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著者(和文)	Poong YEW SIANG
Author(English)	Yew Siang Poong
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Study of Perceptions on Behavioral Expectation to Preserve World Heritage Site through Mobile Learning Application in Luang Prabang, Lao PDR

By
Yew Siang POONG

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Luang Prabang, the world heritage site (WHS) of Lao PDR, faces an urgent need to raise awareness of preservation. This study developed mobile learning content and tested its impact based on modified Protection Motivation Theory in promoting world heritage site preservation awareness. Questionnaire survey was administered to 220 college and university students in Luang Prabang. Structural equation modelling results show that perceived severity, response efficacy, perceived resident effectiveness, and perceived benefits of inscription affect behavioral expectation to preserve WHS. This study contributes to research by explaining factors of promoting world heritage site preservation awareness based on fear appeal theory. Findings from this study support world heritage management practitioners in identifying components essential in the design and dissemination of persuasive public communication to promote WHS preservation awareness.

THESIS SUMMARY

This dissertation consists of seven chapters. The main research objective of this study is to determine the factors affecting world heritage site (WHS) preservation awareness among local young adults in the world heritage town of Luang Prabang through mobile learning application.

Chapter 1 Introduction: this chapter covers background of the study, problem statement, objectives of study and significance of the study.

Chapter 2 Literature review: Literature indicates mobile learning as a new form of learning following the increasing capability of mobile devices. One of the categories of mobile learning application is in development country context, in which the delivery of learning content using mobile devices will reach wider target audience than using other modes of delivery. The Protection Motivation Theory (PMT) posits that three factors influence protection motivation: 1) perceived severity, 2) perceived vulnerability and 3) perceived response efficacy. However, PMT has never been applied in the context of WHS preservation. Therefore, it is of interest of this study to test the applicability of PMT in the explaining the factors of preservation in Luang Prabang. Following extensive literature review, two additional factors are integrated in order to tailor PMT in this study context, namely perceived resident effectiveness and perceived benefit of inscription.

Chapter 3 Summary of previous empirical study: Past empirical findings show that the number of mobile phone ownership is the highest in Luang Prabang compared to other computing devices. In addition, mobile phone is the second most used device in conducting common digital activities. As a result, mobile phone was identified as the potential medium to deliver learning content to promote preservation awareness. Both past empirical findings and literature reviews have provided strong support on the use of mobile learning to promote WHS preservation awareness in Luang Prabang.

Chapter 4 Theoretical framework and methodology: A total of five hypotheses are derived based on extensive literature review and past empirical findings. Questionnaire

survey was used to collect data and consists of two sections, 1) demographic, and 2) PMT related question items. A total of twenty five question items are developed in six categories to assess PMT-related perceptions using 7-point Likert scale. Structural equation modeling is employed to analyze the perception data.

Chapter 5 Mobile learning application development: Following the result of past empirical findings, a mobile learning application, consists of a quiz component and a learning content component, was developed according to four principles: 1) reflecting local needs, 2) interactive and easy to use, 3) bilingual support, and 4) sustainable maintenance. Mobile learning content was developed based on the hypothesized PMT in this study. The final learning content consists of three pages with specific messages addressing the hypothesized elements.

Chapter 6 Data analysis: Data collection was carried out in October 2015 with students in two local higher education institutions. Demographic data based on 190 respondents shows that majority of the respondents are male, aged between 19 to 21 years old, possess mobile phone with internet connection capabilities, and they access to the internet using their mobile devices daily. Both the measurement model and structural model achieved good fit. Hypothesis testing result shows that four out of five hypotheses were supported. Qualitative interview findings of with 16 students and summary of policy makers' opinion and comment provide insights of mobile learning effect and importance in promoting WHS preservation awareness. Paired t-test was used to evaluate the mean difference of perceptions before and after the respondents view the hypothesized PMT-based learning content. Result shows that there is statistically significant difference among all constructs, except for perceived resident effectiveness.

Chapter 7 Discussion and conclusion: Overall, the modified PMT explains 34.7% of the variance of local young adults' behavioral expectation to preserve WHS. There are several new findings regarding the drivers of WHS preservation motivation. First, both perceived benefits of inscription and perceived resident effectiveness are found to be the determinant of preservation motivation. Second, original PMT variables significantly affect preservation motivation, except for perceived vulnerability. Third, mobile learning application has a potential to promote WHS preservation awareness. Finally, this study has validated the applicability of behavioral expectation as a measurement of protection motivation. The outcome of this study is useful in the design of public communication contents to promote

WHS preservation awareness. The findings of this research will not only help heritage management practitioners to develop better public communication strategies, but also provide insights into research on WHS preservation from social perspective.

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CHAPTER 1

INTRODUCTION

This chapter covers the background of study related to world heritage town of Luang Prabang, problem statement and research objectives. Significance of study, research methodology and limitation of this study is also described in this chapter.

1.1 Background

Luang Prabang is located at the northern part of Laos. Historically, Luang Prabang was once the royal and religious capital of Laos. Despite being a small town, it has the highest concentration of Buddhist temples which are built with stone and are richly decorated. Following 60 years of French influence from 1893, colonial style buildings were left behind, and coexist with wooden traditional Lao building. Unlike some other inscribed monuments which are limited to built architectures, the well-preserved townscape is harmonized with natural landscape and is completed by traditional cultures practiced daily by local people. As a result, Luang Prabang was inscribed in the World Heritage List of the United Nations Educational, Scientific and Cultural Education (UNESCO) in 1995. The inscription is based on three Outstanding Universal Values (OUVs): 1) the exceptional fusion of Lao traditional architecture and European colonial style buildings; 2) an example of architectural collections of religious buildings; vernacular constructions, and colonial buildings; and 3) well-preserved unique townscape integrating traditional and urban cultural traditions (UNESCO, 1995).

Following the inscription, the number of visitors arriving to Luang Prabang has been increasing. As illustrated by Figure 1.1, the number of total visitors in 2014 has increased by nearly 800% since 1997.

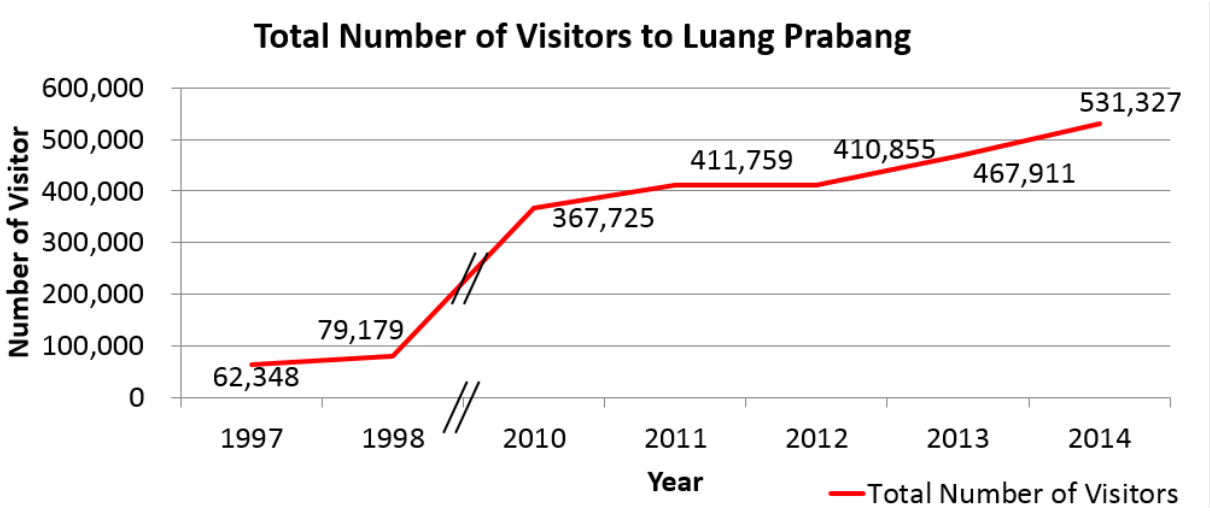


Figure 1.1: Trend of visitor arrivals to Luang Prabang

Source: Tourism Development Deparment of Lao PDR, (2013, 2014)

The Department of World Heritage in Luang Prabang (DPL) was established as a specialized government agency to manage world heritage site of Luang Prabang. In particular, DPL is responsible for ensuring that the work of preservation and development of Luang Prabang are performed in accordance with the Safeguarding Plan (PSMV). PSMV is a complete document specifying the original heritage of Luang Prabang, including view of townscape, building architectures, as well as rules and regulations of land use and building modifications (La Maison du Patrimoine (MdP), 2001).

In 2007, the World Heritage Committee conducted a reactive monitoring on the town of Luang Prabang. Its purpose is to ensure the inscribed world heritage site stays well protected following the management plan. The reactive monitoring report indicates that there is trend of local residents modernizing their houses. Thus, it calls for effective conservation awareness raising to communicate rules and regulations about building and environment alteration to the local residents (Giovanni Boccardi & Logan, 2008). Previous studies support that the degree of awareness among the local residents is one of the most important determinants to the preservation of protected areas (Jimura, 2011; Munjeri, 2004; Ormsby & Kaplin, 2005).

1.2 Problem statement

Given this background, DPL has been engaging the local residents through awareness campaign held in a monthly basis. This is done by holding events such as seminars and

information sessions in each village during the day by gathering the residents. However, two major issues can be identified from existing awareness campaign process:

1) Labor intensive: Organizing awareness campaign in villages involves manpower from DPL and village side, such as venue preparation and assembling villagers.
2) Target audience bias: Local residents who are not available during the designated date and time may not be able to gain benefits from the campaign.

The above issues cause difficulty of meeting the objective of awareness campaign, and therefore there is a need for alternative mode to promote preservation awareness in Luang Prabang.

Based on previous study conducted in Luang Prabang, and a brainstorming session with DPL experts, the high rate of mobile phone ownership among the local residents was recognized. As a result, mobile learning was identified as a potential ICT tool to supplement the effort to promote preservation awareness among the local residents in Luang Prabang (Poong, 2013). Given this background, an appropriate tool to deliver learning content was identified. However, learning content to effectively impact users of mobile learning on the perception of world heritage site preservation needs to be developed. The learning content will be uploaded into the mobile learning application and should be able to persuade users to preserve the world heritage town of Luang Prabang. Nevertheless, there are limited studies providing systematic framework in guiding the development of learning content to promote world heritage site preservation awareness.

Research has shown that awareness is positively correlated with behavior (Ishak & M. Zabil, 2012). According to Ajzen (1991), behavior can be predicted accurately from intention. Yet, factors affecting local residents' to preserve world heritage site is still less understood. Literature shows that threat and coping appraisal forms the basis of an individual's protection behavior (Rogers & Maddux, 1983). Both of the cognitive processes have been empirically proven to function as persuaders. The cognitive processes motivate an individual to perform a recommended protective behavior, which leads to the development of Protection Motivation Theory (Rogers, 1983). Although Protection Motivation Theory (PMT) originally being applied in predicting health protection behavior, recent research has begun to extend the applicability of PMT beyond health context, for instance, in predicting individual's pro-environmental behavior (Bockarjova & Steg, 2014). Yet, there is no study applies PMT to predict individual's world heritage site protection behavior.

Besides predicting individual's protection behavior, PMT is also commonly used as a

framework to develop and evaluate persuasive communications (Norman, Boer, & Seydel, 2005). PMT has provided a comprehensive framework to guide the design and assessment of effectiveness in promoting recommended behavior (Floyd, Prentice-Dunn, & Rogers, 2000; Glendon & Walker, 2013). Therefore, understanding the dynamics of local residents' behavioral expectation to preserve world heritage site helps to facilitate the development of learning content to promote preservation awareness. Behavioral expectation refers to an individual's subjective probability that a behavior will actually be performed. However, there is no empirical study investigate the impact of PMT-based communication materials on people's world heritage site preservation behavior.

Unlike protecting oneself from sickness, preserving a living world heritage site involves the collective effort of each individual. A living world heritage can be thought as a community living in a protected environment. Studies from environment protection has found that environmental problems are related with consumers' behavior (Ölander & ThØgersen, 1995). In order to understand consumers' behavior towards environment protection, researchers have been examining a factor which has received substantial attention in marketing: perceived consumer effectiveness. Perceived consumer effectiveness measures "the extent to which the consumer believes that the efforts of an individual acting alone can make a difference" (Ellen, Wiener, & Cobb-walgren, 1991, p. 103). Studies have found that higher perceived consumer effectiveness is associated with higher behavioral intention engaging sustainable action (Vermeir & Verbeke, 2006). In this study, perceived consumer effectiveness is operationalized as perceived resident effectiveness to better reflect current study context. Given that involvement of community in world heritage site preservation has been an important agenda, however, perceived resident effectiveness on world heritage site preservation is still less understood.

Studies have shown that residents' perception affects behavior, which in turn may impact the protection of world heritage sites (You et al., 2014). The inscription of world heritage site is expected to provide benefits to the locals. Yet, empirical study on residents' perception of benefits brought by inscription of world heritage site is still scarce (Vareiro, Ribeiro, Remoaldo, & Marques, 2011). Further, studies reporting positive perception of benefits rarely explore how the positive perception of benefits influences local residents' behavioral expectation to preserve world heritage site.

1.3 Research objective

Reflecting the problem statements outlined above, the objective of this study is to determine the factors affecting world heritage site preservation awareness among local young adults in the world heritage town of Luang Prabang. Specific research objectives include:

1. To identify perceived factors influencing behavioral expectation to preserve world heritage site by adapting the Protection Motivation Theory.
2. To develop mobile learning content reflecting local needs and requirements.
3. To evaluate the effects of the mobile learning content on learner's perception with regard to world heritage site preservation.

1.4 Significance of the study

There are three major significances to conduct this research. First, this study provides research implication by being the first study employing PMT in evaluating local residents' behavior towards world heritage site preservation. As depicted in previous sections, local residents' behavior would determine the protection level of world heritage site. Yet, studies investigating local residents' perceptions and behavior are limited, which limit the understanding of the dynamics of world heritage site preservation, especially from local residents' perspectives. This is particularly important for living world heritage site, where local residents live and stay within the world heritage site.

Second, the findings of this study benefits heritage management involve in awareness promotion. In addition to the insights gained from the understanding of factors increasing local residents' motivation to protect world heritage site, this study also shows that the application of mobile learning as a potential tool to supplement manual heritage promotion activities.

Third, the findings of this study inform mobile learning implementation policy formulation in international development arena. This is particularly important given that international development agencies, such as UNESCO, is actively expanding the application of mobile learning in different domains.

1.5 Research methodology

Prior to data collection, mobile learning content is developed based on the modified PMT. The learning content is reviewed and validated by DPL experts and is revised based on outcomes of past research. Data collection employs a cross-sectional questionnaire survey in two local higher educational institutions in Luang Prabang. It consists of demographic questions, as well as list of question items measuring perceived severity, perceived vulnerability, response efficacy, perceived benefits, perceived resident effectiveness and behavioral expectation to preserve. A 7-point Likert scale is employed in the questionnaire to measure respondents' perception. A set of pre and post-test is conducted to assess the effect of PMT-based mobile learning content on users' world heritage site preservation awareness. Using post-test data, structural equation modelling is used to test the nomological structure of the modified PMT. A measurement model is developed to assess measurement reliability and validity. Subsequently, fitness of structural model is assessed to evaluate the extent of data fits with the theorized paths. Finally, a structural model is developed to test the hypotheses. Next, a paired sample t-test is conducted to assess the mean difference of perceived severity, perceived vulnerability, response efficacy, perceived benefits, perceived resident effectiveness and behavioral expectation to preserve Luang Prabang world heritage site. Qualitative interview with users and summary of discussions with policy makers are included to supplement the quantitative result with regard to the implementation of mobile learning content in promoting world heritage site awareness.

1.6 Limitation

The sample of this research is collected from young adults studying in higher education institutions in Luang Prabang. Further, random sampling is not possible in this study context, which lead to the adoption of convenience sampling strategy. Therefore, findings may not be generalizable beyond young adults with similar background. Another limitation of this study is not considering actual behavior. Nevertheless, researchers often rely on individual behavior as a predictor to actual behavior. In addition, this study considers tangible heritage, such as temples, French colonial buildings and traditional Lao architecture as the target of preservation. This is because the outstanding universal values and safeguarding plan of Luang Prabang were related to the heritage buildings and natural heritages, such as ponds and wetland.

1.7 Organization of thesis

There are seven chapters in this thesis and they are presented as below:

Chapter One – Introduction: This chapter presents the background of the research, problem statement as well as objective, significance of this research and limitation.

Chapter Two – Literature Review: This chapter reviews concepts of world heritage site and identifies knowledge gaps in world heritage site preservation. Evolution of mobile learning and the meaning of mobile learning is reviewed. This is followed by reviews on relevant theories related to the influence of perceptions on behavior, including the concepts of Protection Motivation Theory. Finally, this chapter concludes by explaining how the use of mobile learning can help to enhance behavioral expectation to preserve world heritage site.

Chapter Three – Summary of Previous Empirical Study: This chapter describes the findings based on author's master's thesis. The content covered in this chapter include the technology readiness of young adults in using mobile phone for learning, review on the theoretical framework used to assess the research objective of master's thesis and the factors affecting mobile learning acceptance. This is followed by the findings of interviews with local residents on the use of mobile learning to promote world heritage site preservation awareness. This chapter ends with the impact of the findings on research and policy based on past findings.

Chapter Four – Theoretical Framework and Methodology. This chapter begins with the development of theoretical framework and hypotheses based on the literature review in Chapter Two. Subsequently, the operationalization of the theoretical framework to suit the context under investigation is outlined. Mobile learning application development and learning content development is presented in this chapter. In addition, this chapter describes the methodology used to collect data, including sample size determination, survey instrument development, and data analysis method.

Chapter Five – Mobile Learning Application Development. This chapter first provides justification on the adaptation of mobile learning in this study context. This is followed by the description on the four principles of mobile learning application development. Mobile learning application technical details and the evolution of learning content are presented accordingly.

Chapter Six – Data Analysis. This chapter reports the findings based on questionnaire survey data. Respondents' demographic, measurement model and result of hypotheses testing based on structural model are presented in this chapter. Finally, interview results supplementing the pre and post-test result of mobile learning content on world heritage site preservation are presented.

Chapter Seven – Discussion and Conclusion. This chapter provides discussion on the findings of data analysis, practical implication, limitations of this research and future research direction recommendation.

1.8 Definition of terms

Perceived severity – an individual's belief of the degree of seriousness of not protecting heritage buildings.

Perceived vulnerability – an individual's belief of the probability that a world heritage site will face negative impact as a result of not protecting heritage buildings.

Response efficacy – an individual's beliefs as to whether the recommended action step will actually avoid the threat.

Perceived resident effectiveness – a resident's belief that he or her efforts can make a difference in world heritage site preservation.

Perceived benefits of inscription – the positive factors associated with the inscription of world heritage site.

Behavioral expectation – an individual's estimation of the likelihood that he or she actually will perform some specified future behavior.

Maladaptive response/behavior – behavior currently engaged in.

Adaptive response/behavior – protection behavior following the recommended response.

CHAPTER 2

LITERATURE REVIEW

This chapter includes five sub sections. First section reviews world heritage site preservation context. Then, the second section presents the concept in which preservation of environment and world heritage site converges. In the third section, literature related mobile learning is reviewed to define the positioning of mobile learning in this study. Accordingly, in forth and fifth sections, theories related to the influence of perceptions on behavior are presented and the rational of adopting Protection Motivation Theory in world heritage site preservation is described.

2.1 World heritage site preservation

A "world heritage site" status is granted by UNESCO if a monument, groups of buildings, or a geographical area possesses outstanding universal values and satisfies selection criteria. The International Council on Monuments and Sites (ICOMOS) states that:

> Outstanding universal value means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole. The Committee defines the criteria for the inscription of properties on the World Heritage List. To be deemed of outstanding universal value, a property must also meet the conditions of integrity and/or authenticity and must have an adequate protection and management system to ensure its safeguarding (ICOMOS, 2008, p. 14).

Although the designation of world heritage site does provide several benefits, such as attentions and revenues, its designation can also bring about some negative effects. (Frey & Steiner, 2011). Therefore, ways to promote protection and preservation of world heritage site are needed. UNESCO has provided operational guidelines to manage world heritage site, including the protection and conservation aspect. It is mainly targeted for government and management level authorities. Among the recommended operational guidelines include the setting up of institutions to monitor and introduce regulating measures to protect world heritage site (UNESCO World Heritage Centre, 2015).

Drost (1996) suggests two important strategies for the conservation of heritage site, namely, education and regulations. The purpose of education is to raise people's awareness about the world heritage site. It is expected that people will then regulate their behaviors which could bring lasting change (Drost, 1996). Among the proposed efforts to promote world heritage site preservation include development of tourists' code of conduct, periodic educational workshops and experience sharing among world heritage site host countries (Drost, 1996).

Drost (1996) study is consistent with the philosophy of protection stated in the work of Ham (2010). According to Ham (2010), interpretation (educational content) leads to understanding, which subsequently lead to appreciation, and then protection behavior. His study has provided cues by relating communication of site protection through the lens of behavior theory, such as the theory of planned behavior and elaboration likelihood model of persuasion. Nevertheless, the target population of Ham (2010) study is visitors of protected sites. Indeed, synthesis of literature reveals that majority of the studies of world heritage site management tend to focus on planning for tourism in general, highly descriptive, and very few studies examine stakeholders' perceptions and involvement (Nicholas, Thapa, & Ko, 2009). Wager (1995) recognizes the importance of involving local residents in the management of Angkor world heritage site as the effort could improve local residents' understanding of the need for protection of landscape. Further evidences show that understanding of the importance of world heritage site enables local residents play important role in reviving intangible cultures in Istanbul and rural villages in Romania (UNESCO, 2012b). Nevertheless, despite that awareness raising has been a necessary component in world heritage site preservation, many of the studies lack a systematic framework organizing factors leading to protection motivation of world heritage site.

