>3.56</td>
<td>.982</td>
<td>.130</td>
</tr>
</tbody>
</table>
### Table 4-6

**t-Test of Learning Attitudes**

<table>
<thead>
<tr>
<th>Q1</th>
<th>Levene's Test for Equality of Variances</th>
<th>t-Test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t</td>
<td>df</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>9.541</td>
<td>.003</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>2.548</td>
<td>88.400</td>
</tr>
<tr>
<td>Q2</td>
<td>Equal variances assumed</td>
<td>.257</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-1.484</td>
<td>94.292</td>
</tr>
<tr>
<td>Q3</td>
<td>Equal variances assumed</td>
<td>3.656</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-2.218</td>
<td>74.040</td>
</tr>
<tr>
<td>Q4</td>
<td>Equal variances assumed</td>
<td>2.548</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>2.088</td>
<td>76.405</td>
</tr>
<tr>
<td>Q5</td>
<td>Equal variances assumed</td>
<td>3.115</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>2.662</td>
<td>86.393</td>
</tr>
<tr>
<td>Q6</td>
<td>Equal variances assumed</td>
<td>.366</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-2.319</td>
<td>88.898</td>
</tr>
<tr>
<td>Q7</td>
<td>Equal variances assumed</td>
<td>.379</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>5.558</td>
<td>94.103</td>
</tr>
<tr>
<td>Q8</td>
<td>Equal variances assumed</td>
<td>.029</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>4.003</td>
<td>87.726</td>
</tr>
<tr>
<td>Q9</td>
<td>Equal variances assumed</td>
<td>.434</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>6.394</td>
<td>93.079</td>
</tr>
<tr>
<td>Q10</td>
<td>Equal variances assumed</td>
<td>1.919</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>1.313</td>
<td>86.129</td>
</tr>
<tr>
<td>Q11</td>
<td>Equal variances assumed</td>
<td>.018</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>4.770</td>
<td>94.171</td>
</tr>
<tr>
<td>Q12</td>
<td>Equal variances assumed</td>
<td>.044</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>4.121</td>
<td>94.663</td>
</tr>
<tr>
<td>Q13</td>
<td>Equal variances assumed</td>
<td>.665</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>4.556</td>
<td>87.384</td>
</tr>
<tr>
<td>Q14</td>
<td>Equal variances assumed</td>
<td>.048</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>.790</td>
<td>87.741</td>
</tr>
<tr>
<td>Q15</td>
<td>Equal variances assumed</td>
<td>3.697</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>3.050</td>
<td>95.045</td>
</tr>
</tbody>
</table>
Findings of Learning Attitudes

As indicated in Table 4-5, the means of questions of the treatment group were greater than the means of the contrast group except for Questions 2, 3, and 6. In fact, Question 2, although it might be helpful, using a DTA/handout is certainly not compulsory in my study and Question 6, the disadvantages of using a DTA/handout far outweigh the advantages, were opposite questions. Thus, if these two questions had functionally opposite descriptions, then their variable answers should be relatively opposite, which should result in the treatment group having greater means than the contrast group.

On the other hand, Question 3, using a DTA/handout enables me to accomplish tasks more quickly, was the only variance in which the mean of the contrast group was higher than the treatment group. From the illustration of the questions, it could be inferred that the students in the contrast group think that the DTA did more enable them to accomplish tasks more quickly, compared to the attitudes of the treatment group regarding the usefulness of the handout. Hence, the statistical data showed that the students in the contrast group using the DFP handout responded more positively to the questions than the treatment group students using the DFP app.

Independent t-Test of Learning Attitudes

The learning attitudes of students showed the variable means of the treatment group were more positive than the contrast group. Whether the mean difference had statistical significance was another important issue regarding the learning attitudes of the students.

According to Table 4-6, the t-test results illustrate that Questions 2, 3, 10, and 14 had no statistical significance between the two groups. The students’ attitudes about those questions showed no high variations. On the other hand, the remaining eleven questions all showed statistically significant differences between the treatment group and the contrast
group. The treatment group students’ learning attitudes were more positive about using the travel application than were those of the contrast group about using the handout in the instructional course design of the tourism geographic course.

Interview Outcomes

The interviews were designed and held in Week Eight. Each group randomly selected five students to be interviewed about their thoughts and their learning experiences. There were five main topics in the interview. The first topic was the frequency of using the DFP travel application/handout after class; the second was the convenience of using the DFP travel application/handout in course scenarios; the third was related to any research limitation pertaining to whether discussion between students of the two groups affected the research outcome; the forth was the attractiveness of the DFP travel application/handout in the scenarios; and the final topic was any advantages, shortages, and other opinions about using the DFP travel application/handout in teaching.

The First Interview Question: Use Frequency of the Travel Application/Handout

This first question attempted to ascertain the students’ frequency of use of the travel application or handout after class activities. In the treatment group, there was a pre-question about the functions of their mobile devices. Regarding the mobile devices, one of the five students in the interview group did not have a smartphone; so he only used the application when it was possible to share with classmates in the classroom. In the case of the second student, the screen of her smartphone did not function after the travel application was installed, as use of the application produced a dark screen. Thus, she could only learn and use the application by sharing with classmates during class activities. The other three students had no problems installing and utilizing the application on their devices. One of those three
students had never used the travel application after class because he thought that the information from official DFP websites and travel brochures was better than the application. However, the other two students said that they had used the application frequently outside of class and explored its functions well. One of those two students had used the application when her family visited her and traveled to DFP from their hometown. She thought that the functions of the application were convenient for traveling in Danongdafu Forest Park, and as a result, she knew more about the park by using the application during her visit.

In the contrast group, since they were using handouts instead of the DTA, the first question asked them whether they used the DFP handout after class. Two students had not used the handout after class, and two other students said that they had only read the handout before the posttest. The fifth student had read the handout twice within the eight weeks of teaching scenarios.