One of the common keyword between environmental protection and world heritage site preservation is sustainable development. Sustainable development is defined as "development that meets the needs of the present without compromising the ability for future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 43). While there is no official definition of sustainable development in the context of world heritage site, the former UNESCO Regional Advisor for Culture in Asia and the Pacific, Engelhardt, had once said:

> World Heritage Convention "carries in itself the spirit and promise of sustainability, …in its insistence that culture and nature form a single, closed

> continuum of the planet's resources, the integrated stewardship of which is essential to successful long-term sustainable development – and indeed to the future of life on the Earth as we know it" (Engelhardt, 2007)

The World Heritage Convention states that the designation of world heritage site may contribute to sustainable development in many dimensions, including human development, natural resources preservation, economic development, spiritual well-being, as well as risk mitigation. Therefore, it is apparent that the common concept between environment protection and world heritage site preservation is apparent. Moser (2010) states that environmental protection issue, such as climate change, requires new ways of thinking and behaving to be addressed adequately and appropriately. As part of the effective communication process, messages which tap into mental models of people and direct people towards climate change friendly action and behavior is recognized as the key element in communication process (Moser, 2010).

2.2 Mobile learning

2.2.1 Mobile learning as a new form of learning

As the objective of this research is to promote world heritage site preservation awareness using mobile learning, it is essential to review the theories related to learning. Psychologists agree that learning begins with stimuli and perception. The Levels of Processing theory by Craik and Lockhart (1972) states that the learning process begins with perceptual analysis on stimuli, such as sounds, sights, smells, and even words as well as images. Learners utilize different levels of elaboration as they process information. This resembles a continuum from perception, through attention, to labeling, and finally to meaning (Craik & Lockhart, 1972). Learning has been defined in various ways. As early as 1929, learning has been defined as "change or modification of behavior" (Woodworth, 1929, p.163). This definition clearly relates the concept between learning and behavior change. Debates have continued on whether it is sufficient to relate learning to behavior. Washburne (1936) argues that Woodworth (1929)'s definition of learning is too broad. And thus, proposes another definition of learning as "an increase, through experience, of problem-solving ability" (Washburne, 1936, p.610). However, the importance of learning on behavior can be understood as researchers retain the term "behavior" in learning definition even after many decades. De Houwer, Barnes-Holmes, and Moors (2013) defines learning as "changes

in the behavior of an organism that are the result of regularities in the environment of that organism" (p. 633). Two main facts can be learnt from this definition. First, learning is the process of change of behavior. In a relatively broad definition, a change in behavior refers to a change in the way an individual responds to the environment as a result of the link between certain stimuli (De Houwer et al. 2013). Second, the process of change of behavior is the result of the presence of stimulus at multiple moments of time. With regard to the second point, De Houwer et al. (2013) argues that learning occurs as a result of regularities, and not because of experience.

Learning takes place in different kinds of settings. In the recent educational context, learning can be classified into the following three categories: 1) formal learning defined as learning that occurs within an organized and structured context which may lead to a formal recognition; 2) non-formal learning defined as learning embedded in planned activities that are not explicitly designated as learning, but which contain an important learning element; and 3) informal learning defined as learning resulting from daily life activities related to work, family, or leisure. Learning is intentional in formal and non-formal learning from learner's perspective, and otherwise for informal learning (Colardyn & Bjornavold, 2004, p. 71). While abundant research have been conducted in improving formal learning, non-formal learning has its importance in developing human capabilities, improving social cohesion, and creating responsible future citizens (Delors, 1996). From international development perspective, non-formal learning can contribute to social and cultural development despite lack of any qualification recognition similar with formal education (UNESCO, 2012a). Hence, based on the definitions of learning, promoting world heritage site preservation awareness is best categorized as non-formal learning.

In traditional learning, learning occurs in classrooms in educational institutions, where educator teaches and students listening and writing notes (O'Malley & McCraw, 1999). The advancement of technologies has given rise to different forms of learning. The earliest form of technology-based learning comes in the form of computer-based learning, which serves as classroom aids. Then, there is e-learning (electronic learning), where students can do the majority of their learning utilizing any technologies, either connected or disconnected to the network (Tavangarian, Leypold, Nölting, Röser, & Voigt, 2004). E-learning is usually used to complement face-to-face learning. This kind of learning style is known as mixed mode, hybrid or blended learning. A fully online learning refers to learning

with no classroom or on-campus teaching. Also known as distance education. Bates and Poole (2003) have described these developments graphically in Figure 2.1.

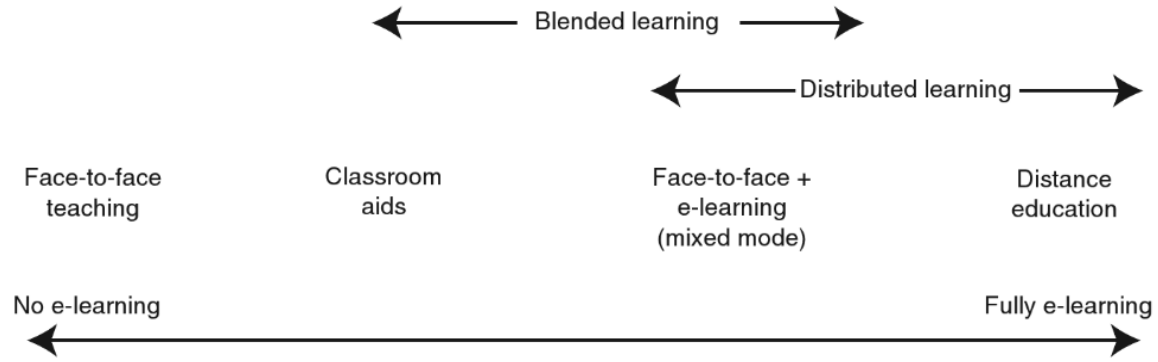


Figure 2.1: The continuum of technology-based learning (Source: adapted from Bates & Poole, 2003, p.127).

Along with the development of e-learning, learning modes evolve as computing devices become smaller and ubiquitous. Devices such as tablet computer, personal digital assistant and even cellular phones and smart phones have become more affordable and powerful, which enable various functions beyond calling and texting. Given wireless connectivity options, such as mobile data networks and WIFI, learners can access to learning content via their mobile devices anywhere at any time without permanent physical connection to cable networks. This form of learning is termed as "mobile learning". Mobile learning is thought to be nested under the scope of e-learning. In turn, e-learning is nested under the scope of d-learning (distance learning). This concept is illustrated in Figure 2.2 (Georgiev, Georgieva and Smrikarov, 2004).

Table 2.1 summarizes the comparison between traditional learning, e-learning and mobile learning across five attributes. Among the keywords for mobile learning include personal, private, informal, connected, while the keywords for e-learning are computer, multimedia and media-rich environment (Crompton, 2013). Mobile learning extends traditional learning by breaking time constraints and context. Given the numerous possibilities of mobile learning, literature has provided different mobile learning definitions, as explained in the next section.

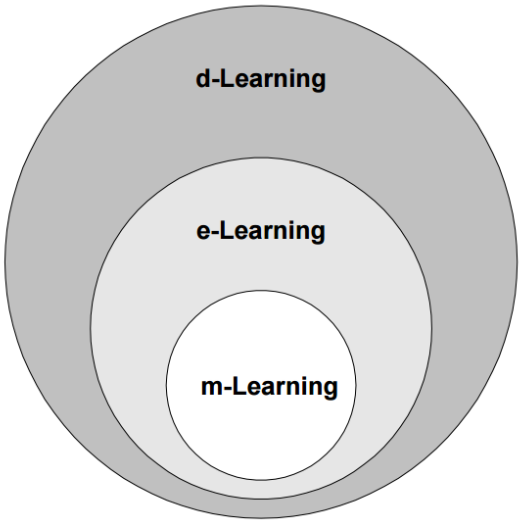


Figure 2.2: Positioning of mobile learning

Source: adapted from Georgiev et al. (2004, p. 28-1))

2.2.2 Characteristics of mobile learning

Park, Nam and Cha (2012) defines mobile learning as "any educational provision where the sole or dominant technologies are handheld and palmtop devices" (p.592). On the other hand, Kukulska-hulme (2005) states that mobile learning occurs when learners engage in learning activities without being tied to a physical location. Sharples, Taylor and Vavoula (2006) defines mobile learning as embracing "both learning with portable technology, and also learning in an era characterized by mobility of people and knowledge" (p. 10). This definition, as opposed to Park et al. (2012) and Kukulska-hulme (2005), combines both technology perspective and the mobility of learning. Further, Crompton (2013) describes mobile learning as "learning across multiple contexts, through social and content interactions, using personal electronic devices" (p. 4). Although definition of mobile learning has evolved over time, the focus is still to support mobility of people and knowledge. Hence, it can be understood that mobile learning occurs when learners are using some form of mobile devices and that learning activity is not constrained by physical location.

Table 2.1: Comparing traditional learning, e-learning and mobile learning with various learning attributes

Attribute	Traditional learning	E-learning	Mobile learning
Time	Often constrained by formal school hours	Constrained to time sat in front of a computer, but can occur at any time of the day	No time constraints. Learning can take place anywhere you can carry and use a mobile device at any time of the day
Personalized	Limited in all aspects of differentiation and concepts taught	Some personalization, with a choice of programs, and concepts to be taught, but computers are typically shared and non-personalized	Personalization through applications, concepts and often the ownership of devices modified for the user
Private learning	Not private	Typically private	Private
Context	Highly limited to a set location and framework	Various locations, although still tied to specific locations and milieu	Learning can take place in numerous environmental and social settings, where wireless access can be obtained
Formal/informal	Formal	Formal and informal	Informal and can also be formal
Socio-connectivity	Connections made to those in direct environment	Virtual connectivity to the networked world	Connections made to those in the direct environment and those networked
Spontaneity	Not spontaneous	Partially spontaneous	Highly spontaneous

Source: reproduced from Crompton (2013)

According to Traxler (2007), there are six categories of emerging mobile learning (Table 2.2). The first category of mobile learning refers to learning driven purely by technology. The second category of mobile learning refers to a smaller version of e-learning. E-learning was originally thought to be mainly conducted on desktop computers. With the advancement of technologies, e-learning can also be performed on smaller handheld devices. The third one refers to technologies used to connect with other technologies in the classroom to facilitate learning. The forth category of mobile learning refers to learning which is informal, personalized and situated. Situated learning posits that learning can be enhanced by ensuring that it takes place in an authentic context (Naismith, Lonsdale, Vavoula, & Sharples, 2004). Since mobile devices can be accessed in different contexts, learning experience can be

enriched by drawing contextual cues from real-world scenarios. The fifth category of mobile learning refers to the use of mobile phone for training or performance support in working environment. The last category proposed by Traxler (2007) refers to the use of mobile learning in international development context. Instead of creating innovative applications to push the mobility limit of mobile learning, this category of mobile learning addresses environmental and infrastructural challenges to delivering and supporting education where conventional e-learning may not be appropriate.

Table 2.2: Emerging mobile learning application categories

Categories of mobile learning	Description
1. Technology-driven mobile learning	Some specific technological innovation is deployed in an academic setting to demonstrate technical feasibility and pedagogic possibility
2. Miniature but portable e-learning	Mobile, wireless, and handheld technologies are used to re-enact approaches and solutions already used in 'conventional' e-Learning, perhaps porting some e-Learning technology such as a Virtual Learning Environment (VLE) to these technologies or perhaps merely using mobile technologies as flexible replacements for static desktop technologies
3. Connected classroom learning	The same technologies are used in classroom settings to support collaborative learning, perhaps connected to other classroom technologies such as interactive whiteboards
4. Informal, personalized, situated mobile learning	The same technologies are enhanced with additional functionality, for example location-awareness or video-capture, and deployed to deliver educational experiences that would otherwise be difficult or impossible
5. Mobile training/performance support	The technologies are used to improve the productivity and efficiency of mobile workers by delivering information and support just-in-time and in context for their immediate priorities
6. Remote/rural/development mobile learning	The technologies are used to address environmental and infrastructural challenges to delivering and supporting education where 'conventional' e-Learning technologies would fail, often troubling accepted developmental or evolutionary paradigms

Source: reproduced from Traxler (2007).

Past survey in Luang Prabang among the young adults shows that mobile phone has the highest ownership among desktop computer, laptop computer, tablet and mobile phone. This is a common phenomenon across least developed and developing countries. In these

countries, mobile phone leapfrogs over legacy technologies, and hence implementing mobile learning application may have higher chances to engage target users in these countries. Past empirical findings are presented in the next chapter. Furthermore, mobile learning has been gaining substantial attention in the field of international development, which will be described in the following section. Therefore, mobile learning implementation in this study is consistent with the sixth category as proposed by Traxler (2007).

2.2.3 Trend of mobile learning initiatives in international development

This section describes the trend of mobile learning in international development from policy making and application perspectives. First, UNESCO has been organizing Mobile Learning Week since 2011 to facilitate discussions on, and the discovery and exchange of creative ideas about how to use mobile technologies to improve learning opportunities in developing nations. In Mobile Learning Week 2013, there were over 300 people from over 45 countries attended the symposium. Since then, the number of participants has increased more than thousand people in Mobile Learning Week 2015. The participants were from diverse backgrounds, such as government officials, international experts and practitioners , and represented more than 70 countries (UNESCO, 2015). These figures suggest that mobile learning has high potential in enabling learning in developing countries.

UNESCO has initiated teacher's training program through mobile learning in Nigeria, Senegal, Pakistan, and Mexico (West, 2012). In Nigeria, mobile phones are used to help primary school teachers to improve their English. In Senegal, mobile application to support student learning in mathematics and science is developed. Teachers are trained to use mobile application to understand students' learning needs. In Pakistan, female teachers who work in the field of Early Childhood Care and Education are trained to use mobile phone to improve their knowledge and professional development. The use of mobile learning enables teachers who live in rural areas to gain equal access to the learning content. In Mexico, mobile phone is used to train Spanish language skills and pedagogical practice of primary school teachers. The use of mobile application for learning has provided several advantages, including improvement of dialogue and increase collaboration among other teachers.

The examples illustrated above are just a part of the many mobile learning initiatives in developing countries. Nevertheless, the examples have provided good indication that mobile learning implementation in developing countries are both significant and effective.

2.3 Perceptions affecting behavior

Understanding determinants affecting human motivation and behavior enables effective development of interventions to promote intended behavior. Among the prominent theories in understanding human behavior are Theory of Reasoned Action and Theory of Planned Behavior. These theories are described as follows.

2.3.1 Theory of Reasoned Action

Fishbein and Ajzen (1975) postulates that an individual's behavior, which is determined by behavioral intention, is affected by two variables: 1) attitude toward an act or behavior, and 2) subjective norm. Attitude toward behavior refers to the general feeling of favorableness or unfavorableness for that behavior. On the other hand, subjective norm refers to the perceived opinion of other people in relation to the behavior in question (Fishbein & Ajzen, 1975). Theory of reasoned action (TRA) has been used extensively in social psychology to explain individual's motivational influence and behavior (Madden, Ellen, & Ajzen, 1983). Figure 2.3 shows the theoretical concept of TRA.

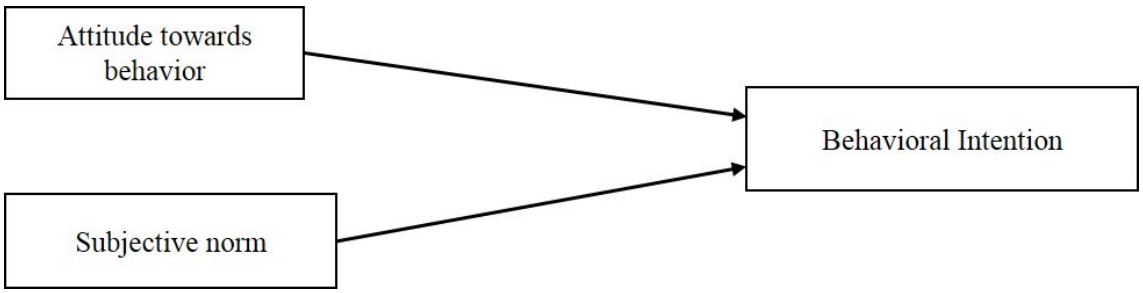


Figure 2.3: Theory of reasoned action

2.3.2 Theory of Planned Behavior

The theory of planned behavior (TPB) extends TRA by including beliefs regarding the possession of requisite resources and opportunities for performing a given behavior (Ajzen, 1991). The objective of TPB is to overcome the limit of TRA in explaining behavior under situation where an individual does not have complete volitional control. In other words, an individual is not able to decide to engage in certain behavior due to the lack of opportunities and resources. The belief of an individual's perception of the ease or difficulty of performing the behavior of interest, termed as perceived behavioral control, is the main focus of TPB (Ajzen, 1991). Perceived behavioral control is theorized to affect behavioral intention and actual behavior. Figure 2.4 depicts the TPB.

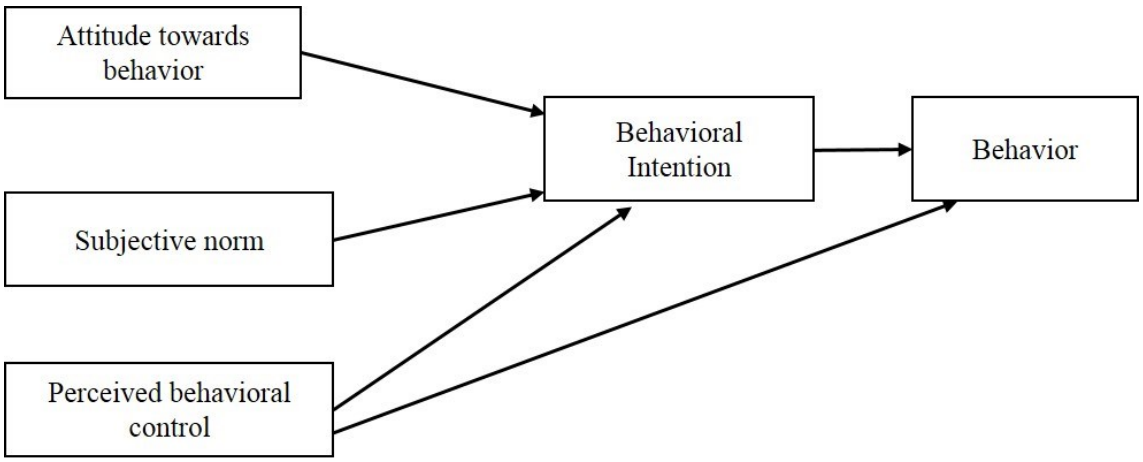


Figure 2.4: Theory of planned behavior.

2.3.3 Protection Motivation Theory

In order to clarify fear appeals, Rogers (1975) developed the protection motivation theory (PMT) based on expectancy-value theory. Fear appeal is defined as "persuasive messages designed to scare people by describing the terrible things that will happen to them if they do not do what the message recommends" (Witte, 1992, p.329). For example, adolescents who were exposed to anti-smoking advertisements communicating the impact of cigarette smoking on health reduced their frequency of smoking, in relation to control group (Smith & Stutts, 2003). Expectancy-value theory states that subsequent behavior is a result of the expectancies or belief an individual possess, and the value of the goal event (Fishbein & Ajzen, 1975). Rogers (1975) have identified three important variables in fear appeal:

1) The magnitude of noxiousness of a depicted event (value)

2) The conditional probability that the event will occur provided that no adaptive activity is performed, and (expectation)
3) The effectiveness of a coping respond that might avert the noxious event (expectation).

Figure 2.5 illustrates the schema of PMT. The three variables of fear appeal described above are posited to initiate two cognitive processes, namely 1) threat appraisal, and 2) coping appraisal of fear appeal. Both noxiousness and probability correspond to threat appraisal, while response efficacy corresponds to coping appraisal. According to PMT, when an individual is exposed to fear appeal, threat appraisal and coping appraisal mediate individual's protection motivation (Rogers, 1983). PMT has provided a new interpretation of the impact of fear appeal on attitude change, in which attitude change is a result of cognitive processes, instead of emotional fear.

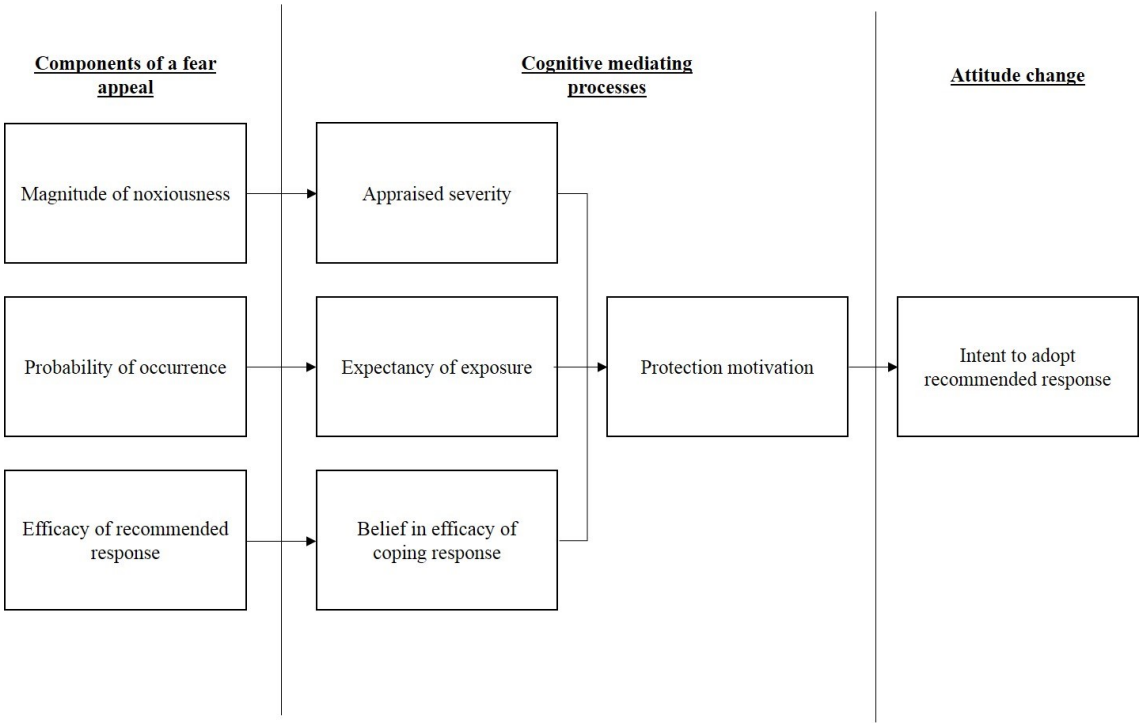


Figure 2.5: A schema of protection motivation theory

Adapted from Rogers (1975, p. 99)

2.3.4 Application and Criticisms of TRA and TPB

Both TRA and TPB have been broadly applied in explaining individual's motivation. For example, attitude, subjective norm and perceived behavioral control were found to be important factors in a study on individual's motivation to visit environmental friendly lodging

property (Han, Hsu, & Sheu, 2010). In the context of environment protection in the world heritage area of Tasmanian Wilderness, Brown, Ham and Hughes (2010) has found that TPB-guided intervention successfully influence pro-environmental behavior in world heritage site context.