The Second Interview Question: Convenience of the Travel Application/Handout in Learning

The main purpose of this question was to ascertain how the students felt using the DFP travel application in the treatment group and the handout in the contrast group. The interview results showed that four of the five students in the treatment group had a positive reaction to using the travel application during course activities. They thought the travel application was convenient and useful, and that it provided plenty of information after class and during the field trip. Only one student preferred to study using official DFP websites and paper materials rather than using the travel application.

The contrast group students used the handout in the course scenarios. Based on their answers during the interviews, their attitudes about the handout were largely neutral as they did not pay much attention to that aspect during their activities. However, the students thought that the handout was not very useful during the field trip.
The Third Interview Question: Social Interaction between the Groups

The third interview question was related to any possible research limitation pertaining to whether discussion between students of the two groups affected the research outcome. The five students interviewed from the treatment group had not talked about the travel application with students from the other group during the study. In the contrast group, one of the five interviewed students asked a treatment group student about the travel application, but had not used the application during the eight weeks of teaching scenarios. Hence, this research outcome had only rarely been affected by the social interaction between the two groups, if at all.

The Fourth Interview Question: Appeal of the DFP Travel Application/Handout

The appeal of utilizing the travel application/handout in the teaching scenarios was the fourth topic in the interview. Four students from the treatment group thought it was definitely interesting to use the travel application in the teaching activities. Only one student thought that he would rather study from a desktop computer using DFP websites. One of the four students pointed out that she had learned many DFP stories and features of the travel spots from the application. That same student also mentioned that the application had helped her to more deeply understand concepts associated with the DFP and increased her motivation for learning. Another student said that the DFP travel application enhanced her curiosity and gave her clear directions in learning. Regarding the field trip, the third and fourth students mentioned that the application improved their experiences in the park and made the trip more meaningful.

In the contrast group using the handout, all five interview students had no specific feelings or indications of appeal of using the handout in the course. The handout did not increase their motivation for learning more about the DFP, except during the field trip.
The final question focused on all other student opinions about using the travel application/handout in the teaching activities. This question provided an opportunity for students to express whatever they wanted to say involving advantages, shortages, suggestions, and any other impressions. The treatment group students fluently shared their opinions. Three of five students suggested designing more valuable application in teaching activities for courses because of convenience, appeal, and usefulness. However, they also pointed out shortfalls including the slow speed of wireless services, the excessively fast audio introductions of DFP attractions, the lack of interactions with the user interfaces, the shortage of systematically organized DFP materials, and the huge size of the application software occupying the mobile device’s memory. Hence, providing subtitles for films, reducing the size of the application, enhancing the speed of wireless services, and well organizing the DFP application constituted their main suggestions. One of the other treatment group students thought that the information from the DFP website on a desktop was superior for him. The one remaining student had uncertain opinions about using the DFP travel application since he did not own a smartphone, though he wished to have one.

On the other hand, in the contrast group, four of the five students said that they used the handout to learn the DFP attractions, but did not give specific opinions, as they regarded the handout to be common learning materials. The final student said that he had not used the handout for learning after the course scenarios and therefore he had no suggestions or other opinions on using the handout in the class.

Summary

After running this action research and analyzing the collected data, the findings were
illustrated in two parts. The first part was the quantitative section examining the hypotheses. The second section illustrated the qualitative findings which were the results of interviews with both student groups.

The quantitative data was examined by one-way analysis of variance (ANOVA) and t-tests. The m-learning outcomes of the research showed no statistical significance between the treatment group and the contrast after eight weeks of teaching scenarios. The first null hypothesis, H01, was accepted. The m-learning outcome, the treatment group, and the handout learning produced similar learning results in this action research.

In analysis of the other research hypotheses, H02 and H03, the t-test results showed that there were statistically significant differences between the pretest and the posttest results in both the treatment group and the contrast group. The t-test outcomes could be summarized as follows: The course design of utilizing smartphones with the travel application helped the treatment group students learn the DFP and resulted in significant outcomes. The contrast group also had significant learning results between the pretest and the posttest using the DFP handout learning course design. Those two different course designs both helped students learn the DFP in the tourism geographical course.

In the findings of learning attitudes between the two groups, the descriptive statistical data showed that the treatment group had higher average scores than the contrast group in most queries excluding the second, third, and sixth questions of the learning attitude questionnaire. This result illustrated that students had more positive learning attitudes when using mobile learning than when using handout learning in the course scenarios.

The last research design was interviews of five students from each group after eight weeks of courses activities. The findings of the interviews also showed that four of the five students in the treatment group had positive attitudes regarding use of mobile phones with the
DFP travel application in the TTG course. Only one student in the treatment group preferred using a desktop computer with website learning rather than adopting a mobile device.
CHAPTER 5
DISCUSSION AND CONCLUSION

The purpose of the research was to examine the learning outcomes of using a mobile travel application compared with a handout for learning about DFP, and this chapter discusses the research findings. The content of Chapter 5 includes discussion of statistical findings, discussion of interview findings, recommendations, future research, and a conclusion.

Discussion of Statistical Findings

According to the analysis of the first research hypothesis, H1, there was no statistically significant difference in learning outcomes between the two groups. The statistical analysis results showed that there were no statistically significant differences between the two teaching scenarios.

The second research question was to examine if there was a significant increase in learning outcomes after eight weeks of teaching scenarios for both the treatment group and the contrast group. The research hypotheses included H2 and H3. The second research hypothesis (H2) was that there was a statistically significant increase in the mastery of learning objectives between the pretest and posttest of the treatment group after eight weeks of m-learning teaching activities. The third research hypothesis (H3) was that there was a statistically significant increase in the mastery of learning objectives between the pretest and posttest of the contrast group after eight weeks of m-learning teaching activities. The study outcomes showed that there was a statistically significant difference in both of the two groups after eight weeks teaching scenarios.

The final research question related to the students’ attitudes towards using m-learning with the travel app in the treatment group and using handout learning in the contrast group in
the TTG course. The fourth hypothesis (H4) was that students in the treatment group had more positive attitudes towards using smartphones in the teaching scenarios than the contrast group did using the handouts. The quantitative research finding related to hypothesis four is discussed below.