While behavior models such as TRA and TPB are effective in explaining the behavior appropriate behavior, TRA and TPB suffers from generality in the sense that additional factors which do not fit into the nomological structure of these theories are not accounted for (Sheppard, Hartwick, Warshaw, & Hartwick, 1988). In addition, TRA and TPB do not explain well in the context where inappropriate behaviors are involved (Mckercher & Weber, 2008). In certain contexts, the need for an individual to understand the severity or risk of failure to perform a behavior is useful in important in persuasion and behavior change. In addition, meta-analysis shows PMT variables produce the largest effect size on intention and behavior (Webb & Sheeran, 2006). This is the result of comparison among TRA, TPB and PMT. Accordingly, PMT is considered useful in such context as it provides wider set of variables in explaining motivation in avoiding threats (Bockarjova & Steg, 2014).

2.4 Interventions based on Protection Motivation Theory

Interventions designed based on PMT has implications on behavior change. This is achieved by changing threat and coping appraisal of target audience. Pechmann, Zhao, Goldberg, Reibling, & Goldberg (2003) study found that anti-smoking advertisements conveying severity, vulnerability, and self-efficacy message themes bolstered students' intention not to smoke. It should be noted that response efficacy was not measured as response efficacy is deemed irrelevant in the study context. Similarly, PMT-derived anti-speed message prompted higher intention to drive within speed limit compared to existing jurisdiction anti-speed message (Glendon & Walker, 2013). Higher intention to drive within speed limit was found to be associated with threat appraisal than coping appraisal (Glendon & Walker, 2013). Further, study shows that addition of PMT variables into the theoretical framework increases variance of explained for pro-environmental behavior for both American and Korean students (Kim, Jeong, & Hwang, 2013). Consistently, PMT provides richer explanation compared to existing theories in environmental psychology in a study related to the adoption of electric vehicles as a pro-environmental behavior (Bockarjova & Steg, 2014).

Examples of PMT application in health protection and environment protection behavior shows that PMT is a suitable theory to study attitude change. Furthermore, PMT has been consistent in explaining protection behavior across cultures. The following section describes the theoretical framework of this study.

2.5 Protection Motivation Theory components

Previous sections review PMT as the theoretical basis of this study. The original PMT posits that perceived severity, perceived vulnerability and response efficacy affect protection motivation. Subsequently, PMT was revised as a general persuasive theory. In addition to the original PMT components, rewards and response cost are included in the full revised PMT. Yet, literature cites the need to subtract rewards from threat appraisal and response cost from coping appraisal have yielded inconsistency result (Plotnikoff & Trinh, 2010). Further, Witte (1992) argues that the inclusion of rewards and response cost in revised PMT has led to logical flaws. This is apparent as reviews of persuasive models has been excluding both rewards and response cost (Cameron, 2009; Witte & Allen, 2000). Thus, rewards and response cost are excluded in this study. Next section explains the component individually based on the original PMT.

2.5.1 Behavioral expectation

The dependent variable of PMT is protection motivation. According to Rogers (1975), protection motivation is a mediating variable which arouses, sustains and directs activity. Under the theoretical framework of PMT, an individual's protection motivation is a result of threat appraisal and coping appraisal (Rogers, 1983). Protection motivation is mainly measured by behavioral intentions (Rogers, 1983). Warshaw and Davis (1985) defines behavioral intention as "the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior." (p.214). Behavioral intention is posited to be the immediate antecedents of actual behavior (Ajzen, 1991). Therefore, it is expected that an individual who possesses higher behavioral intention to engage in a behavior will have higher probability to be engaged in the actual behavior. However, Webb and Sheeran's (2006) meta-analysis on the causes of behavioral intention to behavior shows that intentions have less impact on behavior. The study by Warshaw and Davis (1985) makes a distinction between behavioral intention and behavioral expectation. Behavioral expectation

is defined as “the individual’s estimation of the likelihood that he or she actually will perform some specified future behavior.” (p.215). This distinction is argued based on two reasons. First, behavioral intention merely considers one’s commitment to perform or not to perform an action. Second, the formation of behavioral intention merely considers one’s intention without incorporating non-intentional determinants, such as ability limitations and possible environmental facilitators and/or constraints. Behavioral expectation, on the other hand, fills the gap of behavioral intention. Hence, behavioral expectation is a better predictor for behavior (Warshaw & Davis, 1985). Although behavioral intention is assumed as the best measurement of protection motivation, protection motivation could be measured in several ways (Rogers, 1983). This study, therefore, adopts behavioral expectation as the dependent variable, and defines behavioral expectation as the individual’s estimation of the likelihood that he or she actually will take actions preserving world heritage site.

2.5.2 Threat appraisal

PMT posits that threat appraisal is one of the two main determinants of protection motivation. Threat appraisal is a result of assessment of two components: 1) perceived severity, and 2) perceived vulnerability. Perceived severity is defined as the degree of seriousness of a threat, while perceived vulnerability is defined as the degree of probability of the occurrence of the threat (Rogers, 1985). In this study, threat refers to negative events face by Luang Prabang as a result of failure to preserve heritage buildings. Therefore, in this study context, perceived severity refers to an individual’s belief of the degree of seriousness of not protecting heritage buildings, and perceived vulnerability refers to an individual’s belief of the probability that Luang Prabang will face negative impact as a result of not protecting heritage buildings. Floyd, Prentice-Dunn, and Rogers (2000) meta-analysis of PMT application indicates that the decision of protective action is a positive function of belief of that an event is harmful and one is vulnerable to the harmful event. Fear appeal literature indicates that the original drive state was fear (Janis, 1967). However, fear derived empirical results on attitude change have been inconsistent, leading to the revision of the factors determining attitude change in fear appeal. Subsequently, Leventhal (1970) argue that focus on the emotional fear would lead to maladaptive behaviors, such as ignorance. Instead, focus on cognitive threat would actually engage danger control processes via message recommendation acceptance.

2.5.3 Perceived response efficacy

Studies show that both threat appraisal and coping appraisal need to be sufficiently high in order to stimulate protection motivation. Threatening communication which arouses fear without providing coping information would cause people to engage in maladaptive behavior (Peters, Ruiter, & Kok, 2012). This is due to defensive response, such as denying of severity of the threat and avoidance, when efficacy is low. The original PMT states that response efficacy mediates coping appraisal. Efficacy is defined as "one's ability to negate harm" (Peters et al., 2012). Perceived response efficacy refers to people's belief about the effectiveness of message recommendations message's in deterring threat (Witte, 1994). The nomological structure of PMT asserts that, together with threat appraisal, protection motivation is stimulated when an individual has positive belief about the efficacy of coping response. A water conservation study in Queensland shows that intervention messages based on threat and coping appraisal successfully changed residents' habit of water usage (Walton & Hume, 2011).

2.6 Additional components for modifying Protection Motivation Theory

2.6.1 Perceived resident effectiveness

Studies examining pro environmental behavior indicate that perceived consumer effectiveness as one of the important determining factors of behavioral intention to be engaged in environment protection activity (Akehurst, Afonso, & Gonçalves, 2012; Ellen et al., 1991). Perceived consumer effectiveness is defined as the belief of "the efforts of an individual can make a difference in the solution to a problem" (Ellen et al., 1991, p.103). In fact, early research has shown that perceived consumer effectiveness relates strongly with ecological concern (Kinnear, Taylor, & Ahmed, 1974). This study considers perceived consumer effectiveness as one of the independent variables of world heritage site protection motivation, since perceived consumer effectiveness has been a prominent determinants of pro environmental behavior (Tan, 2011). Consistent with the context of this study, perceived consumer effectiveness is renamed as "perceived resident effectiveness", and is defined as "the belief the efforts of a resident can make a difference in world heritage site preservation".

The notion of perceived consumer effectiveness is related to the concept of perceived behavioral control (Ellen et al., 1991). Perceived behavioral control is defined as "the person's belief as to how easy or difficult performance of the behavior is likely to be"

(Ajzen & Madden, 1986, p.457). In other words, the greater perceived resources or opportunities, and fewer perceived obstacles will lead to greater control of behavior. Perceived behavioral control captures one's belief that the outcome can be influenced by one's own efforts. Among the determinants of perceived behavioral control is control belief (Ajzen, 1991). Control belief allows an individual to assess the difficulty or performing a behavior. Control belief, therefore, can be learnt and can be derived based on past experience with the behavior, or influenced by second-hand information about the behavior (Ajzen, 1991). By assessing control belief, an individual can judge the resources he or she possesses to perform a behavior. As delineated in previous sections, effective response measures to cope with threatening situation is necessary in persuasive communication. Hence, response measures could be considered as learnable information supply to control belief. Since perceived consumer effectiveness is conceptually similar with perceived behavioral control, this study, therefore, asserts that response efficacy determines perceived resident effectiveness.

2.6.2 Perceived benefits of inscription

Nicholas, Thapa and Ko (2009) found that local community perceives that the designation of world heritage site brings potential benefits, such as economic benefits, as a result of tourism activities. In addition, world heritage site designation brings prestige at global and national level, as well as attract conservation efforts, which brings benefits to society (Smith, 2002). Furthermore, Galla (2012) highlights that the possible benefits of the world heritage site inscription include emphasis on sustainable urban development, development of integrated planning strategies with local communities, and valuing living heritage. Hence, the world heritage site inscription is believed to bring benefits to social development.

Perceived benefit is also included in behavioral change theories such as the health belief model. It is defined as "the perception of the positive consequences that are caused by a specific action" (Leung 2013). However, perceived benefit in behavioral change refers to the belief of benefits brought by the action taken, which is conceptually similar with response efficacy (Janz & Becker, 1984). The focus of perceived benefits in this study, however, refers to the positive factors associated with a phenomenon. In the context of this study, perceived benefits of inscription refers to the positive factors associated with the inscription of world

heritage site. Studies show that perceived benefits of positive factors have been shown to be positively related with behavioral intention (Lee, 2009). Therefore, it is of the interest of this study to analyse the relationship between local residents' perceived benefit of inscription and behavioral expectation to preserve world heritage site.

CHAPTER 3

SUMMARY OF PREVIOUS EMPIRICAL STUDY

This chapter summarizes the empirical findings based on Poong (2013) master's thesis work to illustrate the significance of adopting mobile learning in the context of Luang Prabang. This chapter begins with illustration of technology readiness, followed by the result of multiple regression analysis in determining the factors affecting mobile learning adoption among the young adults in Luang Prabang. The findings in this chapter is based on 365 higher education students studying in Luang Prabang.

3.1 Motivation

Mobile-cellular subscription penetration in developing countries has witnessed rapid growth in recent years, especially in the Asia-Pacific region (ITU, 2013). In some least developing countries in Asia, such as Bangladesh and Lao PDR, people often purchase mobile phones in preference of personal computers (ITU, 2013; UNESCO, 2012b). The proliferation of smartphones has changed the traditional way of using mobile phones. Dropping prices and increasing functionalities have given rise to various innovations involving mobile devices, such as mobile learning. Report by The Economist (2011) states that mobile phones are a more accessible and affordable tool for communication and learning than personal computers. Users of mobile learning are expected to benefit from the place and time independence of mobile devices when accessing learning materials (Wang, Wu, & Wang, 2009). The application of mobile learning to facilitate better understanding and learning of heritage monument around the world is not uncommon. For example, the work of Costabile et al. (2008) demonstrates the possibilities of using game-based mobile learning to support middle school students' visit to an archaeological park in Italy. The smartphone application was developed to provide 3D visualizations of historical monuments, which resulted in positive behavioral outcome. Mobile phones are also experimentally deployed as a tour guide system. Visitors used mobile guide to visit cultural heritage in South Korea report satisfaction on historic-spatial awareness, personalization, and shared group experiences

(Suh, Shin, & Woo, 2009). Taking advantage of mobile device's mobility and multimedia capabilities, Ancona et al., (2006) developed a mobile application to provide seamless tour guide-like experience to users visiting archaeological site in Italy and Greece. For instance, users could take a picture of a monument and the mobile phone will propose visiting path for the user. Similar mobile guide system could also be found deployed at Locri Epizefiri of Greece (Cutri, Naccarato, & Pantano, 2008).

As introduced in chapter one, rapid tourist visits to Luang Prabang have created pressure between development and preservation of the world heritage town. Cases of illegal building modifications and illegal new constructions were discovered as reported in UNESCO (2008) monitoring report. Hence, raising awareness among the local community has been an utmost agenda. As presented in previous section, literatures provide sufficient evidences that mobile phone can be a potential tool in promoting world heritage site preservation awareness. Furthermore, mobile phone penetration rate in Lao PDR is reported exhibit similar growing trend, as described in previous section. Hence, a study was carried out with the major aim to investigate mobile learning acceptance among the local community, targeting especially to the young adults. The master's thesis contributes knowledge to the following two points: 1) the results shed light on technology readiness among the young adults, and 2) the results provide understanding on the factors determining mobile learning acceptance in Luang Prabang. Following sections present the theoretical framework, and then the outcomes of the master's thesis.

3.2 Modified Technology Acceptance Model

Understanding the needs and perceptions of potential users is essential to ensure sustainable use of newly introduced technology applications in international development projects (Yamaguchi & Vaggione, 2008). The Technology Acceptance Model (TAM) is thought to be an influential socio-technical model aims to explain user acceptance of new information technology (Lee & Lehto, 2013). TAM posits two fundamental perceptions influencing behavioral intention to adopt new information technology, namely perceived usefulness and perceived ease of use (Davis, 1989). Perceived usefulness is defined as "the degree to which an individual believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). Perceived ease of use is defined as "the degree to

which an individual believes that using a particular system would be free of physical and mental effort" (Davis, 1989, p. 320).

In order to gain more understanding of the dynamics of mobile learning acceptance in Luang Prabang, additional variables were identified following thorough literature reviews. These variables can be categorized into perception of mobile learning characteristics and external factors. Literature indicates that perceived enjoyment and perceived price affect information technology acceptance (Davis, Bagozzi, & Warshaw, 1989; Liao, Tsou, & Shu, 2008). Both perceived enjoyment and perceived price, form the perceptions of mobile learning characteristics, together with perceived usefulness and perceived enjoyment. The hypothesized external factors include social influence, perceived facilitating resources, self-efficacy and personal innovativeness. These variables were drawn from studies by Agarwal and Prasad (1998), Fishbein and Ajzen (1975), Park et al. (2012) as well as Taylor and Todd (1995). Figure 3.1 depicts the theoretical framework of master's thesis.

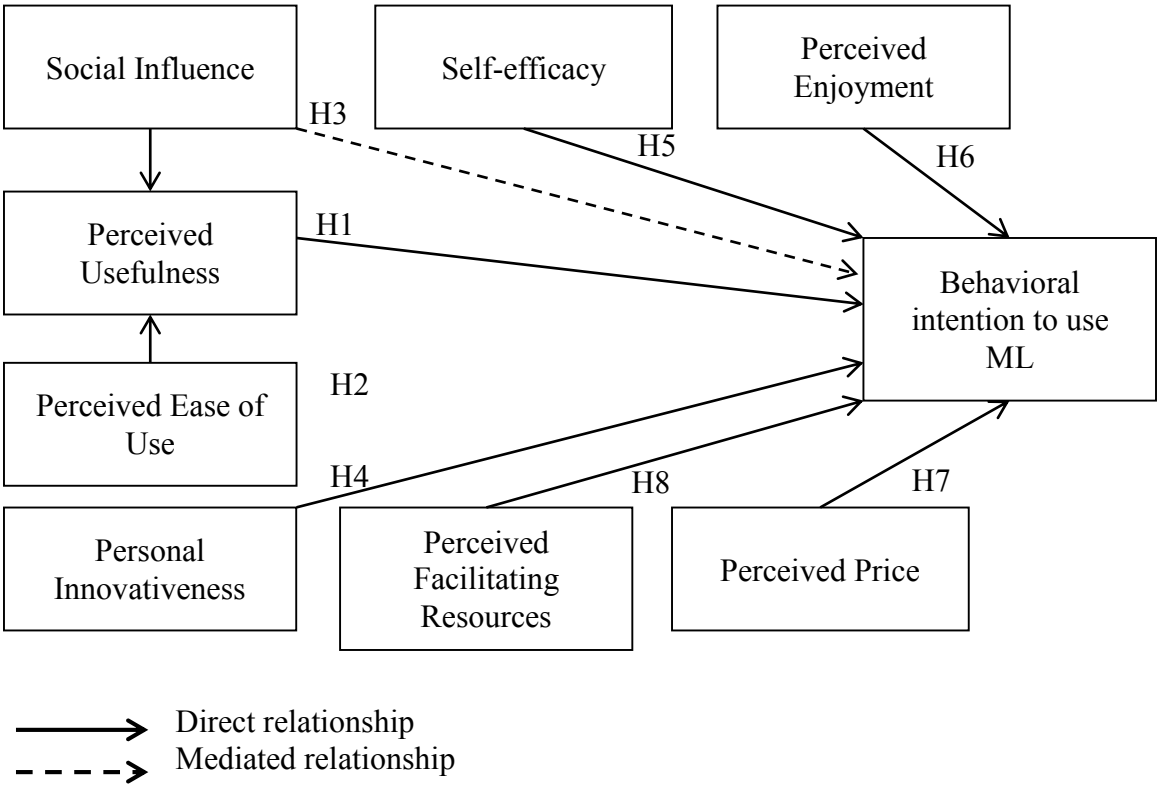


Figure 3.1: Modified TAM for evaluating mobile learning acceptance in Luang Prabang

3.3 Methodology

Data collection was conducted by using questionnaire survey in March 2012 at two local higher education institutions in Luang Prabang, namely Souphanouvong University (SU) and Northern Law College (NLC). SU is one of the four public universities in Lao PDR and was established in 2004 with a total of six faculties. NLC is a public college under the Ministry of Justice established since 2003. Both institutions have an average number of 4,000 students.

The questionnaire asks about respondents' demographic profile and mobile learning perceptions. Questions for demographic profile include respondents' gender, age, devices owned and devices used to perform common digital activities. Perception questions are adapted from the literature and is measured using five-point Likert scale (1 = strongly agree to 5 = strongly disagree). The questionnaire was reviewed by DPL professionals and was then translated into Lao language to suit local context. However, translation from English to Lao language has resulted into reduced scale items due to less word differentiation in Lao language. Pilot testing was carried out in DPL in order to ensure questionnaire validity. The refined questionnaire was then sent to university representative for review. Each construct (perception) is represented by two items except perceived ease of use and perceived enjoyment, which is represented by three items.

A total of 484 questionnaires were distributed. A total of 199 out of 200 questionnaires were returned from SU and 244 out of 284 questionnaires were returned from NLC, yielding a total response rate of 99.5% and 86% respectively. In order to meet the study objective, questionnaire in which mobile phone ownership were not being checked were excluded for data analysis. Subsequently, questionnaire validation was performed on collected questionnaire to ensure completeness of answered questionnaire. Questionnaires with blanks and unanswered questions were discarded. Also, questionnaires with answers not adhering to the answering requirement were removed from analysis procedure. Finally, a total of 353 returned questionnaires were deemed acceptable for data analysis purpose.

3.4 Technology readiness

Four types of computing devices were surveyed to determine the number of ownership, namely laptop, desktop PC, tablets and mobile phones. Multiple response result in Table 3.1 shows that an individual may possess more than one computing devices, as

evidenced by the total number of multiple responses (f = 587) is greater than the number of respondents (N=365). Furthermore, the number of mobile phone ownership is the highest among all the surveyed computing devices at f = 358. Multiple response data among mobile phone owners shows that the connectivity options of the mobile phones appear to be quite well equipped, with 149 mobile phones have 3G connectivity, and 76 mobile phones have WiFi connection capabilities. In addition, place of Internet access shows that the respondents is relatively active over the Internet, resembling the typical characteristics of current young generation.

Table 3.1 Technology and mobile phone profile

Item	Options	Frequency	Percentage
Type of Devices	Mobile Phone	358	61.0
	Desktop PC	29	4.9
	Tablets	12	2.0
Connectivity Options (multiple response, analyzed across mobile phones)	WiFi	76	14.6
	3G	149	28.7
	Bluetooth	209	40.2
	Infrared	15	2.9
	None	71	13.7
Phone Type (analyzed across mobile phones)	Symbian	42	11.7
	Android	21	5.9
	iOS	9	2.5
	Smartphone, unsure operating system	105	29.3
	Non-smartphone	59	16.5
	Don't know	30	8.4
	No answer	92	25.7
Place of Internet Access (multiple response)	Home	119	22.8
	Café	74	14.2
	School	159	30.5
	Mobile phone	110	21.1
	Not using	59	11.3

Source: Field survey in Luang Prabang, 2012 (adapted from Poong, 2013)

In addition to investigating the technological demographics, respondents were also asked about the computing devices used for conducting common digital activities, such as searching for information, communicating with friends, listening to music, watching videos and alike. Figure 3.2 shows the multiple response of devices used for performing digital activities. Result indicates that mobile phone is the second most used device in performing

digital activities among mobile phone, laptop and desktop PC. While laptop is still being used as main device for performing digital activities, empirical data suggests that mobile phone has the potential to become the common tool in performing digital activities.

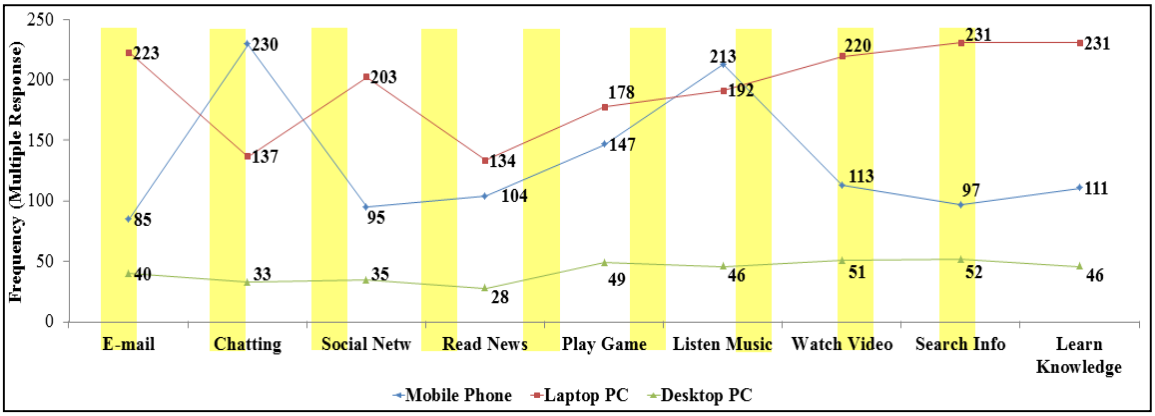


Figure 3.2 Type of devices used for performing digital activities
Source: Field survey in Luang Prabang, 2012 (adapted from Poong, 2013)

3.5 Determinants of behavioral intention to use mobile learning

Literatures point out that understanding potential user' perception prior to technology implementation is essential to ensure acceptance (Dillon & Morris, 1996). Building on the well-established Technology Acceptance Model (TAM), four mobile learning perceptions and four external factors were evaluated. Among the four mobile learning perceptions include perceived usefulness, perceived ease of use, perceived enjoyment and perceived price. In addition, among the four external factors include social influence, facilitating resources, self-efficacy and personal innovativeness. All the variables were hypothesized to affect behavioral intention to use mobile learning among the respondents. Regression analysis shows that all hypothesized variables were supported, except self-efficacy and perceived price, as shown in Figure 3.3. Further, the proposed theoretical model explained 35.2% the variance of mobile learning acceptance among the young adults in Luang Prabang.

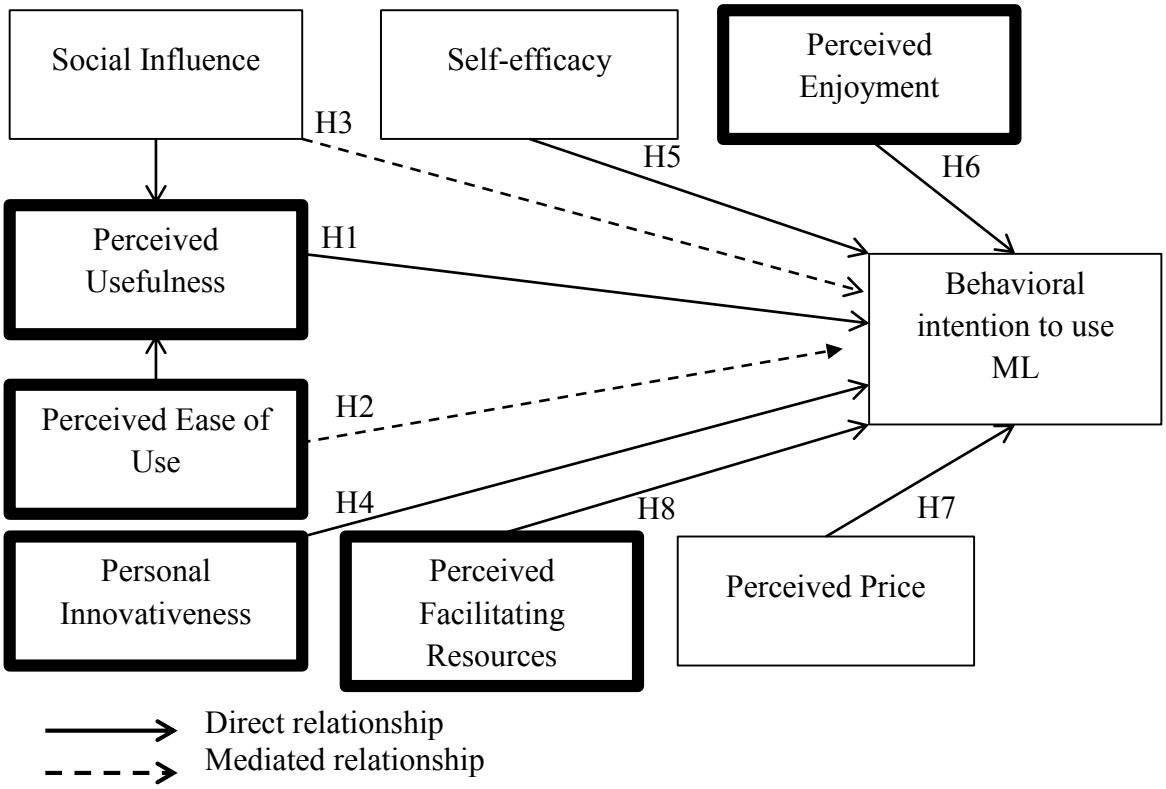


Figure 3.3: Multiple regression result of modified TAM
Source: Developed by author based on literature review

3.6 Interview findings

Several interview sessions were conducted in the course of master's thesis. The interviewees include faculty members, students and DPL staff members. Interview findings are summarized as follows:

a) Faculty interview

Mobile learning is a suitable tool to promote heritage site preservation awareness given that 80% of the Lao people own mobile phone and the cost of mobile phone ownership is relatively cheaper compared to other computing devices. In addition, there is insufficient world heritage site information available in the campus. The initiative to adopt mobile learning fits with young adult's preference towards challenges and new technology. This may increase students' interest and ease of access to information.

b) DPL staff opinion

The introduction of mobile learning could fit into DPL's responsibility to increase awareness among the local community. Currently, DPL conduct awareness promotion by going to each village and speak to the villagers. The inclusion of awareness content in the

form of mobile learning could spread the promotion effort further by penetrating into young generation.

After the first fieldwork, a mobile web prototype was developed by the author and data analysis was conducted to assess gender gap difference on mobile learning perception. It was learnt that female demonstrates stronger positive agreement on most of the technology acceptance dimensions, in relation to male.

In the second fieldwork (November 2012), interview with four college and university young adults (two males and two females) was conducted to obtain feedback from young adults regarding factors affecting mobile learning perceptions. It was found that:

1) Sociability as the key factor influencing self-efficacy, exposure to information technology subjects is another possible factor
2) Choice of mobile application used affects ease of use perception
3) Trend, rich functionality as motivator and financial feasibility as the barrier to adopt smartphones
4) Higher expectation on network coverage and meaningful information from mobile learning

Discussions with DPL staffs were also conducted to explore issues related to the development and maintenance of mobile learning application. It was found that:

1) Rules and regulations as mobile learning content priority
2) Simplicity is the key to implementation sustainability

Issues on Lao font compatibility, means of downloading the mobile application and maintenance were also discussed during the second fieldwork.

3.7 Research and practical implications

Findings provide several important insights in the implementation of mobile learning to promote world heritage site preservation awareness in Luang Prabang. First, respondents had provided, through their perception, important factors towards increasing mobile learning

acceptance among the young adults in Luang Prabang. Among the determining factors include, perceived usefulness, perceived ease of use, perceived enjoyment, social influence, personal innovativeness, and facilitating resources. Second, as supplement to the statistical result, interview with both faculty members and students reveal that 1) the use of mobile learning is in line with current students' mobile phone use behavior, in addition to better accessibility to information, 2) mobile learning needs to be designed in an interesting and motivating way to attract young adults, such as enable learning through quizzes, and 3) mobile learning supplements the limited accessibility to world heritage site information and is deemed as an effective approach to promote world heritage site preservation awareness.

Past empirical work has provided strong support and justification on the use of mobile learning as a suitable medium to promote world heritage site preservation awareness in Luang Prabang. Results of master's thesis provide strong basis for mobile learning application development, as described in chapter five.

CHAPTER 4

THEORETICAL FRAMEWORK AND METHODOLOGY

This chapter describes the theoretical framework and hypotheses of this study. Subsequently, study design, mobile application and learning content are explained. This is followed by questionnaire development, data analysis procedure, and sample size decision. Finally, data collection procedure is presented.

4.1 Theoretical framework

The research objectives of this study include the following: 1) to identify perceived factors influencing behavioral expectation to preserve world heritage site by adapting PMT, 2) to develop mobile learning content reflecting local needs and requirements, 3) to evaluate the effects of the mobile learning content on learners' perception with regard to world heritage site preservation. Figure 4.1 shows the theoretical framework of this study.

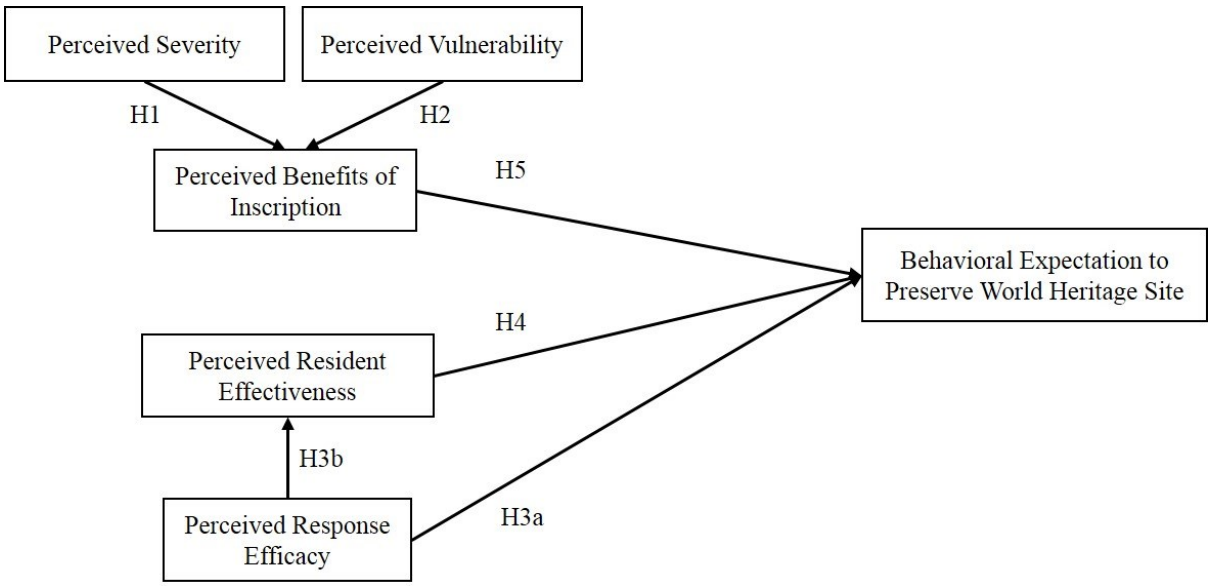


Figure 4.1: Theoretical framework

Based on the literature review of presented in Chapter 2, the hypotheses of this study are the following:

H1: Perceived severity is positively related with perceived benefits of inscription

H2: Perceived vulnerability is positively related with perceived benefits of inscription

H3a: Perceived response efficacy is positively related with behavioral expectation to preserve world heritage site

H3b: Perceived response efficacy is positively related with perceived resident effectiveness

H4: Perceived resident effectiveness is positively related with behavioral expectation to preserve world heritage site

H5: Perceived benefits of inscription is positively related with behavioral expectation to preserve world heritage site

In this model, the dependent variable is behavioral expectation to preserve world heritage site. Five independent variables are identified based on literature review, which are: perceived severity, perceived vulnerability, perceived residents effectiveness, perceived response efficacy, and perceived benefits of inscription. Next section describes research methodology of this study.

4.2 Study design

This study employs a structured, quantitative approach to the research problem. A structured, quantitative research approach is suitable for study which aim to investigate magnitude of variation (Kumar, 2011). Therefore, this research approach fits the purpose of this study since it aims to measure the extent of belief of the hypothesized independent variables as shown in Figure 4.1. Data collected in this study is cross-sectional. A cross-sectional study collects data over a short period of time and is common in research aim to find a common fact with regard to a target population (Kumar, 2011). This fits the purpose of this study as the major objective is to understand the factors affecting world heritage site

preservation awareness among local young adults in the world heritage town of Luang Prabang.

4.3 Instrument development

Research shows that questionnaire is the primary approach of data collection in PMT studies (Floyd et al., 2000; Norman et al., 2005). Consistent with literatures, this study adopts questionnaire survey approach for data collection. The questionnaire consists of two sections, 1) demographic, and 2) PMT related question items. Demographic questions include gender, age, and origin of province. In addition, questions asking availability of WIFI and/or 3G functions on mobile phone, and frequency of using Internet via mobile phone are included to assess technology aspect.

A total of twenty five question items are developed in six categories to assess PMT-related perceptions. Each construct is measured with four question items, except for behavioral expectation, which is measured with five questionnaire items. Perceived resident effectiveness and behavioral expectation both include reverse wording items. Perceived severity, perceived vulnerability and response efficacy question items are adapted from PMT-related literatures and behavioral studies (Ajzen, 1991; Kim et al., 2013; Rippetoe & Rogers, 1987). Question items of perceived resident effectiveness are adapted from studies utilizing perceived consumers' effectiveness (Akehurst et al., 2012; Ellen et al., 1991; Tan, 2011). Question items measuring perceived benefits of inscription are derived from behavioral studies (Ajzen, 1991; Lee, 2009). Table 4.1 shows the questionnaire items for each construct respectively.

The questionnaire was first developed in English, and was reviewed by professors, and experts of DPL. It was then being translated into Lao language by DPL, and was reviewed by local academician who is well-versed in both English and Lao language to ensure translation quality. A seven-point Likert scale was adopted in the questionnaire. Literature shows that having more point scales reduces problems of normality issue and increases sensitivity (Leung, 2011). Further, 5-point Likert scale could cause information loss, and 7-point Likert scale is a preferred scale without over imposing cognitive load for respondents (Finstad, 2010; Russell & Bobko, 1992). Perceived severity, perceived residents efficacy, and perceived benefits of inscription are measured by level of agreement, where point 1 to point 7 represent 'strongly disagree' and 'strongly agree' respectively. On the other

hand, perceived vulnerability and behavioral expectation is measured by level of probability, where point 1 to point 7 represent 'very improbable' and 'very probable' respectively. Complete questionnaire is shown in Appendix 1.

Table 4.1: Adapted questionnaire items

ID	Construct	Items
S1	Severity	I think Town of Luang Prabang will lose its "World Heritage Site" status if we do not preserve the temples, Lao traditional buildings, and French colonial buildings.
S2		I think it is a serious problem if we do not preserve the temples, Lao traditional buildings, and French colonial buildings in the Town of Luang Prabang.
S3		I think there will be negative impact on Town of Luang Prabang if we do not preserve the temples, Lao traditional buildings, and French colonial buildings.
S4		I think it is a serious problem to Town of Luang Prabang if the temples, Lao traditional buildings, and French colonial buildings are destroyed.
V1	Vulnerability	How possible do you think that Town of Luang Prabang will lose its "World Heritage Site" status?
V2		How possible do you think that there will be a negative impact on Town of Luang Prabang?
V3		How possible do you think that it will be serious problem for Town of Luang Prabang?
V4		How possible do you think that Town of Luang Prabang original heritage will be lost?
R1	Response efficacy	I think Town of Luang Prabang original heritage can be kept if we preserve the temples, Lao traditional buildings, and French colonial buildings.
R2		I think preserving the temples, Lao traditional buildings, and French colonial buildings are effective to maintain Town of Luang Prabang World Heritage Site.
R3		I think Town of Luang Prabang can maintain its "World Heritage Site" status if we preserve the temples, Lao traditional buildings, and French colonial buildings.
R4		I think we can prevent Town of Luang Prabang from losing its "World Heritage Site" status if we take proper actions to

		preserve the temples, Lao traditional buildings, and French colonial buildings.
PRE1	Resident effectiveness	I believe I can do something positive to protect Town of Luang Prabang World Heritage Site.
PRE2		I believe each person's action can have a positive effect on Town of Luang Prabang World Heritage Site.
PRE3		I believe my effort can bring positive effect on Town of Luang Prabang World Heritage Site.
PRE4		There is nothing much a person can do to protect Town of Luang Prabang World Heritage Site. (negative phrase)
PBI1	Benefits of inscription	I think the inscription of Town of Luang Prabang as a World Heritage Site brings along positive impact to the country and the society in the Town of Luang Prabang.
PBI2		I think the inscription of Luang Prabang as a World Heritage Site brings along advantages to the country and the society of Town of Luang Prabang.
PBI3		I think the inscription of Town of Luang Prabang as a World Heritage Site is favourable to the country and he society of Town of Luang Prabang.
PBI4		I think the country and the society of Town of Luang Prabang gains benefit from the inscription of World Heritage Site.
BE1	Behavioral expectation to preserve	How possible will you do something positive to the Town of Luang Prabang World Heritage Site?
BE2		How possible will you do something good to Town of Luang Prabang World Heritage Site?
BE3		How possible will you do something beneficial to Town of Luang Prabang World Heritage Site?
BE4		How possible will you destroy original heritage of Town of Luang Prabang? (Negative)
BE5		How possible will you do something harmful for Town of Luang Prabang World Heritage Site? (Negative)

4.4 Data analysis procedure

4.4.1 Analysis of factors affecting behavioral expectation to preserve world heritage site

Structural equation modeling (SEM) is employed in this study. One of the obvious advantages of SEM is the ability to measure mediation variable concurrently (Iacobucci, 2009). In a normal multiple regression analysis, assessment of mediation variable requires two separated regression formulas. This approach may lead to less accurate result compared

to SEM (Nusair & Hua, 2010). A mediation variable provides explanation on how an independent would influence the dependent variable of interest (Baron & Kenny, 1986). Further, the confirmatory nature of this study is consistent with the purpose of SEM to test hypotheses about relations among observed and latent variables (Hoyle, 1995). Observed variables refer to variables directly measured, such as questionnaire items, while latent variables is opposed to observed variables. Latent variables are not directly measured but are inferred variables related to a set of observed variables. Latent variables are sometimes known as manifest variables. Data analysis in SEM is performed in two phases (Anderson & Gerbing, 1984; Nusair & Hua, 2010). In the first phase, confirmatory factor analysis is conducted through measurement model. Reliability and validity are assessed in this phase. In the second phase, structural model is assessed for hypotheses testing. A measurement model analyses the relationship between observed variables and latent variables. On the other hand, a structural model analyses the relationship among latent variables.

Structural equation modelling evaluates model fit based on the comparison between model-implied covariance matrix $\sum$ (also known as expected covariance matrix, estimated covariance matrix, predicted covariance matrix, population covariance matrix) and the sample covariance matrix *S* (also known as observed covariance matrix). Covariance is calculated based on the following;

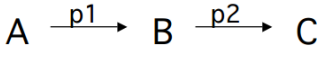
$$Cov\ X,= \sigma XY= (X,Y)[(X- \mu X)(Y- \mu Y)] \quad (1)$$

where

X, Y are the values of the variables

μ_X, μ_Y are the mean of the variables

A covariance matrix is a square matrix whose element in *i* , *j* position is the covariance between the *i* th and *j* th variables. Elements in position *ii* and *jj* are variances of the variable itself. The distinction between model-implied covariance matrix and sample covariance matrix is illustrated as follows. Assume there is a simple model where variable A is hypothesized to affect variable B, which is then is hypothesized to affect variable C. Figure 4.2 shows the theoretical model of this relationship.



As a result, the expected model will have three parameters to be estimated, which are:

$$r_{A,B} = p1; r_{B,C} = p2;\ r_{A,C} = p1 * p2;$$

where $r_{X,Y}$ is the correlation between two variables. Assume that data from sample indicates that $r_{A,B}$ = 0.4 and $r_{B,C}$ = 0.4, hence $r_{A,C}$ = 0.16 is expected (implied). If result of data shows that $r_{A,C}$ = 0.16, then a perfect fit is concluded. However, if $r_{A,C}$ = 0.70, then there is unacceptable fit between the model and data. Finally, if $r_{A,C}$= 0.20, it can be said that there is a moderate or good fit between the model and data. Nevertheless, whether or not $r_{A,C}$ =0.20 is considered a moderate fit or good fit is depend upon the threshold of fit indices set by researchers in the field of structural equation modelling.

Statistical software AMOS (short for Analysis of Moment Structures) by IBM is one of the computing sofware used to conduct SEM analysis. A list of fit indices is provided in the end of data analysis process. Both measurement model and structural model are subjected to this set of fit indices. Fit indices are a list of indicators assesses the extent of how fit the hypothesized model and data is, and is known as "goodness-of-fit". Researchers generally report several fit indices as each of the fit index has its limitation. Among the common fit indices to be reported include the Chi-square (χ^2) and its degree of freedom together with *p*-value, the standardized root mean square residual (SRMR), the comparative fit index (CFI) and the Root mean square error of approximation (RMSEA) (Iacobucci, 2010; Kline, 2005).