**Discussion of M-learning Outcomes and Students’ Learning Attitudes**

The first research question was focused on the strategies of the m-learning outcomes for operating smartphones with the travel app in the Taiwan Tourism Geographic (TTG) course. The first research hypothesis, H1, is that there was no statistically significant difference in learning outcomes between the two groups.

Nevertheless, the quantitative analysis outcomes of the learning attitudes were highly difference between the treatment group and the contrast group. Table 4-5 shows that the means of all questions of Group 1, the treatment group, were higher than Group 2, the contrast group, except Questions 2, 3, and 6. Question 2 was although it might be helpful, using a DTA/handout is certainly not compulsory for mastering course content in this study. Question 3 was using a DTA/handout enables me to accomplish tasks more quickly. Question 6 was the disadvantages of using a DTA/handout far outweigh the advantages. Questions 2 and 6 were reverse queries. When the two questions were described in an opposite way, the means of these two questions should be the same as others. The mean of Question 3 was 4.02 in Group 1, and was 4.05 in Group 2. It had no significant difference in t-test outcomes (see Table 4-6).

From data analysis of the learning attitude questionnaire, it could be inferred that there were no statistically significant differences between using m-learning and handout learning in this study. However, the treatment group students had more positive attitudes about utilizing a smartphone with a travel application in classes than did the contrast group
students about using handouts. Compared to the study outcomes of Hwang and Chang (2011), which showed that m-learning improved students’ learning attitudes and achievement, this research inference was similar. Students’ learning attitudes showed acceptance of the new teaching methods and new devices in course activities. In other words, the findings supported that m-learning was accepted by the study participants.

Discussion of the $t$-Test of Learning Attitudes

In Table 4-6, eleven of fifteen questions had statistical significance, showing that treatment group students had more affirmative attitudes about using a mobile phone during class activities than contrast group students. Only four questions revealed no significant differences within the two groups. The four questions are listed below.

Q2. Although it might be helpful, using a DTA/handout is certainly not compulsory in my study.

Q3. Using a DTA/handout enables me to accomplish tasks more quickly.

Q10. Overall, I find using a DTA/handout to be advantageous in my study.

Q14. I've had a great deal of opportunity to try various DTA/handout applications.

First, for Question 2, although it might be helpful, using a DTA/handout is certainly not compulsory in my study, the treatment group’s mean was 2.60 ($SD = .767$) and the contrast group’s mean was 2.84 ($SD = .882$). One could infer from these outcomes that most students in the two groups thought that the m-learning and handout learning were compulsory in their study. While the delivery method and the learning material were necessary for them, the treatment group students had higher learning motivation (Question 1: voluntary), learning quality (Question 4), learning performance (Question 7), and learning effectiveness (Question 8) from using m-learning with the DFP travel application.

Secondly, Question 3 was using a DTA/handout enables me to accomplish tasks more quickly. The mean of the treatment group was 4.02 ($SD = .715$) and the contrast group’s
mean was 4.05 (SD = .548). The data indicated that the students of the both groups recognized that teaching scenarios helped them to do their tasks. Although there was no statistical significance, the teaching activities did assist the students to achieve their assignments whether using m-learning or handout learning. This result might illustrate the statistical examination of the first research hypothesis: There was no statistically significant difference in learning outcome between the two groups.

Thirdly, in Question 10, overall, I find using a DTA/handout to be advantageous in my study, the treatment group’s mean was 4.26 (SD = .665) and the mean of the contrast group was 4.09 (SD = .635). From the two groups’ means, the study may indicate that m-learning with a travel application and handout learning both had advantages during study of DFP objectives. As a consequence, the result that learning effectiveness showed no significant difference within the two groups could be understood.

Finally, for Question 14, I have had a great deal of opportunity to try various DTA/handout applications, the treatment group’s mean was 4.07 (SD = .778) and the mean of the contrast group was 3.95 (SD = .766). In the teaching scenarios, the delivery methods also included presentations with projectors, website materials, and field trips to DFP for both groups. Hence, students could learn the course objectives in various ways. The only control factor was m-learning for the treatment group and handout learning for the contrast group. The research findings from this question were reasonable and understandable.

Discussion of Interview Findings

According to the research hypothesis four (H4), students in the treatment group had positive attitudes towards using smartphones in the teaching scenarios than the contrast group, and related research design, the study also included interviews of ten participating students, consisting of five students from each group, yielding qualitative data that showed
quite valuable feedback from students. This section discusses the statistical findings and attempts to illustrate the research outcomes.

Discussion of the First Interview Question

According to the outcomes of the interviews of the treatment group students, two of five students did not have functional mobile devices with the DFP travel application. One of those students could not afford the smartphone, and the other student had an older generation mobile device with an outdated operational system, such that her smartphone could not run the DFP travel application. Another two of the five students used the application frequently and utilized its functions well after class activities. Although the final student had no problems with the device and the application, he did not like to learn using the small screen of a smartphone. He said that he preferred to use paper materials and desktop computer searching on the DFP official website.

From the outcomes described above, two students could not purchase the needed functionality since smartphones were, in their estimation, too costly. In the framework for the rational analysis of the mobile education model, Koole (2009) indicated that an affordable mobile device was a noteworthy portion of his m-learning model. Thus, this circumstance might have influenced the outcomes of this study.

Discussion of the Second Interview Question

The collected answers from the second interview question revealed that the travel application was convenient for assisting students to gather the DFP information and materials after the teaching scenarios. Additionally, during the field trip to DFP, students could also use the location-based services (LBS) function to locate their position and to download or view
the DFP materials at the right time. As a result, the travel application could provide learning resources for the treatment group students anytime and anywhere during the study.

According to the literature review, mobile technologies can provide many benefits for learning such as supplying the most current information for learners, enhancing training courses and strategies, motivating people who might not be as eager to participate in the course, increasing learning likelihood anytime-anywhere, and saving time for increased productivity (Ally, 2004; Shih, 2005; Cao et al., 2006; Brink 2011; Ting, 2012). These study results proved that the students had similar feelings about using the travel application during m-learning activities.