Chi-square is the fundamental measure used in SEM to quantify the differences between the sample and model-implied covariance matrices. (Fornell & Larcker, 1981). Chi-square is obtained by the following formula,

$$\mathcal{X}^2 = (N-1)FMIN \quad (2)$$

where *N* is the sample size and *FMIN* is the minimum difference between the sample and model-implied covariance matrices. *FMIN* result depends on the estimation techniques employed. Maximum likelihood estimation is adopted in this study as this estimation is unbiased, consistent and efficient (Wickens & Kmenta, 1972). The maximum likelihood fit function is

$$FMIN = F_{ml} = \log|\sum(\theta)| - \log|S| + \mathrm{tr}[S\sum(\theta)^{-1}] - p \quad (3)$$

where

F_{ML} is the value of the fitting function evaluated at the final estimates,

θ is the parameter vector,

S is the sample covariance matrix,

$\boldsymbol{\Sigma}(\theta)$ is the model-implied covariance matrix and $|\boldsymbol{\Sigma}(\theta)|$ its determinant,

tr is the trace of a matrix, and

p is the number of observed variables.

Chi-square should show that there is no significant difference, indicating no discrepancy between the model and the data. However, solely depending on Chi-square is problematic because Chi-square is sensitive to sample size (Hair et al., 2006). Therefore, researchers often rely on the relative chi-square. A model is considered good fit if the relative chi-square is less than 3.00 (Kline, 2005). Relative chi-square is defined as:

$$\text{Relative } \chi^2 = {\chi^2}\Big/{df} \tag{4}$$

where

df is the degree of freedom.

The SRMR measures the residual difference between sample covariance matrix and the model-implied covariance matrix. SRMR measures how bad the fit is, and is evaluated by values between 0.0 and 1.0, with values less than 0.07 is considered good fit (Anderson & Gerbing, 1984). SRMR is a standardized RMR because without standardization, RMR reports values based on the scale employed by researchers, which lead to difficulty in interpretation. RMR is given by:

$$\text{RMR} = \sqrt{\frac{2\sum_{i=1}^{p}\sum_{j=1}^{i}(s_{ij}-\hat{\sigma}_{ij})^2}{p(p+1)}} \tag{5}$$

where

s_{ij} is an element of the sample covariance matrix **S**,

$\hat{\sigma}_{ij}$ is an element of the model-implied covariance matrix $\boldsymbol{\Sigma}(\hat{\theta})$, and

p is the number of observed variables.

By dividing the residual $(s_{ij} - \hat{\sigma}_{ij})$ with the standard deviations of the respective manifest variables, SRMR can be obtained as:

$$\text{SRMR} = \sqrt{\frac{2\sum_{i=1}^{p}\sum_{j=1}^{i}\left[\frac{s_{ij}-\hat{\sigma}_{ij}}{\sqrt{s_{ii}s_{jj}}}\right]^2}{p(p+1)}} \tag{6}$$

Standardizing RMR bounds RMR value between 0 and 1, which allows for easy interpretation of the extent of discrepancy between sample and model-implied covariance matrix.

Next, CFI compares the improvement fit of researcher's model over the independence model. CFI is given by the following formula:

$$\text{CFI} = 1 - \frac{\max[\chi_t^2 - df_t, 0]}{\max[(\chi_t^2 - df_t), (\chi_i^2 - df_i), 0]} \tag{7}$$

where

max denotes the maximum of the values given in brackets,
χ_i^2 is the chi-square of the independence model (baseline model),
χ_t^2 is the chi-square of the target model (researcher's model), and
df is the number of degrees of freedom.

The denominator in equation (7) $\max[(\chi_t^2 - df_t), (\chi_i^2 - df_i), 0]$ can be simplified as $\max(\chi_i^2 - df_i), 0]$(Bentler, 2006). Further, $\max[\chi_t^2 - df_t, 0]$ in equation (7) is referred as an estimated noncentrality parameter of $\text{d} = \chi^2 - df$, where *df* is the degrees of freedom of the model. Therefore, equation (7) can be simplified as

$$\text{CFI} = 1 - \frac{d_t}{d_i} \tag{8}$$

$$\text{CFI} = \frac{d_i - d_t}{d_i} \tag{9}$$

$$\text{CFI} = \frac{(\chi_i^2 - df_i) - (\chi_t^2 - df_t)}{\chi_i^2 - df_i} \tag{10}$$

Latent variables in researcher's model are normally related in some ways as specified by the researcher. On the other hand, the independence model is a very restricted model which only estimates the variances of variables (Schermelleh-Engel & Moosbrugger, 2003). This is achieved by assuming the error variances are fixed to zero, all factor loadings are fixed to one, and all variables are uncorrelated. This resulted a covariance matrix in which the covariance among the latent variables are all assumed to be zero (Bentler, 2006). Further,

the independence model is considered the worst case or baseline model. Therefore, if researchers' hypothesized model is better than the null model, the fit index becomes higher. CFI fit index range between 0.0 and 1.0, with values greater than 0.90 as good fit.

Finally, as a residual-based index, RMSEA measures whether researcher's model fits approximately well in the population covariance matrix, and is concerned with the discrepancy due to approximation (Steiger, 1990). RMSEA is computed based on:

$$\text{RMSEA} = \sqrt{\max\{\left(\frac{F(S,\sum(\hat{\theta}))}{df} - \frac{1}{N-1}\right), 0\}} \quad (11)$$

where

$F(S,\sum(\hat{\theta}))$ is the minimum of the fit function,

df = s – t is the number of degrees of freedom, and

N is the sample size.

Maximizing the likelihood of minimum fit function is essentially equals to χ^2. Hence, simplifying equation (11) results into the following computational formula of RMSEA:

$$\text{RMSEA} = \sqrt{\frac{\chi^2}{df} - \frac{1}{N-1}} \quad (12)$$

$$\text{RMSEA} = \sqrt{\frac{\chi^2 - df}{df(N-1)}} \quad (13)$$

RMSEA can also be examined based on a formal hypothesis framework (Browne & Cudeck, 1992). RMSEA with values less than 0.07 and is not significant ($p > 0.05$) will accept the null hypothesis that there is a close fit between the model and the data.

4.4.2 Investigating the effectiveness of mobile learning application

In order to investigate the effectiveness of mobile learning application, a paired sample t-test is conducted. A paired sample t-test is useful in comparing the means of same subjects in a "before" and "after" test of intervention. The hypotheses for paired t-test employed in this study are

$$H0: \mu d = \mu 0$$

$$H1: \mu d \neq \mu 0$$

in which, the null hypothesis states that the mean of two paired samples (before and after using mobile learning application) are equal. Hence, if the mean difference of perception changes is statistically significant, then the null hypotheses can be rejected. In order to provide further insights into the findings of the effectiveness of mobile learning application, interviews with users is conducted on the following questions: 1) "What are your perception changes towards preserving Luang Prabang world heritage site before and after using the mobile application?" 2) "What are the strengths of using mobile phone to learn about Luang Prabang world heritage site?" 3) "What are the weaknesses of using mobile phone to learn about Luang Prabang world heritage site?" and 4) "What suggestions would you give to improve the application?" Summary of discussions with policy makers are also included, covering the following list of topics: 1) problems/challenges faced by the traditional awareness campaign, 2) role of mobile application from policy makers' perspective, and 3) advantages and/or disadvantages of mobile learning application in raising world heritage site preservation awareness.

4.5 Sample size decision

Since findings from a research are often extrapolated to the target population, the determination of sample size is therefore important. This is particularly true for research where studying whole population is not possible. Some researchers state that given minimum three measurement variable per factor, a sample size of 150 is sufficient for convergent (Anderson & Gerbing, 1984). However, beyond structural model convergence, sample size plays an important role to ensure sufficient power for the detection of significant difference (Nayak, 2010). Therefore, in addition to rule-of-thumb method, this study utilizes power analysis to determine the sufficiency of sample size based on the study of Maccallum, Browne, and Sugawara (1996) study. This approach has been cited by over 4000 papers, and is especially suited for structural equation modeling analysis (Iacobucci, 2010).

Maccallum et al. (1996) states that minimum sample size required in a structural model depends on: 1) confidence level, 2) degrees of freedom, 3) hypothesised RMSEA value, 4) degree of lack of fit and 5) the desired power value, and should be greater than the

number of measured items. In addition, MacCallum et al. (1996) provides recommended values for each of the variables, in which 1) confidence level =0.05, 2) hypothesised RMSEA value <0.05, 3) degree of lack of fit = 0.08, and 4) desired power value = 0.80. While desired power value of 0.80 is a common benchmark, any value lesser than 0.80 would imply that a researcher is satisfied even the experiment does not return statistically significant results 80% of the time. This may negatively impact the quality of result generalization.

Degree of freedom is computed by using the following formula:

$$d=p\ \ (p+1)/2-q, \tag{14}$$

where

p is the number of manifest variables (measured items),

and

q number of uncorrelated manifest variables.

Since the questionnaire consists of 25 questionnaire items, p=25, and these items are uncorrelated, hence q=25. Calculation shows that degree of freedom = 300. According to Maccallum et al. (1996), when degree of freedom is large, required sample size would become smaller. Given that degree of freedom of 100 would require minimum 132 samples, a degree of freedom of 300 would require even lesser sample than 132. Therefore, a minimum sample size of 132 is considered sufficient to produce power of 0.80 in this study. Therefore, it appears that sample size of 150 is both satisfying structural model convergent criteria and sufficiently powered to detect significant differences.

4.6 Data collection procedure

Data was collected from students in Northern Finance College and Souphanouvong University in Luang Prabang on October 2015 under the arrangement by the Department of World Heritage. As of the date of data collection, Northern Finance College and Souphanouvong University has student population of about 1,400 and 4,000 respectively. There are six faculties in Souphanouvong University. Students from the Faculty of Computer Engineering were arranged to participate in the survey. In pre-test stage, questionnaire was distributed, labeled as “BEFORE”, and students were required to answer the questionnaire. Then, students were asked to access to Google Playstore from their mobile phones and

download the mobile learning application. They were given sufficient time to read and understanding the learning content from mobile application. In post-test stage, the same questionnaire was distributed, labeled as “AFTER”, and students were required to answer the questionnaire. After this step, students were allowed to leave the classroom. A total of 220 students participated in this survey experiment.

CHAPTER 5

MOBILE LEARNING APPLICATION DEVELOPMENT

This chapter describes the development of mobile learning application. Mobile learning application development took place from 2012 to 2015, with numerous minor revisions and a major revision. First, the principles of mobile learning application is explained. This is followed by the description of technical details.

5.1 Adaptation of mobile learning application in this study context

There are three points to support the appropriateness of mobile learning application in promoting world heritage site preservation awareness in Luang Prabang. First, as illustrated in this chapter, empirical findings from the field reveals that mobile phone ownership is the highest among the young adults in Luang Prabang. Hence, implementation of mobile learning increases the chances of preservation awareness message diffusion.

Second, mobile learning has been gaining very strong momentum in international development. UNESCO has been organizing Mobile Learning Week since 2011. Since then, more than 1,000 experts have been gathering, including policy makers, business entities and beneficiaries of developing countries. The purpose of Mobile Learning Week is to shed light on the ways mobile technology can be leveraged in different contexts and for different groups to provide learning opportunities for all people. As described in the literature review, mobile learning is used as a medium in rural or development context because it is a more suitable medium to deliver learning. The number of cases and presentations in Mobile Learning Week has been increasing year by year, suggesting that mobile learning is indeed a feasible approach in promoting learning in developing countries.

Third, the characteristics of mobile devices of being portable has enabled learning to take place anywhere and anytime. Young adults, sometimes known as “Millennials”, have been identified with several distinct characteristics, which distinguishes the learning attitude and learning habit in relation to the previous generations. They grow up in environment in which they “expect technology to serve them: to be available 24 hours a day, 7 days a week,

and to be visual, auditory, stimulating, sharable, and, to some degree, sensational" (Wade et al., 2015, p.36). Chang and Gütl (2010) explain that young adults tend to prefer "just in time" and "anywhere anytime" learning habit. Therefore, given the above characteristics, mobile devices is thought to cater best to these kinds of learning habits (Chang & Gütl, 2010). The fact that mobile phone adoption has been proliferated in Lao PDR, similar with other developing countries, suggesting that mobile learning application is an appropriate implementation to facilitate learning among the young adults in Luang Prabang.

Fourth, several mobile learning characteristics as depicted in Table 2.1 fit the promotion of world heritage site preservation awareness among the young adults in Luang Prabang. For instance, mobile learning enables learning to take place in numerous environmental and social settings. Similar to other developing countries, mobile phone leapfrogging in Lao PDR has created a situation where individuals who possess mobile devices are many more than personal computers, as presented in Chapter 3. The declining costs for mobile devices and data plans, the near-ubiquitous access to mobile phones holds potential for expanding learning opportunities among the communities of developing countries. Also, mobile learning practices supports learning beyond formal education settings. As described in Chapter 2, the promotion of world heritage site preservation awareness can be categorized as non-formal education. When a resident is not able to attend face-to-face seminars, mobile learning is expected to be a suitable alternative to promote preservation awareness.

Based on the above four justifications, a mobile learning application was developed. The following sections depict the details of application development.

5.2 Principles of development of mobile learning application

The mobile learning application is developed based on the following four principles, as shown in Figure 5.1. Explanation on each principle follows accordingly.

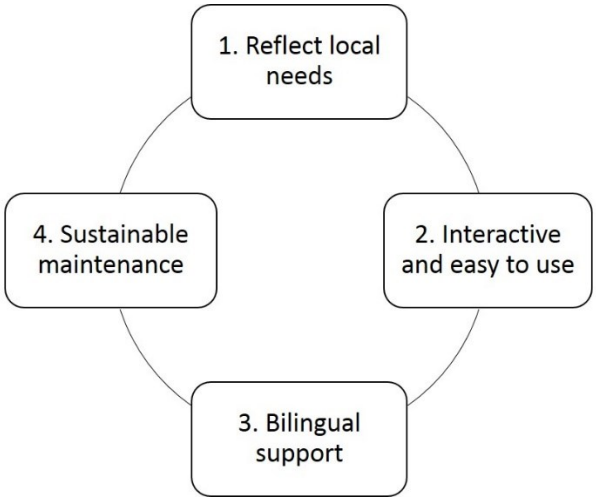


Figure 5.1: The four principles of mobile learning application development

5.2.1. Reflecting local needs

The mobile learning application is developed reflecting local needs. Numerous brainstorming sessions and workshop discussions were held together with DPL staff members, representatives of local colleges and university to identify their requirements and needs. The author had worked in Luang Prabang three times per year to intensively discuss the requirements of mobile learning development with DPL ICT team members. In addition, workshops to obtain feedback were held within DPL with members from across units, including the Director, the Deputy directors, and the architects. Further, the idea of mobile learning was also presented at the Local Heritage Committee of Luang Prabang, which include the representatives from the Urban Development Administration Authority, the Department of Tourism, the Department of Information and Culture and the Department of Communication Transportation, Post and Construction. The Local Heritage Committee is the decision-making entity in charge of the protection and rehabilitation of the heritage town of Luang Prabang. Besides acquiring opinions from the management side, interviews with lecturers and students in local higher education institutions were also carried out. All these comments and opinions were taken into consideration in the development of mobile learning application.

In addition to responding to the requirements from related stakeholders, the mobile application was developed to meet environmental limitations. For instance, considering Internet access cost may be high for some local residents, the mobile learning application was developed to be used offline. In addition, considering the need to download from Google

Playstore during initial use, the application size was revised by through code optimization. As a result, the size of application was reduced from 15 MB to 2MB. This allows users to download the application with minimum burden on data packet size and shorter download time even when Internet speed is slow.

5.2.2 Interactive and easy to use

The mobile learning application is developed to be interactive and easy to use. This is in accordance with the result of the master's thesis on the investigation on factors affecting mobile learning acceptance among young adults in Luang Prabang (Poong, 2013). Details of master's thesis findings are presented in Chapter three. Accordingly, the interface is designed with clear navigation using list object, together with icons and clear words (Figure 5.2).

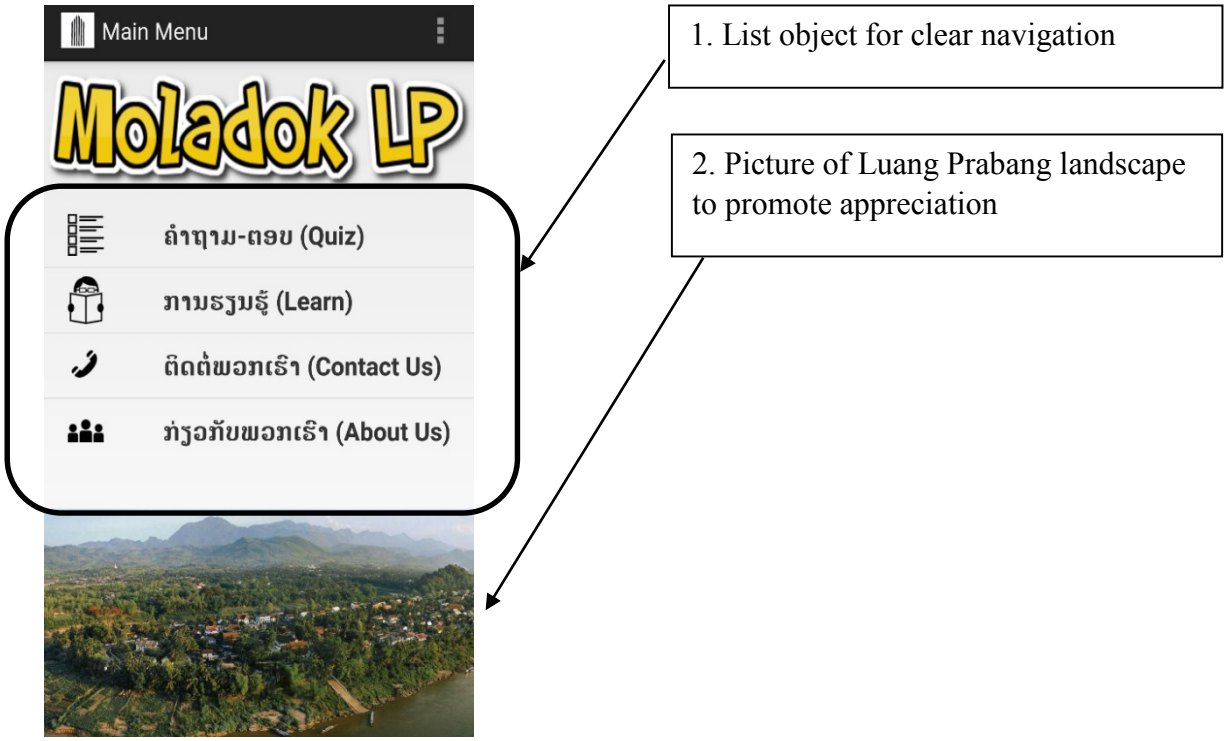


Figure 5.2: Main interface of mobile learning application.

Source: developed by author

Two fun features were developed in order to increase enjoyment to use the application, which include four quiz levels of difficulty and time challenge, as shown in Figure 5.3. Among the four quiz levels, a learning mode was built in. In learning mode, timer is disabled. Further, answer explanation is popped up when user chose an incorrect response in order to

facilitate learning, as shown in Figure 5.4. The details of each quiz level and time challenge are described in the next section.

5.2.3 Bilingual support

The mobile learning application supports bilingual language. Originally the application supported only Lao language. The feedback from faculty members of local university and colleges indicated that including English in the application would promote students to acquire world heritage site knowledge and to learn English at the same time. As shown in Figure 5.2, both English and Lao languages are presented in the menus. In addition, bilingual is supported in quiz as well as learning content. Figure 5.5 depicts the pop up screenshot allowing users to choose the intended language.

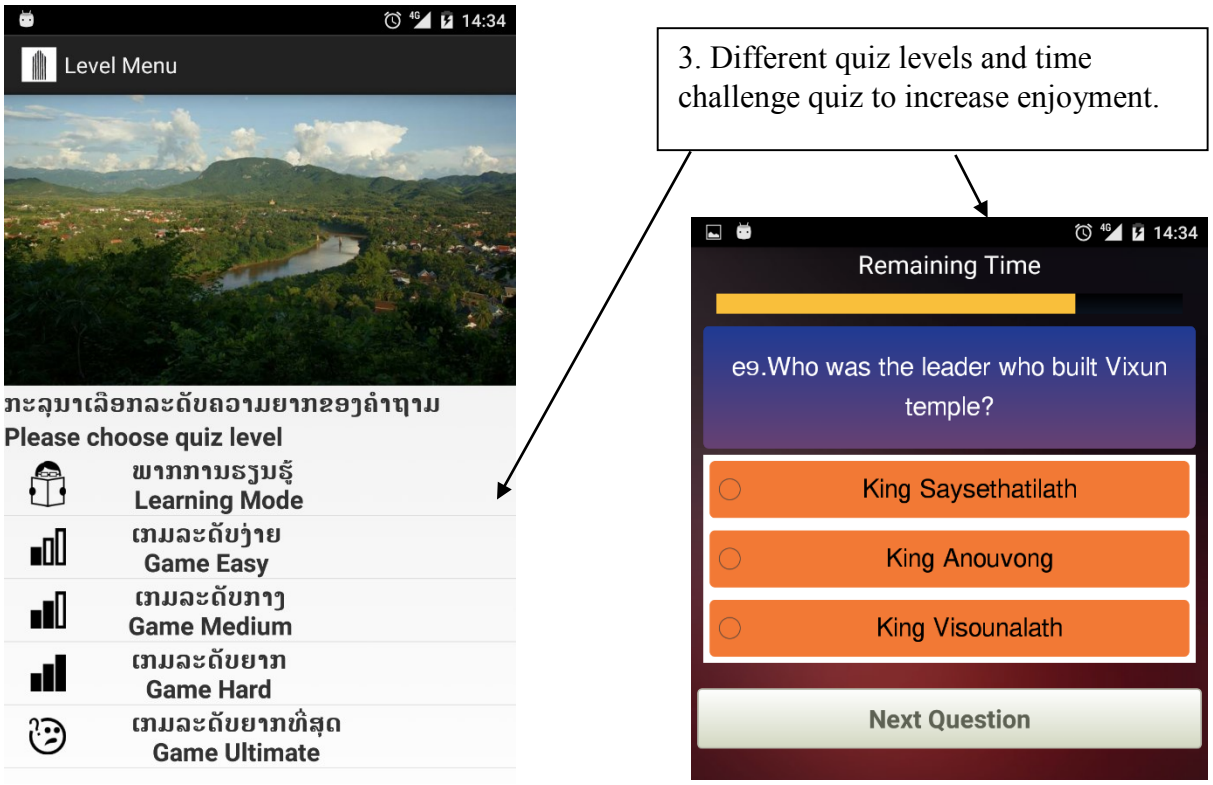


Figure 5.3: Fun features in the mobile learning application.

Source: developed by author

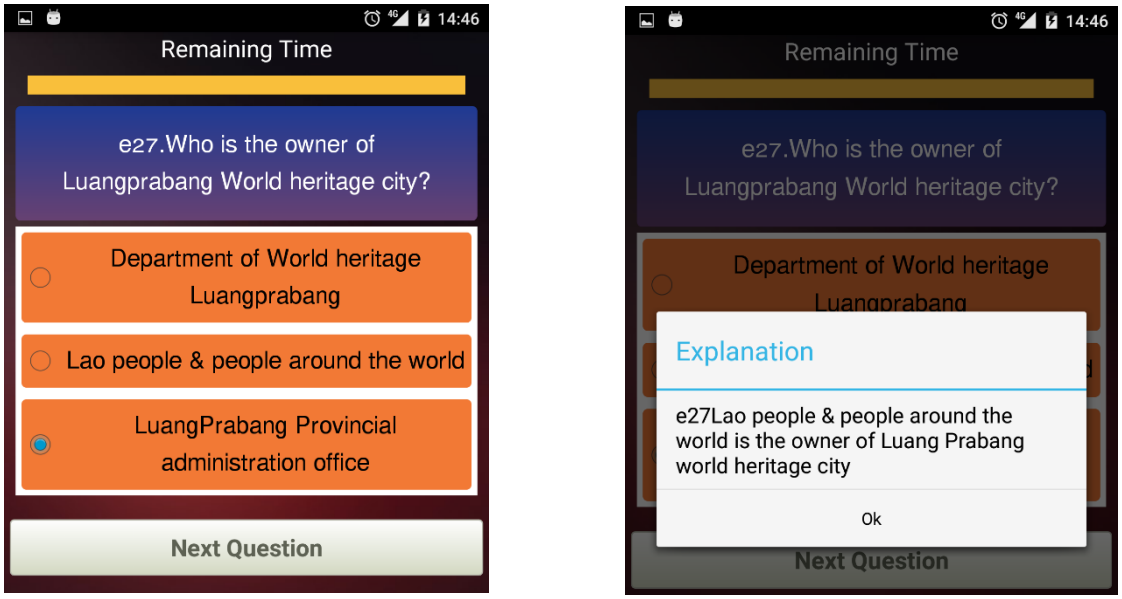


Figure 5.4: Explanation pops up when wrong answer is selected.

Source: developed by author

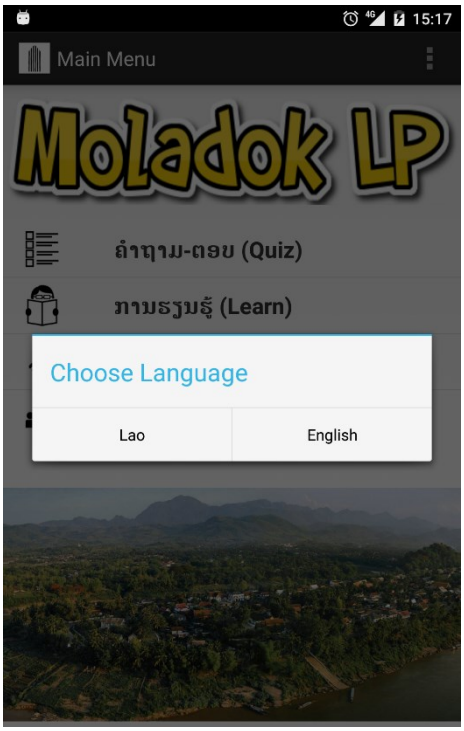


Figure 5.5: Options to allow users to choose between Lao and English language.

Source: developed by author

5.2.4 Sustainable maintenance

The mobile learning application is developed with sustainable maintenance from the beginning. Thus, the application is developed based on object-oriented programming to facilitate easy coding object management. A separate quiz object is developed in the application to handle quiz presentation and logic of matching user's answer with the correct answer. If there are updates on quiz questions, such as increasing number of questions, the maintenance team adds quiz questions in the quiz collection code segment as shown in box 5.1, without needing to attend to quiz logic. By using this scheme, the maintenance team is free of repeated tasks to update the logic of quiz component after quiz question updates as the logic of quiz presentation and answer matching engine is taken care by the quiz object.

```
String[] question = {
      "ไ1. ວັດປາກຄານສ້າງປີໃດ?",
      "ไ2. ວັດຊຽງທອງສ້າງຂຶ້ນປີໃດ?",
      "ไ3. ໃຜເປັນຜູ້ກໍ່ສ້າງວັດຊຽງທອງ?",
     ...}
String[] answer = {
      "ปี 1737",
      "ปี 1560",
      "ເຈົ້າໄຊເສດຖາທິລາດ",
     ...}
String[] distractor = {
      "ปี 1773","ปี 1757",
      "ปี 1565","ปี 1570",
      "ເຈົ້າອານຸລຸດ","ເຈົ້າຟ້າງຸ່ມ",
     ...}
String explanation []={
"ไ1 ວັດປາກຄານສ້າງຂຶ້ນໃນປີ1737",
"ไ2 ວັດຊຽງທອງສ້າງຂຶ້ນໃນປີ1560",
"ไ3 ເຈົ້າໄຊເສດຖາທິລາດເປັນຜູ້ສ້າງວັດຊຽງທອງ",
...}
```

Box 5.1: Quiz questions, answer, answer options, and explanation code snippet

Source: developed by author

5.3 Mobile application development

The mobile learning application is known as Moladok LP, which means Luang Prabang world heritage site. This application is a result of major redevelopment from the first version. The first version of mobile application was a web app. A web app is a mobile application developed based on HTML. Therefore, one of the advantages of web app is portability, allowing the application to be installed on cross-platform devices, including iOS and Windows Mobile operating system. However, several web app limitations were discovered, including lag during usage, difficulty of media inclusion and Lao font type support, as well as sustainable maintenance issue due to hard-coding components. With regard to the last limitation, the initial idea was that HTML may facilitate ease of maintenance. However, lack of supported package and component availability made hard-coding a necessary, which increases application maintenance difficulty. As a result, the mobile application is developed on Android platform since empirical finding shows that Android based mobile phone are popular among young adults in Luang Prabang (Poong, Yamaguchi, & Takada, 2013). Figure 5.6 shows the architecture of the mobile application.

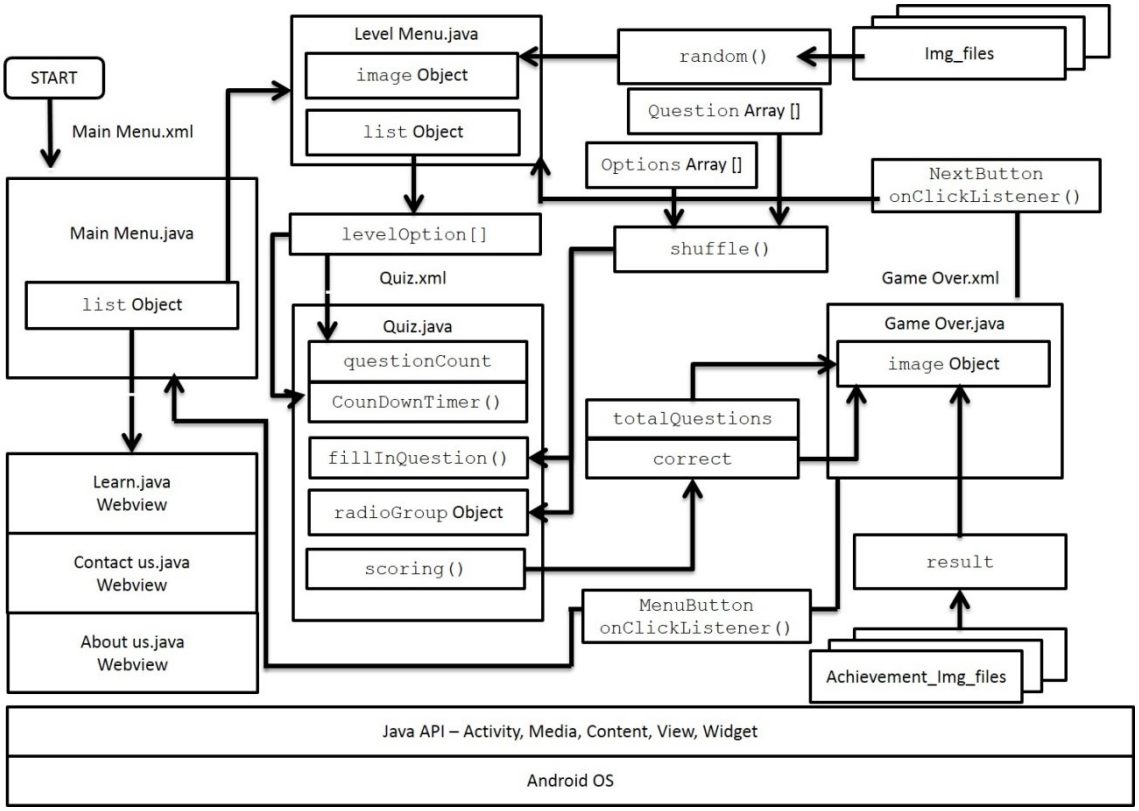


Figure 5.6: Application architecture and interface flow

Source: developed by author

The application is programed in Java and consists of two major components, namely, quiz component, and learning component. The purpose of quiz component is to provide an interactive way for users to learn about Luang Prabang world heritage site. Discussion with experts in DPL revealed the need to impart the following knowledge to local residents: 1) rules and regulations of building modification; 2) history of Luang Prabang; and 3) intangible heritage of Luang Prabang. As explained earlier, interview result supported the idea that quiz approach provides an interactive way of learning (Poong, Yamaguchi, & Takada, 2012). A total of 60 questions (30 questions in Lao language and the same set of 30 questions in English language) provided by DPL are included in the application. List of quiz questions are appended in Appendix 2. As identified in the previous study in Luang Prabang, perceived enjoyment influences behavioral intention to use mobile phone for learning (Poong et al., 2012). In order to increase sense of gaming and motivation to use, countdown timer, randomized questions and randomized answer option are built into the application.

Four levels of quiz answering methods are provided, which differs in the time allocated for answering questions and the number of questions required to answer. Pseudocode of quiz engine execution is shown in the box 5.2. The first level (case 0), however, is not bounded by countdown timer, in order to allow interested users to learn at their own pace. Users in this level are also supported by pop ups displaying the right answer if a wrong answer is chosen. Quiz questions are presented to users after quiz level is decided by user. Following that, two possible situations may occur: 1) user completed quiz questions before countdown timer runs out; or 2) countdown timer runs out before user completes the questionnaire. In both cases, the game-over screen would be displayed, with scores and motivating graphic elements. Subsequently, user is able to choose to restart quiz or return to the main menu for other options. Other levels (case 1 to case 3) do not show explanation. In addition, the number of questions increases and time allocated for answering quiz decreases as level gets higher. To cater for local residents, language options of Lao and English is selectable in the main menu for both quiz and learning content. As shown in Figure 5.6, learning content is presented as a simple webview to provide clean and easy interface for learning. The completed application is uploaded into Google Playstore for public access. Next section presents learning content development.

```
INPUT level
CASE 0
      IF all questions answered
            IF answer is right
                  Pop-up RIGHT
            ELSE if answer is wrong
                  Explain answer
            MOVE to game over page
      ELSE time up before all questions answered
            IF answer is right
                  Pop-up RIGHT
            ELSE if answer is wrong
                  Explain answer
            MOVE to game over page
CASE 1
      IF all questions answered
            IF answer is right
                  Pop-up 'right'
            ELSE if answer is wrong
                  Pop-up 'wrong'
            MOVE to game over page
      ELSE time up before all questions answered
            IF answer is right
                  Pop-up 'right'
            ELSE if answer is wrong
                  Pop-up 'wrong'
```

Box 5.2: Pseudocode of quiz algorithm

Source: developed by author

5.4 Learning content development

Learning content was developed based on the hypothesized component in the theoretical framework. As there has not been similar materials existed before in this study context, pilot studies, review by experts of DPL and local academics were conducted to ensure construct validity and to optimize message quality. Learning content was first developed in English, and then translated in Lao language by DPL experts. Translated content was reviewed by local academician who is fluent in both English and Lao language to ensure translation consistency. The translated learning content was then administered for testing.

5.4.1 Pilot study

In the pilot study took place in 2014 in DPL, learning content with a total of thirteen pages were developed. The first six pages cover overall introduction to world heritage site. The remaining pages contain contents related to PMT components. The learning content begins with the introduction of world heritage site. This is followed by showing the difficulty to world heritage site inscription process. In addition, information about Luang Prabang world heritage site safeguarding plan was shown. Figure 5.7 shows the first six pages of the learning content.

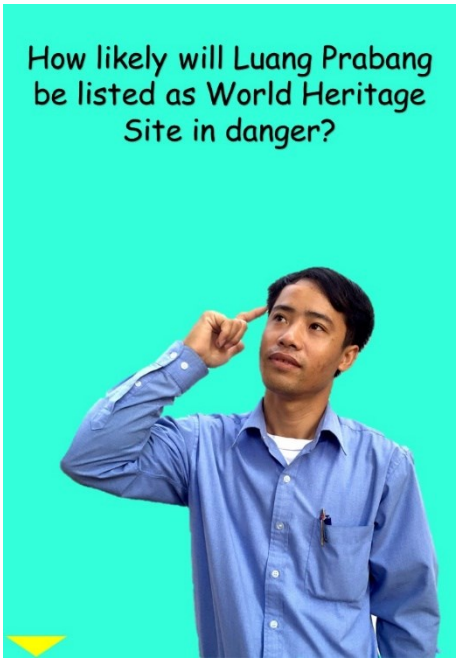
Subsequent content illustrates PMT components. Severity of not protecting Luang Prabang world heritage site is stimulated by asking the question “What if we do not protect Luang Prabang world heritage site?” Then, four negative outcomes are provided, namely, (1) possible loss of traditional heritage in the future; (2) tourists visits will fall; (3) national pride will be affected; and (4) local economic income will fall. Similarly, Luang Prabang vulnerability to heritage destruction is shown by asking the question “How likely will Luang Prabang be listed as world heritage site in danger?” Two possibilities are highlighted: (1) people not following rules and regulations when building or renovating houses; and (2) lack of awareness to preserve Luang Prabang as a world heritage site. Next, recommended solutions to protect Luang Prabang world heritage site is explained by suggesting to learning content readers to (1) understand and know that it is important to preserve Luang Prabang

Figure 5.7: Pages in the learning content introducing world heritage site inscription process and town of Luang Prabang

Source: developed by author

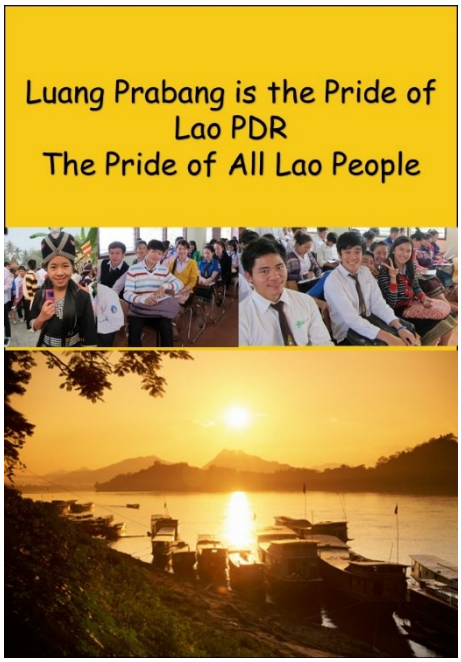
World Heritage Site; and (2) Use Internet technologies (such as Facebook, LINE messenger application) to promote Luang Prabang heritage and culture, and (3) follow rules & regulations. To assure that everyone can help to preserve Luang Prabang world heritage site, a statement of "You can easily help to preserve Luang Prabang world heritage site" is included in the learning content. Figure 5.8 depicts the pages in the learning content related to each PMT components.

a) Perceived severity



b) Perceived vulnerability

c) Response efficacy and self-efficacy



d) Place attachment through pride

Figure 5.8: Pages in learning content depicting PMT components

Source: developed by author

Result of pilot study took place in November 2014 in Luang Prabang with 212 higher education students showed that the learning content failed to instil coping appraisal components. Reflection session was conducted with DPL experts and professors. Possible

revision include: 1) simplifying learning content by focusing to the point; 2) reconsider effective solution which is practicable by local residents, in particular with the possible negative effects of social network media perceived by young adults in Luang Prabang (Poong et al., 2013); and 3) re-evaluate the appropriateness of self-efficacy in the context of world heritage site preservation. With regard to the third point, the statement "You can easily help to preserve Luang Prabang world heritage site" may be emotionally burdening to a local resident. Hence, it was suggested to consider the preservation of world heritage site as part of the effort of community.

5.4.2 Final learning content

Based on the outcomes of the pilot studies, learning content was revised to focus directly on PMT constructs. The learning content begins by communicating the beauty of Luang Prabang, benefits of inscription, severity of not preserving Luang Prabang, vulnerability, recommended solution, role of local residents. The following section illustrate specific content included in revised mobile learning content.

1) The beauty of Luang Prabang: There are three specific information related to the beauty of Luang Prabang as follows:

1-1: "Town of Luang Prabang was given the status of "World Heritage Site" because of well-preserved Lao architecture buildings, French colonial buildings, and Temples. The buildings are now becoming the heritage of Laos and heritage of the World."

The benefits of world heritage site inscription to Luang Prabang:

1-2: "The inscription of Luang Prabang world heritage site brings along international recognition to Laos, pride to our country, and better social development to the Town".

Severity of not preserving world heritage site of Luang Prabang:

1-3: "It is a serious problem if we do not preserve the heritage buildings. The buildings represent the history and the sacrifice of our past ancestors. The buildings represent our identity and Lao identity. It is important to make sure that these heritage is passed on to the future generation."

2) Vulnerability: he following is the important information described to be related to factor of vulnerability:

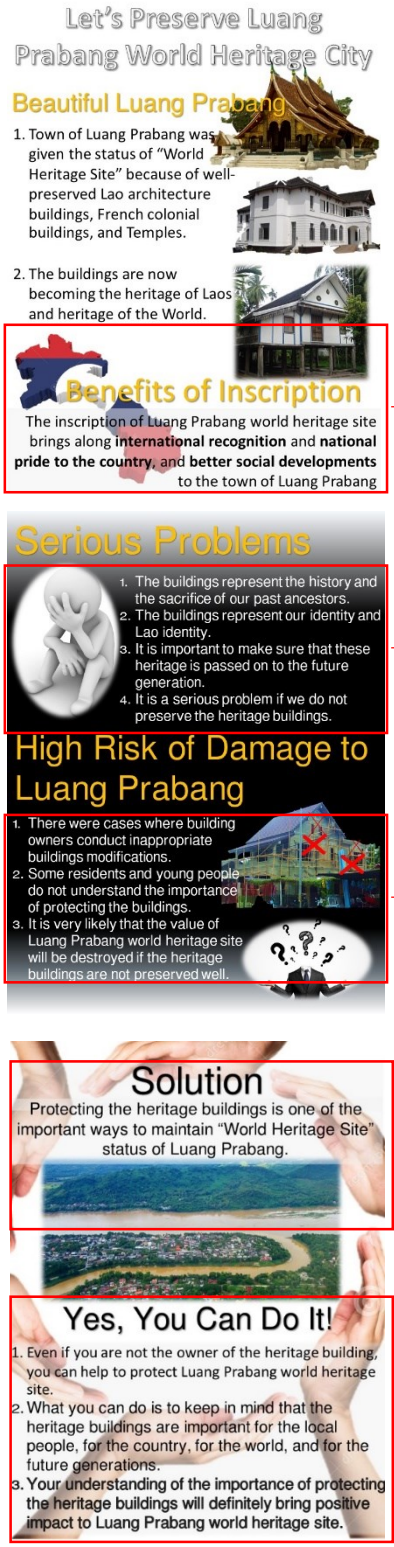
“There were cases where building owners conduct inappropriate buildings modifications. Some residents and young people do not understand the importance of protecting the buildings. It is very likely that the value of Luang Prabang world heritage site will be destroyed if the heritage buildings are not preserved well”.

3) Recommended solution:

“Protecting the heritage buildings is one of the important ways to maintain “World Heritage Site” status of Luang Prabang”.

4) Role of local residents:

“Even if you are not the owner of the heritage building, you can help to protect Luang Prabang world heritage site. What you can do is to keep in mind that the heritage buildings are important for the local people, for the country, for the world, and for the future generations. Your understanding of the importance of protecting the heritage buildings will definitely bring positive impact to Luang Prabang world heritage site.” Figure 5.9 depicts the actual content presented in mobile learning in English and Appendix 3 shows the actual content presented in Lao language. The learning content is saved as images, and stored in the mobile learning application. Learning content in Figure 5.9 is stored into the mobile application and can be accessed through the “Learn” option as shown in the application screen shot in Figure 5.10.