Discussion of the Third Interview Question

This third question involved the concern about potential research limitations. If the treatment group and the contrast group had too much communication about the learning methods and class activities, the research effectiveness could be influenced by those social interactions. For instance, whether or not the contrast group students used the travel application, if the contrast students asked the treatment group students for information, the posttest scores could be prejudiced by m-learning activities in the contrast group. Fortunately, according to the interviews, the students from the two groups had very little interaction and exchange regarding the different learning approaches. Thus, this research was not affected or only slightly affected by the social interactions.

Discussion of the Fourth Interview Question

The purpose of Question 4 was to investigate whether the treatment group students enjoyed the mobile device with travel application in the course. The question was how appealing was utilizing the DFP travel application. The collected responses indicated that
four students from the treatment group had higher motivation, more excitement, and greater interest in operating the travel application with mobile devices since this course was their first opportunity to use such methods in college. Only one male student preferred learning from a desktop computer and DFP paper materials.

Shih and Mills (2007) applied m-learning to create a motivational design model called attention, relevance, confidence, and satisfaction (ARCS), and likewise Koole (2009) created the FRAME Model. These two models indicated that m-learning could increase a learner’s motivation and enhance a student’s interest in learning. For example, Hwang and Chang (2011) used m-learning to improve learning motivation in a local culture course. Those scholars’ models and studies included the learning models, evidence, and study outcomes which show that learning motivation and interest are enhanced by adopting m-learning. This study outcome also supported the same point of view.

Discussion of the Fifth Interview Question

At the end of the interview, the research included an open-ended question which allowed students to comment freely about the m-learning course design and course scenarios. These comments included advantages, shortfalls, suggestions, and any other thoughts.

The treatment group students described more thoughts, feelings, opinions, problems, and suggestions than the contrast group students. All treatment group students responded that they would like to have more m-learning in future courses because of its learning convenience, its practicality in learning, and the application’s appeal. However, they also pointed out some problems and shortfalls. Those points could essentially be dealt with in future course designs. For example, the speed of mobile devices and wireless services, the design of the application, the friendly interface design, and the size of the application were all shortfalls mentioned by the students. Those deficiencies were also found by Cheverst et al.
Recommendations

According to the outcomes of the research questions, although m-learning effectiveness in the treatment group had no significant differences from the contrast group, the learning attitudes of the treatment group students did demonstrate improvement in learning motivation, learning interest, learning convenience, and interest in having more m-learning courses. For those reasons, some recommendations are given below:

1. From the questionnaire of students’ learning attitudes, most means of the treatment group were higher than the contrast group. One could deduce that students’ learning attitudes were more accepting of m-learning than of handout learning. Therefore, the first recommendation for the department from this outcome was to develop more m-learning courses for students. Mobile devices such as smartphones and tablets with wireless service are becoming more and more popular. Utilizing the tools that students already have in hand would benefit learners and boom up learning attractions.

2. In the previous discussion of students’ learning attitudes, Question 2 was although it might be helpful, using a DTA/handout is certainly not compulsory in my study. The t-test analysis showed no significant difference between the two groups. This result indicated that the DFP application and the handout were not much different for students. The course and effect could not be determined from the research. Therefore, further investigation of this issue would be one opportunity for additional research. For instance, determination of the reason that the treatment group students thought that the DFP application was not compulsory in
their study although they accepted the benefits of m-learning. This should be an interesting topic for other educators.

3. In the discussion of the interviews with students, one student said that the small screen of mobile devices limited his motivation for m-learning. Thus, the third suggestion is that when designing m-learning scenarios, instructors ought to deal with the potential shortfalls of mobile devices.

4. When developing the m-learning course activities, course design needs to consider the existing hardware and software of students’ mobile devices. In the research interviews, one student did not have a mobile device, and another student’s device could not operate the DFP travel application. This type of situation diminishes the use and learning opportunities for learners, and may have affected m-learning outcomes in this study. This final recommendation was thinking about the participants’ devices and the functions before applying the m-learning course design.

Future Research

First of all, because the DFP travel application was designed for visitors traveling to the park, it was not created as learning materials for students in the geographic course. The functions and designs of the DFP app were not fully suitable for course learning. For example, in Shih’s mobile learning model (SMSE in 2005), there are four sectors including scenario, message, synchronization, and evaluation (Figure 2-1). Those elements are the essential sections for m-learning. An ideal m-learning app should contain those sections. However, the DFP travel app only provides travel information for visitors. It can support and provide learning materials for the treatment group students in this study scenario, but it does not provide the elements of message, synchronization, and evaluation. Hence, in future m-learning research, which focuses on using mobile applications, it would be better to create
course applications specifically for the learners. Hence, the research could design the learning application with appropriate materials, interfaces, and functions so that m-learning outcomes could be amplified.

Secondly, in the treatment group of this research, some students had difficulty acquiring a smartphone or other mobile device due to the expense of the new products and the wireless service charges. M-learning will likely be one of the more important learning methods from now on. Future research should give consideration to the proportion of students owning applicable mobile devices, so that all participants could fully participate in the learning activities.

Based on the results of this study, it was probably premature to use m-learning in all courses because of the listed barriers. Nonetheless, m-learning research in 2013 in Taiwan was valuable since the cost of mobile devices was going down and wireless broadband quality was slated for enhancements. Moreover, the speed of wireless broadband was a noteworthy issue. During the research the wireless carriers in Taiwan were just providing 3G service and were planning to launch 4G services at the end of 2014. Wireless acceleration could solve this struggle in future research.

Finally, m-learning was lauded by the treatment group members. Students gave positive feedback and requested more m-learning classes. As a consequence, future research could widely explore all sectors of m-learning phenomena. For instance, for students who respond to different learning styles such as visual, auditory, or tactile learning, investigating how m-learning could be adjusted to better function for different learning populations would be useful. M-learning with similar applications could also be developed in other diverse fields.
Conclusion

The primary purpose of this study was to investigate whether m-learning with a travel application could provide better learning effectiveness than using handout learning over eight weeks of teaching activities in the Taiwan Tourism Geographic Course at THTC. After eight weeks of teaching scenarios and data collection, the ANOVA and t-test were used to inspect the learning outcomes. The results showed no statistically significant differences between using m-learning (smartphone with a travel application) and handout learning. The data analysis outcomes showed that both groups of students had statistically significant learning effectiveness whether using handouts or smartphones with an application.