Perceived benefit of inscription

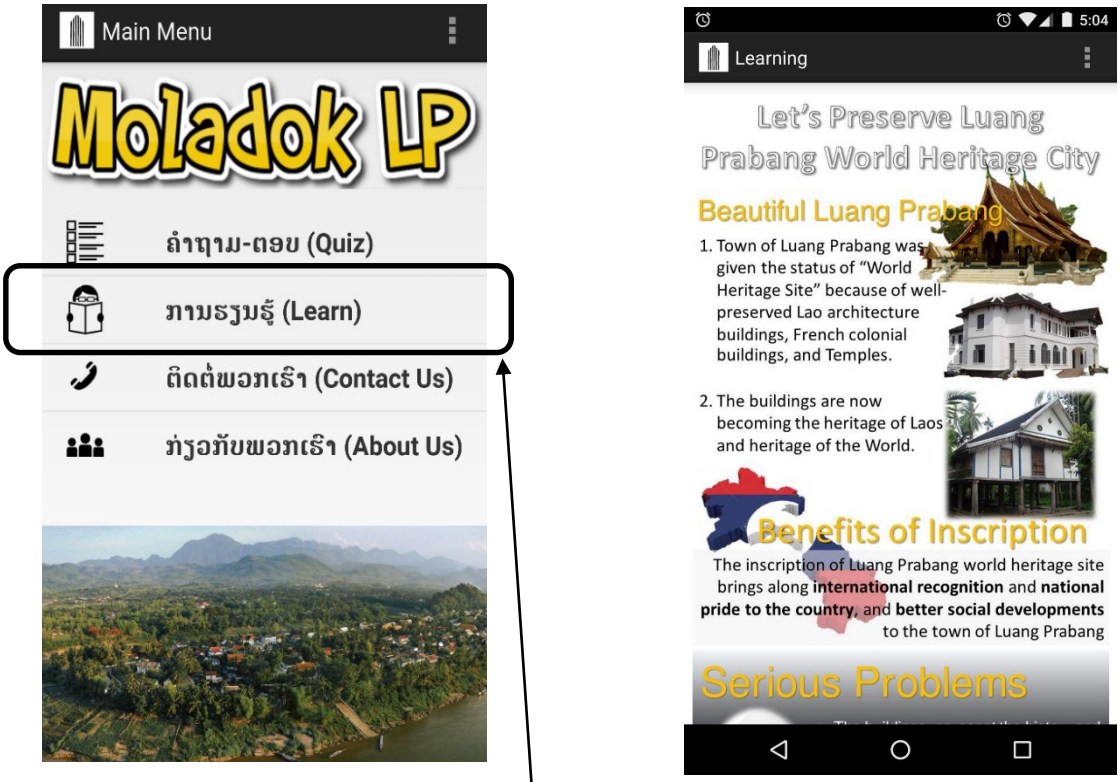
Perceived severity

Perceived vulnerability

Perceived response efficacy

Perceived resident effectiveness

Figure 5.9: Final version of learning content focusing on PMT constructs



1. Users can access to the learning content by tapping "Learn" in the main menu of the mobile learning application, as shown in a).

2. A pop-up will appear, as shown in Figure 5.5 to allow user to select in which language the learning content should be presented.

3. The actual learning content viewed in mobile learning application is illustrated in b)

Figure 5.10: Accessing to the learning content from mobile learning application

As presented in previous chapters, mobile learning application is believed to be the most suitable medium to deliver learning content to the young adults. Next chapter presents data analysis and findings of this study based on the research objectives.

CHAPTER 6

DATA ANALYSIS

This chapter begins with result of respondents demographic profile. Subsequently, a two-stage process consisting of confirmatory factor analysis (CFA) and structural model analysis is conducted. CFA is measured based on the measurement model. Structural model is then used to test the structural model fit and hypotheses. Then, effect of mobile learning content is tested using pre-test and post-test. Interview results with users and summary of discussion with policy makers supplement the findings of the pre-test and post-test quantitative findings.

6.1 Respondents demographic profile

A total of 220 questionnaires were distributed to students in two higher learning education institutions in Luang Prabang, namely Northern Finance College and Souphanouvong University. Data collection was conducted in October 2015. A total of 207 questionnaires were returned, yielding a return rate of 94.1%. Subsequently, incomplete questionnaires, such as blank and high rate of unanswered questions, were screened and discarded (Biemer & Lyberg, 2003, p. 230). Finally, 190 questionnaires were deemed valid for data analysis, yielding a valid response rate of 86.4%.

Table 6.1 illustrates the demographic profile of the respondents. Self-reported result shows that male and female respondents comprise of 56.3% (n=107) and 38.4% (n=73) respectively. There is a total of 131 respondents (68.9%) aged between 19 and 21 years old, followed by 41 respondents (21.6%) aged between 22 and 24 years old. Among the province of origin, respondents coming from Luang Prabang comprise of 34.2% (n=65) while those of other respondents are mainly distributed in the northern provinces of Lao PDR. A total of 70.5% (n=134) of the respondents access to the internet through their mobile devices, and 76.3% (n=145) of them possess mobile phone with internet connection capabilities, such as

3G connection and WiFi wireless technology. Overall, findings show that respondents are relatively technologically savvy.

Table 6.1: Respondents demographic profile

	Frequency	Percent (%)	Cumulative (%)
Gender			
Male	107	56.3	59.4
Female	73	38.4	100.0
No answer	10	5.3	
Age			
16-18	4	2.1	2.2
19-21	131	68.9	75.8
22-24	41	21.6	98.9
25 and above	2	1.1	100.0
No answer	12	6.3	
Province origin			
Bokeo	13	6.8	7.1
Houaphan	11	5.8	13.2
Xekong	1	0.5	13.7
Luang Namtha	9	4.7	18.7
Luang Prabang	65	34.2	54.4
Phongsali	20	10.5	65.4
Oudomxai	24	12.6	78.6
Xaignabouli	31	16.3	95.6
Xiangkhouang	8	4.2	100.0
No answer	8	4.2	
Mobile internet use frequency			
Daily	134	70.5	77.9
Weekly	22	11.6	90.7
Monthly	4	2.1	93.0
Less than once a month	4	2.1	95.3
Never	8	4.2	100.0
No answer	18	9.5	
Internet connection in mobile phone			
Yes	145	76.3	84.3
No	26	13.7	99.4
Don’t know	1	0.5	100.0
No answer	18	9.5	

Source: Developed by author

6.2 Hypotheses testing

This section first explains eight steps of procedures in assessing preparation for hypotheses testing. Post-test data is used for hypotheses testing. First, results of reliability and validity assessment of the scale items are presented. Subsequently, multicollinearity and measurement model fit are evaluated. Then structural model fit is examined before hypotheses are tested based on the structural model. A measurement model was developed in AMOS v 22.0. Latent variable is represented in circle, and is measured by multiple observed variables. Perceived severity is measured by four times, except perceived resident effectiveness and behavioral expectation. The measurement model is used to assess convergent and discriminant validity. Measurement model is shown in Appendix 4a. In addition, measurement model sample covariance matrix, model-implied covariance matrix, residual matrix and standardized residual matrix are shown in Appendix 4b, 4c, 4d and 4e respectively.

6.2.1 Convergent validity assessment

Standardized loadings of each item are assessed in order to proceed with reliability analysis. Measurement model shows that all items achieved loadings greater than 0.50, except item 2 of response efficacy, which loads at 0.208. Hulland (1999) claims that items with factor loadings less than 0.40 should be removed. Hence, R2 is removed from the data analysis. Composite reliability refers to the assessment of internal consistency among the construct indicators. Threshold commonly adopted is 0.70 and above, indicating the degree of indicators consistency in measuring their respective latent constructs (Hair et. al., 2006). Composite reliability for SEM is calculated using the formula:

$$\frac{(\sum \text{standardised loading})^2}{(\sum \text{standardised loading})^2 + \sum \varepsilon} \tag{15}$$

,where ε denotes the measurement error (Hair et. al., 2006).

Standardised loading is acquired directly from AMOS output. Measurement error, however, is calculated by:

$$\varepsilon = 1.0 - (\text{standardised loading})^2 \tag{16}$$

,where the square of the standardised loading represents the reliability of the indicator.

Next, average variance extracted (AVE) of the latent construct is evaluated. AVE depicts the construct's variance explained by the underlying indicators. AVE is another way to assess construct reliability (Cheung & Lee, 2000). A latent construct exhibits high reliability when AVE is greater than 0.50 (Bagozzi & Yi, 1988; Lui & Jamieson, 2003). AVE is calculated based on the following formula:

$$\frac{\sum(\text{standardised loading}^2)}{\sum(\text{standardised loading}^2)+\sum\varepsilon} \quad (17)$$

, where ε denotes measurement error. Table 6.2 shows the composite reliability, AVE, as well as Cronbach's alpha values for each construct. Composite reliability for each construct ranges from 0.763 for response efficacy to 0.901 for perceived vulnerability. In addition, AVE for each construct ranges from 0.519 for response efficacy to 0.694 for perceived vulnerability. Both composite reliability and AVE indicate that items exhibit sufficient convergent validity.

6.2.2 Discriminant validity assessment

Assessment of discriminant validity is carried out through the evaluation of square root AVE and constructs correlation. According to Chin (1998), discriminant validity is achieved when square root AVE of a construct is greater than the correlation between the construct and other constructs. This method infers that the latent construct should explain its item measures better than it explains another construct (Khosrow-Pour, 2006). Table 6.3 shows the square root AVE comparing with construct correlation. Result shows that square root AVE of each construct is greater than the correlation among each construct. Thus, it can be concluded that data exhibits discriminant validity.

Table 6.2: Reliability indices

Latent Variable	Items	Standardized Loadings	Composite Reliability	AVE	Cronbach Alpha
Perceived severity	S1	0.791	0.820	0.535	0.809
	S2	0.724			
	S3	0.769			
	S4	0.630			
Perceived vulnerability	V1	0.869	0.901	0.694	0.894
	V2	0.843			
	V3	0.786			
	V4	0.832			
Response efficacy	R1	0.731	0.763	0.519	0.758
	R2	0.208	-	-	
	R3	0.642			
	R4	0.781			
Perceived resident effectiveness	PRE1	0.894	0.811	0.593	0.810
	PRE2	0.701			
	PRE3	0.698			
Perceived benefits of inscription	PBI1	0.712	0.834	0.557	0.833
	PBI2	0.788			
	PBI3	0.735			
	PBI4	0.748			
Behavioral expectation	BE1	0.853	0.771	0.540	0.748
	BE2	0.794			
	BE3	0.511			

Note: Negative questions were removed from analysis

Table 6.3: Squared AVE and construct correlation

	SEV	VUL	REF	PRE	PBI	BEX
SEV	**0.731**					
VUL	0.103	**0.833**				
REF	0.653	-0.064	**0.720**			
PRE	0.139	-0.009	0.256	**0.770**		
PBI	0.417	0.025	0.570	0.237	**0.746**	
BEX	0.267	-0.071	0.436	0.497	0.396	**0.735**

**√AVE values are shown in bold*

6.2.3 Multicollinearity

Multicollinearity refers to situation when two or more variables are not independent, i.e. the variables are highly correlated with each other (Maruyama, 1998). High level of multicollinearity would lead to fallacious parameter estimates and erroneous non-significant relationship (Niemelä-nyrhinen & Leskinen, 2014). One of the common ways to examine multicollinearity is evaluation of correlation among constructs (Grewal, Cote, & Baumgartner, 2004). According to Grewal et al. (2004), correlations in the range of 0.7 or 0.8 are common in structural equation modelling analysis, which is considered highly correlated. However, if data set meets discriminant validity requirements, inference errors are less likely (Grewal et al., 2004). Referring to Table 4.4, the highest correlation is between perceived severity and response efficacy at 0.653, which is less than 0.7. Furthermore, there is acceptable level of discriminant validity as shown in section 6.3.2. Therefore, multicollinearity is not considered a problem among constructs in this study.

6.2.4 Goodness-of-fit indices for measurement model

Having determined convergent and discriminant validity, the goodness-of-fit test for measurement model is assessed. Table 6.4 shows that chi-square is significant (255.748, p=0.002) with degrees of freedom 180. However, literatures have acknowledged that chi-square is sensitive to sample size, where higher sample size would lead to statistically significant chi-square (Anderson & Gerbing, 1984; Iacobucci, 2010). Therefore, researchers often resort to chi-square adjusted by degrees of freedom ($\chi 2$ /df) less than 3.0 (Kline, 2005).

Following this, additional fit indices are reviewed. The chi-square over degree of freedom demonstrates a value of 1.318, indicating a good fit between the measurement model and the data. CFI achieves 0.964 and finally, RMSEA is statistically not significant at 0.049, accepting the null hypothesis that there is a close fit between the measurement model and the data.

Table 6.4: Model fit indices for measurement model

Goodness-of-fit Measures	Recommended Value	Measurement Model
Chi-square	Not statistically significant	255.748 (p=0.002)
χ_2/df	<=3.000	1.318
CFI	>=0.950	0.964
RMSEA	<=0.070	0.041
SRMR	<=0.080	0.049

6.2.5 Goodness-of-fit indices for structural model

A structural model was developed to assess the causal paths among latent variables as shown in Appendix 5a. In addition, structural model sample covariance matrix, model-implied covariance matrix, residual matrix and standardized residual matrix are shown in Appendix 5b, 5c, 5d and 5e respectively. Table 65 depicts the fit indices of structural model. Chi-square is statistically significant at 1.428. As chi-square is sensitive to sample size, examination of chi-square over degree of freedom ratio shows that the model achieves a good fit at 1.428. In addition, CFI, RMSEA, and SRMR values are 0.954, 0.048 and 0.066 respectively, suggesting that the theorized structural model reflects the data very well. Next, hypotheses are evaluated.

Table 6.5: Model fit indices for structural model

Goodness-of-fit Measures	Recommended Value	Structural Model
Chi-square	Not statistically significant	1.428 (p=0.000)
χ_2/df	<=3.000	1.428
CFI	>=0.950	0.954
RMSEA	<=0.070	0.048
SRMR	<=0.080	0.066

6.2.6 Hypothesis testing

Hypothesis testing is conducted by evaluating the standardised regression weights from the exogenous construct (measured items) to the endogenous construct (latent variable). Level of significance adopted is p<0.050. Analysis shows that all hypotheses are supported, except for hypotheses 2. Standardized regression on the path between perceived severity and perceived benefit of inscription is statistically significant at 0.470 (T=5.038) and hence, H1 is supported. However, the path between perceived vulnerability and perceived benefit of inscription is not statistically significant (β = -0.024, T=-0.358), hence H2 is not supported. Standardized regression on both paths from response efficacy to perceived residents effectiveness and behavioral expectation are statistically significant at 0.247 (T=2.811) and 0.230 (T=2.564) respectively, supporting H3a and H3b. Finally, standardized regression on the path between perceived resident effectiveness and behavioral expectation is statistically significant at 0.406 (T=4.790), hence supporting H4. The path from perceived benefit of inscription to behavioral expectation is statistically significant (β = 0.200, T=2.377), thus supporting H5. Variance explains for perceived benefit of inscription and perceived resident effectiveness is 21.9% and 6.1% respectively. Finally, overall variance explained on behavioral expectation is 34.7%, controlling for other variables. Figure 6.1 depicts the supported factors in bolded square and Table 6.6 summarizes hypotheses testing result.

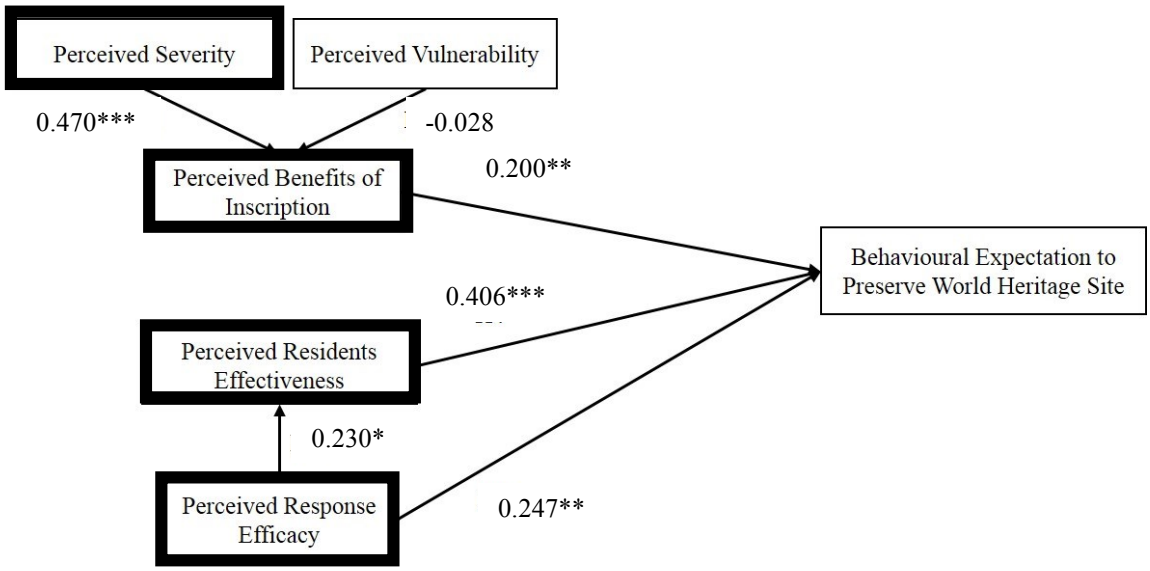


Figure 6.1: Factors affecting behavioral expection to preserve world heritage site

Table 6.6: Hypothesis testing result

Path	Hypothesis	Standardized regression coefficient	T-value	Outcome
SEVE → BENEFI	H1	0.470***	5.038	Supported
VULN → BENEFI	H2	-0.028	-0.358	No supported
RESP → BEX	H3a	0.247**	2.811	Supported
RESP → PRE	H3b	0.230*	2.564	Supported
PRE → BEX	H4	0.406***	4.790	Supported
BENEFI → BEX	H5	0.200**	2.377	Supported

Not supported $P > 0.05$, * $P \leq 0.050$, ** $P \leq 0.010$, *** $P \leq 0.001$

6.3 Effect of mobile learning content on perceptions

This section presents qualitative interview findings conducted with higher education students in Luang Prabang on the use of mobile learning in promoting world heritage site preservation awareness. Summary of policy makers' opinion on the importance of mobile learning implementation is provided as well. This section also shows the results of perceptions changes before and after reading mobile learning content.

6.3.1 Qualitative interview result

A total of 16 students from both Souphanouvong University and Northern Finance College participated in the interview. DPL assisted in the translation of interviewee responses. There are three major opinions on the impact of mobile learning application. First, impact on world heritage site preservation knowledge. With regard to the changes of perception before and after using the mobile application, interviewees state that the use of mobile learning application improve their knowledge and understanding of importance of preservation. Specifically, one of the response states "after learning from the application, I understand the importance of world heritage site, so I would like to be part of the member to preserve Luang Prabang world heritage site", "Before, I did not understand well about preservation. But after learning from application, I can perceive that we should preserve Luang Prabang world heritage site for its sustainability." Furthermore, the increase of awareness of the importance of preserving building architectures can be inferred from this

specific statement “The construction of building is very important as it represents the authenticity to be passed to the next generation”.

Second, interviewees emphasize the appropriateness of mobile learning application for their generation. The use of mobile phone to learn about world heritage site preservation is also being thought to fit young adults’ lifestyle well. Specifically, the use of mobile learning has its strengths because there is increasing trend among young people of new generation use their mobile phones to conduct various activities. Further, mobile learning is convenient and portable for learning about world heritage site. Specific responses include “it is very good to use application for learning about Luang Prabang and dissemination of information through technology”. Furthermore, the impact of threat appraisal can be inferred from this statement “it is very good for me I can learn everything in my mobile phone. I can know what happen in Luang Prabang, something good*, something not good*”.

Third, interviewees demonstrate high interest to learn about world heritage site preservation using mobile learning application. They think that more information on preservation is appreciated to be added to the current content. They wish that the application can be expanded to support iOS to allow more people to use the application. This illustrates positive attitude toward the mobile learning application to promote world heritage site preservation awareness.

Contribution of mobile learning in world heritage site management has been conducted in various workshops and discussed extensively. Summary of the discussion is illustrated. As part of the heritage management responsibility, DPL had been conducting awareness campaign through presentation slides by visiting villages, education institutions and construction companies. Originally, awareness campaign was to be held between five to ten times a year. However, DPL identified some challenges in conducting face-to-face awareness campaign such as high cost and lack of human resources. Hence, the introduction of mobile learning application is thought to be a feasible and effective solution in assisting awareness raising in Luang Prabang. Recently, DPL has begun to promote preservation awareness through radio, TV program and website. However, given that most residents possess Internet-ready mobile phones, there is a comparative advantage of using mobile application in raising awareness.