Even though the m-learning outcomes had no statistical significance, the treatment group students’ learning attitudes were more enthusiastic than those of the contrast group students. The descriptive statistical outcomes of learning attitudes showed that the means of the m-learning group were higher than the handout learning group. It could be inferred that the treatment group students had better positive m-learning attitudes than the contrast group students.

The interview results of the participants showed that the treatment group students had more positive learning attitudes such as learning motivation, learning interest, and more learning participants in the tourism geographic classes. Those students also recommended having more m-learning courses in the future.

Since m-learning will be one of the most popular teaching methods in the future, administration and instructors should pay more attention to designing m-learning courses. Researchers might also focus more on m-learning issues so that m-learning barriers and problems could be investigated, solutions and suggestions provided, and m-learning outcomes heightened.
APPENDIX A

EXAMPLE OF QUESTIONS FOR PRETEST AND POSTTEST
1. ( ) Around the Danongdafu Forest Park, it is worthwhile to experience nearby cultural and activities, which one is not included? (A) Hakka tea culture of Dafu village (b) Amis culture of Mahor tribe (c) Famous cuisine of Dafu village’s sugarcane workers (d) taking a small steam train

1. ( ) 大農大富森林園區附近有許多值得參訪的文化活動，請問哪一個不是？(a)大富村客家擂茶 (b) 馬佛部落阿美族文化 (c) 大富村蔗工的美食 (d) 小蒸汽火車體驗

2. ( ) which is not one of the three consensuses concluded from the meeting experts and community to develop the Danongdafu Forest Park? (a) low carbonated activities (b) lower resource consuming (c) less exploitation (d) low density of construction

2. ( ) 在開發大農大富森林園區前，所舉辦的專家會議及社區說明會後，取得了三項共識，請問哪一個不是？(a) 低碳 (b) 低利 (c) 低開發 (d) 低密度

3. ( ) Which year does government start to create the forest parks in the flat land? (a) 2006 (b) 2002 (c) 2010 (d) 2012

3. ( ) 政府於民國哪一年開始推動平地森林政策？(a) 民國95年 (b) 民國91年 (c) 民國99年 (d) 民國101年

4. ( ) An Amis legend is the idea to create the rainbow bridge as a significant landscape of the Danongdafu Forest Park. Which story is it? (a) story of developing a rainbow (b) story of protecting clansman (c) story of developing the moon (d) myth of shooting the sun

4. ( ) 大農大富森林園區中，南環道上的景觀吊橋的設計理念來自阿美族的哪個故事？(a) 開創彩虹的故事 (b) 保衛族人的故事 (c) 開闢月亮的故事 (d) 射日的神話故事
5. There are several green-designs for bike tracks in the park. Which is not included?
   (a) tracks under the tree shadow (b) power chargers for electric bicycle (c) travel signs and guides to cycling (d) billboards of solar-power generators

5. 大農大富森林園區中，森林自行車道有幾種特別的綠色設計，何者不是？(a)樹林的綠色隧道 (b) 電動腳踏車充電設備 (c) 導覽指示牌 (d) 綠能發電里程碑

6. Which faith from Amis is the idea to create the “Sun Shaped Land and Moon Liked lagoon ” in the Danongdafu Forest Park? (a) fear and obedience of nature (b) traditional view of aestheticism (c) We make the thing we want it to be (d) nothing is impossible

6. 大農大富森林園區中的“日地月池'，是以阿美族的哪種觀點設計出來的？(a) 敬畏天地順服大自然 (b) 傳統美感觀點 (c) 事在人為 (d) 人定勝天

7. The totem of flower-sea in the Danongdafu Forest Park is the biggest one in Taiwan; How big is it? (a) 6 hectares (b) 16 hectares (c) 21 hectares (d) 11 hectares

7. 大農大富森林園區中的圖騰花海是花東最大的花海，請問它的面積有幾公頃？ (a) 6公頃 (b) 16公頃 (c) 21公頃 (d) 11公頃

8. Which artist created the “Life Treasure Tree,” which is next to the Travel Information Center in the Danongdafu Forest Park? (a) Juming (b) Giddens Ko (c) Lily Yeh (d) Li Meishu

8. 大富大農森林園區服務核心區旁的生命寶樹是哪位藝術家與居民的創作？(a) 朱銘 (b) 九把刀 (c) 葉蕾蕾 (d) 李梅樹

9. Which river is not the one in the Danongdafu Forest Park? (a) Hualien creek (b) Chianung creek (c) Guangfu creek (d) Hsiukuluan creek

9. 哪一條河川，不是大農大富森林園區內的主要與次要河川？(a) 花蓮溪 (b) 嘉農溪 (c) 光復溪 (d) 秀姑巒溪
10. ( ) The ancient name of Guangfu township is “Vataan”, which is the homeland of Amis. What does “Vataan” mean in Amis language? (a) place full of the fire-woods (b) Tree-Beans (c) land of nurtures (d) tall tree forest

10. ( ) 光復鄉舊地名“馬太鞍”，為阿美族原住民聚集的故鄉,其中“馬太鞍”阿美族語指為 (a)薪材很多之地 (b) 樹豆 (c) 魚米之鄉 (d) 大樹森林

11. ( ) Which description is not correct for the forest park of Lin Hou Sih Lin? (a) keeping the railways of early Taiwan sugar train (b) combining railways’ features to create a slow traveling style with LOHAS and organic production (c) developing the low altitude natural forest near Dawu mountain (d) near from the trailhead of Kunlunao ancient trail

11. ( ) 林後四林平地森林園區的特色，哪一個不對? (a) 保有早期臺糖火車之鐵道 (b) 將結合鐵道慢遊遊程，發展為具休閒樂活及有機生產的園區 (c) 將發展為大武山低海拔自然森林 (d) 鄰近「崑崙坳古道」之內社登山口

12. ( ) Which one is the authority of the Danongdafu Forest Park? (a) Forestry Bureau (b) Tourism Bureau (c) Water Resources Agency (d) Construction and Planning Agency

12. ( ) 大農大富平地森林園區的主管機關是? (a) 農委會林務局 (b) 交通部觀光局 (c) 農委會水利署 (d) 內政部營建署

13. ( ) Which county does not have a flat forest park currently? (a) Chiayi (b) Hualien (c) Pingtung (d) Yilan

13. ( ) 下列哪個縣市目前未規劃平地森林園區？ (a) 嘉義縣 (b) 花蓮縣 (c) 屏東縣 (d) 宜蘭縣

14. ( ) The ecosystem is vivid in the Danongdafu Forest Park. Which description about the Ring-necked Pheasant is not true? (a) a representative bird of Hualien (b) one of
the three rare birds in Taiwan (c) endemic sub-specie in Taiwan (d) white neck ring on the neck

14. The strategy of creating the Danongdafa Forest Park is a LOHAS style that has five directions; which is not correct? (a) Amis natural culture and environmental aesthetics of local culture (b) Organic production (c) Leisure LOHAS (d) Sugar refinery

15. Which one is not the surrounding attractions of Danongdafa Forest Park? (a) National Museum of Prehistory (b) East Rift Valley (c) Vataan tribe (d) Hualien sugar factory

16. Among the local cultures that involved in Danongdafa Forest Park, which is the main aboriginal tribe? (a) Paiwan (b) Saisiat (c) Kebalan (d) Amis

17. Which service is not provided by travel information center of the Danongdafa Forest Park? (a) bicycle rental services (b) commentary for attractions (c) emergency aid (d) multimedia show of the park
18. ( ) 請問大農大富平地森林園區服務中心“不”提供下列哪項服務？ (a)租借自行車 (b)定點解說 (c)緊急救護 (d)多媒體導覽

19. ( ) There are five parts of Danongdafu Forest Park such as travel information center, forest learning area, nature exploring area, LOHAS recreation area, and environment protecting area. Which facility is in the LOHAS recreation area? (a) visitor center (b) bicycle trails (c) flood detention pool (d) carpentry classroom

19. ( ) 大農大富平地森林園區區分八大設施規劃核心服務區、森林經營體驗區、自然探索區、樂活休閒區、環境保全緩衝等五區。下列何者在樂活休閒區內？ (a) 遊客中心 (b)自行車道 (c)滯洪池 (d)創意木工教學

20. ( ) Which is not a strategy for designing the Danongsdafu Forest Park plans? (a) creating a roaming trip by using the railway (b) creating a LOHAS forest park (c) forming the organic farming, rural scenes in the east rift valley (d) becoming a showcase of the Tropic of Cancer showing the natural resource from forest to coastal

20. ( ) 下列何者非大農大富平地森林園區規劃之觀光策略？ (a) 結合花東鐵道慢遊遊程 (b) 樂活森林園區 (c) 有機稻作、田園景致的縱谷風光景觀特色 (d) 為北回歸線上，海岸至森林資源之展示櫥窗

21. ( ) When Japan Occupied Taiwan, “Daho” is the old name of Dafu village including Danau, Dafeng, Daxing. What is the main farm product of those villages? (a) sugar cane (b) peanut (c) pepper (d) taro

21. ( ) 大富村舊名「大和村」，是日據時期大農、大豐、大興合稱的移民村，當時居民大多種植何種作物為生？ (a) 甘蔗 (b) 花生 (c) 甜椒 (d) 芋頭

22. ( ) Which description is not true for the three flat forest parks? (a) Danongsdafu Forest Park nears the trailhead of Kunlunao ancient trail (b) Danongsdafu Forest Park combines the railway with roaming trip (c) Aogu Wetland Forest Park involves
wetlands, sandbanks and fish ponds (d) Lin Hou Sih Lin Forest Park keeps the earlier railways of sugar train

22. 目前政府所規劃之三處平地森林園區，下列特色敘述何者為非？ (a) 大農大富平地森林園區鄰近「崑崙坳古道」之內社登山口 (b) 大農大富結合花東鐵道漫活遊程 (c) 鱷鼓濕地森林園區含濕地、沙洲、魚塭等景觀 (d) 林後四林平地森林園區保有早期臺糖火車之鐵道

23. Around the Danongdafu Forest Park, there are lots of special landscapes worth for visiting. Which is not included? (a) Vataan wetland (b) Niu Li cultural tribe (c) Ma Hou tribe (d) Tafalong tribe

23. 大農大富森林園區附近有許多值得順道拜訪的旅遊景點，請問哪一個不是在園區附近? (a) 馬太鞍濕地 (b) 牛犁文化部落 (c) 馬佛部落 (d) 太巴塱部落

24. Which description about topography of the Danongdafu Forest Park is not true? (a) a joint alluvial plain that affected by three rivers (b) is mainly alluvialed by Guangfu creek (c) Between Central Mountains and Coast Mountains (d) locate at the common boundary of Eurasian plate and Philippine plate

24. 關於大農大富森林園區地形的描述，哪一個不正確? (a) 是由三條河流共同作用形成的聯合沖積扇平原 (b) 主要是由光復溪沖積而成 (c) 位於中央山脈與海岸山脈之間 (d) 位於歐亞大陸板塊與菲律賓板塊交界處

25. There are many precious protected animals in the Danongdafu Forest Park such as ring-necked pheasant with particular habit. Where does it sleep in the night? (a) on the tree (b) under the eaves (c) around the creek (d) on the meadow

25. 大農大富森林園區中，有著許多珍貴的保育類生物，譬如環頸雉，環頸雉的習性常常遊走於草地間覓食，請問夜間時它會睡在哪裡? (a) 樹上 (b) 屋簷下 (c) 溪旁 (d) 草地上

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26. What is name of the bridge crossing the Chianung river in the Danongdafu Forest Park? (a) colorful fishing rod bridge (b) sun bridge (c) moon bridge (d) rainbow bridge

27. What name is the artwork that has a beautiful curve, makes with bamboo, metal, and pine wood in the Danongdafu Forest Park? (a) House is Your Habitat, Habitat is Your House. (b) That is Your House. (c) That is Your Home. (d) Home is Your Habitat, Habitat is Your Home.

28. In the Danongdafu Forest Park, a hot air balloon festival is held in "playground near the detention pond", which is the conception coming from? (a) moon and mythology (b) earth and moon (c) sun and moon (d) sun and mythology

29. What name is the artwork which has a beautiful curve and makes by bamboo, metal, and pine wood in the Danongdafu Forest Park, also it publish in the international architecture magazine in June 2011? (a) bamboo house (b) police station (c) pine-bamboo dwelling (d) home is habitat
29. ( ) 大農大富森林園區中的竹子、金屬、與松木編織，擁有優美弧線的藝術作品於2011年6月登上國際建築雜誌，其名稱為何？(a)竹居 (b)駐在所 (c) 松竹苑 (d)居所

30. ( ) Which is the alternative name of the "Masadi" Forest Park? (a) Augu Wetland Forest Park (b) Fuyuan Butterfly Valley Forest Park (c) Danongdafa Forest Park (d) Linhouslin Forest Park

30. ( ) Masadi是指哪一個森林園區？(a) 鰲鼓濕地森林園區 (b) 富源蝴蝶谷森林園區 (c) 大農大富森林園區 (d) 林後四林平地森林園區

31. ( ) Which directional description is not correct for the Danongdafa Forest Park? (a) about 1 hour driving north to Hualien City (b) about 3.5 hours driving south to Taitung City (c) easy to reach from both highway No.9 and country road No.193 (d) the nearest train station is Rueisuei station of Taiwan Railway Eastern Line

31. ( ) 大農大富森林園區的交通客觀條件，哪個不正確？(a) 北距離花蓮市區約1小時的車程 (b) 南至台東市約需3.5小時 (c) 台9線道和縣道193皆可方便抵達 (d) 搭乘台灣鐵路東部幹線至瑞穗站下車最近

32. ( ) Which is the previous name of Dafu village's near the Danongdafa Forest Park? (a) Mataian (b) Mafoshe (c) Jialiwan (d) Taibalang

32. ( ) 大農大富坪地森林園區旁的大富（大和）聚落舊名稱為何？(a) 馬太鞍 (b) 馬佛社 (c) 加禮灣 (d) 太巴塱

33. ( ) When Japan occupied Taiwan, what was the name of the Hualien Sugar Factory which was near the Danongdafa Forest Park? (a) Ensuiko Sugar Manufacturing Co. Ltd. Hualien Daho Factory (b) Hualien Sugar Manufacturing Co. Ltd. Hualien Factory (c) Ensuiko Sugar Manufacturing Co. Ltd. Hualien Taian Factory (d) Hualien Sugar Manufacturing Co. Ltd. Guangfu Factory
33.( )大農大富坪地森林園區旁的光復糖廠，在日據時期，其全名為何? (a)鹽水港製糖株式會社花蓮製糖株式會社花蓮工場 (b)花蓮港製糖株式會社花蓮工場 (c)鹽水港花蓮製糖株式會社台安工場 (d)花蓮港製糖株式會社光復糖場

34.( ) Which is not true about the description of the Augu Wetland Forest Park? (a) Featured organic rice and countryside views (b) owning the wetland, sandbank, fish ponds, forest land and agricultural areas (c) officially announced as an important habitat for wild animals (d) scheduling to be an international wetland park in the future

34.( )關於鰲鼓濕地森林園區的特色，哪一個不對? (a) 具有機稻作、田園景致特色 (b) 有濕地、沙洲、漁塭、造林地及農業區等景觀 (c) 經農委會依法公告為野生動物重要棲息環境 (d) 期望將來可提昇為國際級湿地公園

35.( ) There are The five designing strategies for Danongdafu Forest Park. Which one is not true? (a) connecting non-toxic agricultural and forestry cultural (b) shaping local characteristic and connect residents cultural (c) building low carbon leisure ecology travel and link eastern tourism viewpoints (d) recovering the forest for this flat land

35.( )大農大富平地森林園區有五大規劃策略，哪一個不是? (a) 連接無毒農業與林業文化 (b) 塑造在地特色，鏈結住民文化 (c) 建構低碳休閒生態旅遊，串連花東觀光景點 (d) 重現平地森林，延續山水脈絡

36.( ) Where is the Danongdafu Forest Park's located? (a) Guangfu township (b) Mizuho township (c) Shincheng township (d) Fenglin township

36.( ) 大農大富平地森林園區位於哪個鄉鎮？ (a) 光復鄉 (b) 瑞穗鄉 (c) 新城鄉 (d) 鳳林鎮
37. ( ) Which is not the township’s previous name of the Danongdafu Forest Park’s? (a) Mataian (b) Shangdahe (c) Jrkashiuan (d) Taian

37. ( ) 下列何者不是大農大富平地森林園區所在鄉鎮之舊名？(a) 馬太鞍 (b) 上大和 (c) 知卡宣 (d) 台安

38. ( ) There are plenty ecological resources in the Danongdafu Forest Park, and there is the plant names "chinaberry." Which description is not true? (a) Taiwan native deciduous trees (b) bloom purple flowers in the spring (c) it is characteristic four color trees in Taiwan (d) growing at flat land and mid-elevation hills

38. ( ) 大農大富平地森林園區內含許多生態資源，其中以植物─苦楝樹敘述，下列何者為非？(a) 台灣原生落葉喬木 (b) 春天開淡紫色花瓣 (c) 台灣特有四色樹種 (d) 遍生於平地及中海拔丘陵

39. ( ) There are plenty ecological resources in the Danongdafu Forest Park. The most valuable animal is Pointed-scaled pit viper. Which description is not true? (a) it head have apparent triangle (b) it back is tawny, also have irregular black stripe (c) Non-toxic and have black box around the eyes (d) be distributed mid and low elevation area

39. ( ) 大農大富平地森林園區內含許多生態資源，其中以珍貴稀有物種─龜殼花敘述，下列何者為非？(a) 頭部呈明顯三角形 (b) 體背為黃褐色、棕褐色，並有不規則形黑色斑紋 (c) 無毒性，眼睛周圍有黑框 (d) 普遍分布於中、低海拔地區

40. ( ) Which is the main traditional cultural festival of aboriginal tribe near the the Danongdafu Forest Park? (a) The Ritual to the Elf (b) The Ritual to Ancestors (c) Harvest Festival (d) The Ritual of shooting deer’s ears

40. ( ) 大農大富平地森林園區主要在地住民傳統文化祭典為何？(a) 矮靈祭 (b) 祖靈祭 (c) 豐年祭 (d) 打耳祭
41. Which one was not the activity held in Danongdafu Forest Park? (a) Xuan Tian God blessing (b) Huailan forest concert (c) totem flowers-welcom the golden year of snake year (d) the city of sky- hot air balloon

41. 下列何者不是大農大富平地森林園區相關活動? (a) 玄天上帝繞境祈福 (b) 洄瀾森林音樂會 (c) 圖騰花海—繽紛迎金蛇 (d) 天空之城-熱氣球試飛

42. Which description is not the criterions of flat land forest project in 2008? (a) Organizing national hiking trails (b) the altitude lower than 500 meter & the range more than 1000 hectares (c) plenty travel resources and easy to reach (d) travel attractions nearby

42. 政府於民國97年籌組平地森林園區專案評選小組，下列何者非遴選條件? (a) 整合建置全國登山健行之步道系統 (b) 海拔500公尺以下，面積至少1000公頃 (c) 有豐富觀光資源及交通可及性高 (d) 臨近周邊遊憩景點

43. Which park is executed by the same office of the Danongdafu Forest Park? (a) Siraya National Scenic Area Administratio (b) Lintian Mountain Forestry Center (c) Yangmingshan National Park (d) Wuling Farm

43. 請問下列何處與大農大富平地森林園區同一主管單位? (a) 西拉雅國家風景區 (b) 林田山林業文化園區 (c) 阳明山國家公園 (d) 武陵農場

44. Where was the place held the 2013 Hualien Hot Air Balloon Festival? (a) Danongdafu Forest Park (b) Luye Highland (c) Tsoumalai Farm (d) Fuyuan National Forest Recreation Area

44. 請問在2013暑假期間的花蓮國際熱氣球嘉年華活動，在下列哪處舉辦? (a) 大農大富平地森林園區 (b) 鹿野高台 (c) 走馬瀨農場 (d) 富源森林遊樂區
45. ( ) The Danongdafu Forest Park has a lovely ecosystem. Which is the peculiar species of Taiwan? (a) Japanese Climbing Fern (b) Alocasia Macrorrhizos (c) Flame Gold-rain Tree (d) Common Elaeocarpus

45. ( ) 大農大富平地森林園區內含許多生態資源，下列何種植物為臺灣特有種？(a)金沙 (b)姑婆芋 (c)台灣欒樹 (d)杜英

46. ( ) Danongdafu Forest Park divides five parts: Tourist Service Area, Learning through Forest Area, Exploring Ecosystem, LOHAS Recreation Part, and Protection Zone. Which of following facility is in the Tourist Service Area? (a) Green building of Display Room (b) Green building of pavilion (c) Tree Climbing facility (d) Showroom of Timber

46. ( ) 大農大富平地森林園區內分區設施規劃核心服務區、森林經營體驗區、自然探索區、樂活休閒區、環境保全緩衝等五區。下列何者在核心服務區內？(a) 綠建築 解說教室 (b) 綠建築避雨亭 (c) 爬樹體驗 (d) 林業展示中心與特色館

47. ( ) Danongdafu Forest Park divides five parts: Tourist Service Area, Learning through Forest Area, Exploring Ecosystem, LOHAS Recreation Part, and Protection Zone. Which of following facility is in the Learning through Forest Area? (a) Covered Cut wood Trail (b) Organic Farm Zone (c) the Detention Pond (d) Old Style Water withdrawing

47. ( ) 大農大富平地森林園區內分區設施規劃核心服務區、森林經營體驗區、自然探索區、樂活休閒區、環境保全緩衝等五區。下列何者在森林經營體驗區內？(a) 木屑自然步道 (b) 有機農田 (c) 滯洪池 (d) 引水大水車

48. ( ) Danongdafu Forest Park has plenty natural eco-resources. Which of following is not the peculiar species of Taiwan? (a) Takydromus Luyeanus (b) Styan's Bulbul (c) Papilio Hermosanus (d) Rana latouchii Boulenger
48. 大農大富平地森林園區內含許多生態資源，下列何者動物非臺灣特有種？
(a)鹿 野草蜥  (b)鳥頭翁  (c)台灣琉璃翠鳳蝶  (d)拉都希氏樹蛙

49. There are many aboriginal tribes near the Danongdafu Forest Park. Which tribe is not closed to the park?  
(a) Chimei Tribe  (b)Vataan Tribe  (c) Tafalong Tribe  (d) Mahor Tribe

49. 大農大富平地森林園區園區周邊多有特色的原住民聚落，下列何者不包含在內？
(a)奇美部落  (b)馬太鞍部落  (c)太巴塱部落  (d) 馬佛部落

50. The agriculture office schedules are three flat land forest parks. Which description is not correct?  
(a) Linhousilin in Pingtung County  (b) Danongdafu Forest Park in the Nantou County  (c) Aogu Wetland Forest Park in the Chiayi County  (d) Danongdafu Forest Park in the Hualien County

50. 目前政府所規劃三處平地森林園區，下列園區所在縣市何者為非？  
(a) 林後四林  
森林園區位於屏東縣  (b)大農大富平地森林園區位於南投縣  (c) 鰲鼓濕地森林園區位於嘉義縣  (d)大農大富平地森林園區位於花蓮縣

APPENDIX B

THE STATISTICAL OUTCOMES OF THE PDA QUESTIONNAIRE
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APPENDIX C

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<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly agree</th>
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<td>Q15</td>
<td>4.12</td>
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<td>2.38%</td>
<td>21.43%</td>
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REFERENCES