Having said that, DPL also states that face-to-face awareness campaign is still necessary as the level of interaction between organizer (DPL) and target audience (villagers,

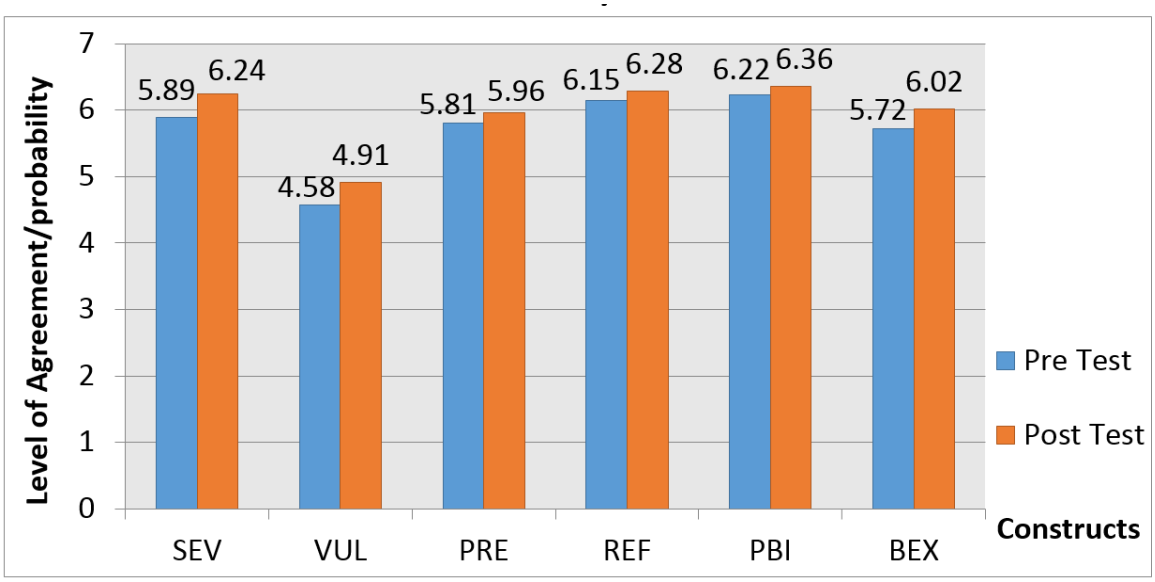
students, companies and etc.) is higher compared to mobile learning application. Nevertheless, mobile learning application is still considered as an important tool for DPL to supplement the organization of sustainable awareness campaign along with website, radio, TV and newspaper.

6.3.2 Quantitative test

A within-subject pre-test and post-test was conducted to assess the perception changes before and after the mobile learning content intervention is shown to the respondents. As depicted in Chapter 4, each of the perceptions is measured using 7-point Likert scale. Both perceived vulnerability and behavioral expectation are evaluated using level of probability scale, in which the lowest scale of 1 value indicates "very improbable" while the highest scale of 7 value indicates "very probable". Other perceptions are evaluated using agreement value scale, in which the lowest scale of 1 value indicates "strongly disagree", and the highest scale of 7 value indicates "strongly agree". Mean analysis shows that both pre-test and post-test results are on the agreement range. A paired-sample t-test was conducted to assess the degree of mean changes before and after intervention. As shown in Figure 6.2, positive statistically significant changes were observed for perceived severity, perceived vulnerability, perceived response efficacy, perceived benefits of inscription and behavioral expectation, in which the mean changes are 0.3470 (p=0.000), 0.3316 (p=0.004), 0.1327 (p=0.027), 0.1307 (p=0.032) and 0.2972 (p=0.000) respectively. Result indicates that respondents' level of agreement on severity, vulnerability, response efficacy, benefits of inscription and expectation to preserve world heritage site increases significantly after viewing the mobile learning content.

Mean results for perceived severity shows that respondents agree that Luang Prabang could suffer from negative impact if inventory buildings, such as protected traditional Lao buildings, French colonial buildings, and temples, are not preserved well (pre-test: $\mu = 5.8934$, std = 0.97088; post-test: $\mu = 6.2404$, std = 0.87477). Perceived vulnerability, despite being rated on the lower probable range (pre-test: $\mu = 4.5773$, std = 1.47683; post-test: $\mu = 4.9090$, std = 1.62198), respondents' perception of chances that Luang Prabang would lose its world heritage site status increases after they are exposed to the learning content. Also, respondents' perception on response efficacy changes positively (pre-test: $\mu = 6.1486$, std = 0.74130; post-test: $\mu = 6.2814$, std = 0.61523) after they viewed the learning content, suggesting that respondents agree with the fact that preserving traditional

buildings is an effective way to protect Luang Prabang. Furthermore, the agreement on the benefits of world heritage site inscription were also increased significantly (pre-test: μ = 6.2232, std = 0.80455; post-test: μ = 6.3559, std = 0.67923) after respondents viewed the learning content, indicating the agreement that world heritage site inscription will bring along social and national benefits. Finally, respondents expect themselves to engage in constructive actions for the preservation of Luang Prabang (pre-test: μ = 5.727, std = 0.876; post-test: μ = 5.994, std = 0.794).



SEV: perceived severity, VUL: perceived vulnerability, PRE: perceived response efficacy, REF: response efficacy, PBI: perceived benefits of inscription, BEX: behavioral expectation

Figure 6.2: Bar graph comparing the mean changes before and after respondents read the learning content

Although the change of means for perceived resident effectiveness (pre-test: μ = 5.8060, std = 0.90179; post-test: μ = 5.9555, std = 0.91407) is not statistically significant (μ = 0.1475, p=0.080), the total mean values for each of the perceptions are already on the strong agreement range (near to scale 7). Result suggests that even before the intervention of learning content, respondents agree that their actions could bring positive impact to Luang Prabang with regard to preservation.

As explained in section 2.2.1 in Chapter 2, the premise of learning is stimuli and perception. Furthermore, literature shows that "meaningful stimuli will be processed to a deep level more rapidly and will be well-retained" (Craik & Lockhart, 1972, p.676). Hence, while this mean difference analysis result, which was conducted within the same day, does

not reflect immediate learning effect, the result has provided indication on the effect of the learning content on perception. Next section presents interview result with regard to the use of mobile learning to promote world heritage site preservation awareness.

The findings from both quantitative and qualitative result suggest that mobile learning is an effective tool to promote world heritage site preservation awareness among the young adults. Next chapter discusses the findings of this study.

CHAPTER 7

DISCUSSION AND CONCLUSION

This chapter provides discussion on the data analysis results. Based on the observed results, implications for research and practice are outlined. In addition, this chapter presents suggestions for future studies, to enhance the understanding of this research. Finally, this chapter ends with the limitations of this research and conclusion.

7.1 General Discussion

Local residents who are living in a world heritage site remain as one of the key stakeholders when confronting with the issue of preservation. The sudden change of status as a humble living city to a place where the world's attention is focusing on demands a shift of local residents' behavior in treating their original living space. While visitors are often blamed as the source of world heritage site deterioration, reports show that local residents could also be the source of harm to the world heritage site (Pedersen, 2002). Thus far, however, theories explaining local residents' motivation to preserve world heritage site is lacking. This research fills this knowledge gap by borrowing the theoretical lens from PMT, and conducted an empirical research based on local residents in the world heritage town of Luang Prabang, Lao PDR.

Overall, the modified PMT explains 34.7% of the variance of local young adults' behavioral expectation to preserve world heritage site. Two new variables, namely perceived benefits of inscription and perceived resident efficacy were integrated into the PMT. There are several new findings regarding the drivers of world heritage site preservation motivation. First, perceived benefits of inscription was found to be the determinant of preservation motivation. In this study, perceived benefits of inscription refers to the positive factors associated with the inscription of world heritage site, and was measured by the extent of world heritage site inscription brings benefits to the country and society of town of Luang Prabang. This finding is consistent with study conducted by Vodouhê, Coulibaly, Adégbidi, and Sinsin (2010). The authors found strong correlation between perceived benefits and

positive perception of conservation, in particular when conservation benefits the local communities (Vodouhê et al., 2010). Accordingly, respondents in this study think that the inscription of town of Luang Prabang as world heritage site may bring along benefits to social and national development, and therefore forms positive attitude toward preservation of town of Luang Prabang.

Second, while perceived benefits of inscription is hypothesized as a direct antecedent of behavioral expectation to preserve world heritage site, it also explains the relationship between perceived severity and behavioral expectation to preserve world heritage site. This finding is somewhat contrasting with the conceptualization of perceived benefits in behavior change theories. In behavior change theory, people who recognize the seriousness of current behavior will act on recommended behavior as a result of perceived benefits of the consequence of change of behavior. However, this study shows that benefits of positive factors *per se* is the reason why people who perceive seriousness of current behavior will act on recommended behavior, at least in the case of world heritage site preservation. Studies on human behavior provide evidence that experience of negative outcome enables individuals to derive perceived benefits following negative experience (Wadey et al. 2011). Thus, perceived severity of losing world heritage site status may have enabled respondents in this study to appreciate the benefits brought along by world heritage site inscription. Consequently, this affects respondents' attitude towards preservation.

Third, perceived resident efficacy significantly influences preservation motivation of world heritage site. Research has shown that in order for a recommended action to be taken, an individual has to be convinced that their actions can help change the outcomes (Ellen et al., 1991; Vermeir & Verbeke, 2006). According to the study result, respondents' belief that their effort as part of the community can contribute to the preservation of world heritage site.

Fourth, perceived residents effectiveness explains the relationship between response efficacy and behavioral expectation to preserve world heritage site. This finding indicates that an individual will engage in adaptive behavior based on his or her positive belief of recommended threat avoidance actions as they believe in their effort in making a difference. This is a consistent with the logic depicted in the third point above. Therefore, respondents who believe in the effectiveness of the recommended actions to preserve world heritage site, they will engage the actions accordingly to preserve because they believe that their effort can contribute positively to town of Luang Prabang.

Fifth, original PMT variables significantly affect preservation motivation, except for perceived vulnerability. Perceived severity was found to affect behavioral expectation. This

finding is consistent with behavior change theories that individual must first recognize that the maladaptive behavior brings deleterious consequences before any adaptive behavior is followed (Witte, 1994). Hence, it can be inferred that respondents in this study recognize the seriousness of maladaptive behavior, such as failure to preserve heritage buildings, would bring to the town of Luang Prabang. Further, the result indicates that response efficacy affects behavior expectation to preserve world heritage site. This finding is consistent with the original conception of PMT that fear appeal will not initiate any protection behavior without providing appropriate recommended solution to overcome the negative consequences (R. Rogers & Mewborn, 1976). This study shows that respondents perceive preserving heritage buildings as one of the effective solutions toward the preservation of world heritage town of Luang Prabang.

A contrasting result was found in this study. Perceived vulnerability, however, has no effect on behavioral expectation to preserve world heritage site. One possible explanation could be due to the result of defensive interpretation, as perceived vulnerability has been found to be irrelevant when extreme negative consequences are presented (Dziokonski & Weber, 1977). In this study, respondents were asked about their perception on the likelihood that town of Luang Prabang may lose its traditional heritage as well as world heritage site status. These questions may deemed too extreme and unrealistic with what is perceived by the respondents. This could be interpreted that the respondents recognize the potential harm currently Luang Prabang is facing may not as great to the extent of losing traditional heritage or the status of world heritage site. Further, Weinstein (1984) found that risk thought to be controllable will evoke optimism about vulnerability. Respondents in this study may be optimistic about the preservation status of town of Luang Prabang. The lower average mean values (the lower, the less probable) of perceived vulnerability in comparison with other perceptions provides support to this explanation.

Sixth, mobile learning application has a potential to promote world heritage site preservation awareness. This finding comes from two perspectives, target users and policy makers. Pre and post-test on perception using mobile learning content shows that mobile learning content improves users' perception. This outcome is further supported by interview result with users. Interviewees acknowledge three strengths of mobile learning application. First, they trust that the mobile learning application contribute to expanding their knowledge about world heritage site preservation. Second, they express the appropriateness of mobile learning for their generation from the perspectives of "just in time" and "anywhere anytime" learning habit. Third, they possess strong interest of using mobile learning and think that

more people can benefit from the mobile learning application. From the policy makers' perspective, the mobile learning application supplements awareness campaign activities by approaching to the local residents' through a new channel, which is also one of the most diffused technology in Luang Prabang. In the report of Mobile Learning Week, UNESCO states, while developing world faces book shortages, "increasingly however, people do have access to a working mobile device, even people living in areas of extreme poverty" (UNESCO, 2013). Thus, the findings of this study are in line with the trend of mobile learning implementation in international development arena.

7.2 Research implication

This study contributes to literature in the following four ways. First, this study has provided an empirical evidence that the Protection Motivation Theory is a useful framework for the evaluation of world heritage site preservation motivation. The Protection Motivation Theory originally explains how fear appeal will affect individual to engage in protection behavior. It has been primarily being a popular framework in the analysis of health protection behavior. Subsequently, Protection Motivation Theory has been applied in domains beyond health protection, such as predicting individuals' environmental protection behavior and organizational information protection behavior. This study is the first in applying the Protection Motivation Theory in the context of world heritage site preservation. Result shows that 34.7% of the preservation motivation is explained by the factors hypothesized in this study based on the Protection Motivation Theory.

Second, perceived benefits of inscription and perceived resident effectiveness appear to be salient variables in the context of world heritage site preservation. As depicted in the general discussion, perceived benefits of inscription as a belief of the positive factors of world heritage site *per se* will affect preservation motivation. As a new variable derived from perceived consumer effectiveness, perceived resident effectiveness was also found to be related with world heritage site preservation motivation. In essence, the successful integration of the two new variables in the PMT has enabled the development of world heritage site preservation motivation model.

Third, this study provides explanation on the mechanism of perceived severity and response efficacy influence on protection motivation. This is an answer to the critics by Witte (1994) that the PMT merely provides "what" affects protection motivation, but not "how" the proposed factors affect protection motivation. In particular, the context of world heritage site

preservation, perceived benefits of inscription mediates the relationship between perceived severity and behavioral expectation to preserve. Furthermore, this study shows that perceived residents effectiveness mediates the relationship between response efficacy and behavioral expectation to preserve.

Finally, this study has validated the applicability of behavioral expectation as a measurement of protection motivation. Venkatesh et al. (2000) has recommended the investigation of behavioral expectation in studying by user behavior instead of behavioral intention because behavioral expectation includes the appraisal of other possible factors in carrying out a behavior. Therefore, behavioral expectation can accurately predict behavior. Rogers (1983) states that while there is no fix conceptualization of protection motivation, many studies have been using behavioral intention as a concept to protection motivation. Based on the previous arguments, this study adopts behavioral expectation as the dependent variable and successfully found to be a valid outcome of protection motivation.

7.3 Practical implication

The outcome of this study is particularly useful in the design of public communication contents to promote world heritage site preservation awareness. In order to investigate the impact of the modified PMT, a set of pre and post test was conducted based on the theoretical framework of this study. Result indicates that respondents' perception and world heritage site preservation motivation changed positively before and after the intervention of the mobile learning content. Hence, the proposed framework has practical impact in promoting world heritage site preservation awareness. This study suggests that, first, public communication content should explain the seriousness of maladaptive behaviors with regard to world heritage site preservation, following the recommended solution to achieve preservation objectives. Further, new findings in this study indicate that it is also important to educate the public with regard to the benefits brought along by the inscription of world heritage site. Also, when proposing recommended solutions to preserve world heritage site, these solutions should be deemed achievable by the public. It is important to the public that their cooperation in following the recommended solutions contributes to the success of preservation. Further, this study suggests that mobile learning is an appropriate approach to promote world heritage site preservation awareness in developing country. This study has reported the positive impact of learning content delivered in the form of mobile learning,

given that mobile phone ownership is high and expanding among young generation in the world heritage town of Luang Prabang.

7.4 Limitations and Future Research

A limitation of this study can be discussed from four perspectives. First, the use of student sample and convenience sampling may limit the generalizability of the findings of this study. Hence, future research is suggested to expand the sample selection across age and job background in order to increase result generalizability. Second, this study does not considering the actual behavior. Although behavioral expectation measures the willingness of an individual to perform an action, future study should consider developing measures to assess actual behavior of world heritage site preservation. Third, variance explained indicates that there are other factors not accounted in the proposed theoretical framework. Thus, future research should investigate other possible factors which may contribute to individual's preservation motivation. Fourth, the target protection of heritage buildings is focus in questionnaire. While protection of heritage buildings as an effective approach to preserve world heritage town of Luang Prabang, future research should also examine the applicability of the modified Protection Motivation Theory including intangible heritage. Future studies should also test the modified PMT in other world heritage sites to validate the applicability of the theoretical framework.

7.5 Conclusion

This study aimed at applying PMT to explain world heritage site preservation awareness in world heritage town of Luang Prabang, Lao PDR. In addition to the three original variables of PMT, the theory was modified by integrating two new variables, namely perceived benefits of inscription and perceived resident efficacy. Both of these new variables complement the original Protection Motivation Theory by providing explanation of how perceived severity and response efficacy influence behavioral expectation of preservation. Furthermore, the impact of proposed theoretical framework was tested in a set of pre and post-test through the use of mobile learning application. Positive outcomes were observed from the pre and post-test. The findings of this research will not only help heritage management practitioners to develop better public communication strategies to promote world heritage site preservation awareness, but also provide insights into research on world heritage site preservation promotion.

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APPENDICES

Appendix 1: Questionnaire

ກະລຸນາອ່ານປະໂຫຍກຂ້າງລຸ່ມນີ້ຢ່າງ ລະອຽດ ແລະ ຕອບແບບສອບຖາມ /

Please carefully read the following statements before answering the questionnaire:

1. ກະລຸນາຕອບ**ໝົດທຸກ**ຄຳຖາມ (ການບໍ່ຕອບຄຳຖາມໃດນຶ່ງຈະພາໃຫ້ຂໍ້ມູນບໍ່ຊັດເຈນ) / Please answer **ALL** questions (leaving a question unanswered will lead to inaccurate data).

2. ກະລຸນາໃຊ້ເວລາຂອງທ່ານປຶດຫນຶ່ງເພື່ອປ້ອນຂໍ້ມູນໃສ່ແບບສອບຖາມ (ປະມານ 15 ນາທີ) / Please take some time to complete this questionnaire (approximately 15 minutes).

3. ກະລຸນາເຂົ້າໃຈວ່າ ບໍ່ມີຄຳຕອບທີ່ຖືກ ຫຼື ຜິດ / Please keep in mind that there are no right and wrong response.

ຂໍ້ມູນປະຊາກອນ / Demographic Data

ເພດ / Gender	ຊາຍ / Male	ຍິງ / Female			
ກຸ່ມອາຍຸ / Age Group	16 - 18	19 - 21	22 – 24	25 and over / 25 ປີຂຶ້ນໄປ	
ລະດັບ / Level	ມັດທະຍົມປາຍ/High School	ວິທະຍາໄລ / College	ມະຫາວິທະຍາໄລ / University		
ມາຈາກແຂວງໃດ/Which province are you from?					
ແຂວງອັດຕະປື Attapu Province	ແຂວງບໍ່ແກ້ວ Bokèo Province	ແຂວງບໍລິຄຳໄຊ Bolikhamxai Province	ແຂວງຈຳປາສັກ Champasak Province	ແຂວງຫົວພັນ Houaphan Province	Salavan Province ແຂວງເຊກອງ Xékong Province
ແຂວງຄຳມ່ວນ Khammouan Province	ແຂວງຫຼວງນ້ຳທາ Luang Namtha Province	ແຂວງຫຼວງພະບາງ Louangphabang Province	ແຂວງຜົ້ງສາລີ Phôngsali Province	ແຂວງອຸດົມໄຊ Oudômxai Province	ແຂວງສະຫວັນນະເຂດ Savannakhét Province
ແຂວງໄຊຍະບຸລີ Xaignabouli Province	ແຂວງຊຽງຂວາງ Xiangkhouang Province	ນະຄອນຫຼວງ Vientiane Capital	ແຂວງວຽງຈັນ Vientiane Province		
ມືຖືທ່ານມີລະບົບ 3ຈີ ຫຼື ໄອ-ໄຟ ຫຼືບໍ່ / Does your phone have WIFI or 3G function?					
ມີ / Yes	ບໍ່ມີ / No	ບໍ່ຮູ້ຈັກ / I don't know			
ທ່ານມັກນຳໃຊ້ອິນເຕີເນັດຜ່ານມືຖືຊໍ້າໃດ / How often do you use the Internet via mobile phone?					
ທຸກມື້/Daily	ອາທິດ/Weekly	ເດືອນ/Monthly	ຕ່ຳກວ່າເດືອນລະຄັ້ງ/Less than once a month	ບໍ່ເຄີຍ/Never	

ພາກທີ1: ກະລຸນາໝາຍໃສ່ວ່າ ທ່ານເຫັນດີຫຼາຍຊໍ້າໃດກັບປະໂຫຍກຕໍ່ໄປນີ / Section 1: Please state how much do you agree with the following statements

			ບໍ່ເຫັນດີ Disagree						ເຫັນດີ Agree
1.	S1	ຂ້າພະເຈົ້າຄິດວ່າ ເມືອງຫຼວງພະບາງຈະສູນເສຍ ນາມມະຍົດ "ເມືອງມໍລະດົກໂລກ" ຖ້າວ່າພວກເຮົາບໍ່ປົກປັກຮັກສາວັດວາອາຮາມ, ສິ່ງປຸກສ້າງແບບພື້ນເມືອງລາວ ແລະ ແບບຝຼັ່ງ I think Town of Luang Prabang will lose its "World Heritage Site" status if we do not preserve the temples, Lao traditional buildings, and French colonial buildings.	1	2	3	4	5	6	7
2	S2	ຂ້າພະເຈົ້າຄິດວ່າມັນເປັນບັນຫາໃຫຍ່ ຖ້າວ່າພວກເຮົາບໍ່ປົກປັກຮັກສາວັດວາອາຮາມ, ສິ່ງປຸກສ້າງແບບພື້ນເມືອງລາວ ແລະ ແບບຝຼັ່ງ ໃນເມືອງຫຼວງພະບາງ / I think it is a serious problem if we do not preserve the temples, Lao traditional buildings, and French colonial buildings in the Town of Luang Prabang.	1	2	3	4	5	6	7
3	S3	ຂ້າພະເຈົ້າຄິດວ່າ ຈະມີຜົນກະທົບທາງດ້ານລົບຕໍ່ເມືອງຫຼວງພະບາງ ຖ້າວ່າພວກເຮົາບໍ່ປົກປັກຮັກສາວັດວາອາຮາມ, ສິ່ງປຸກສ້າງແບບພື້ນເມືອງລາວ ແລະ ແບບຝຼັ່ງ / I think there will be negative impact on Town of Luang Prabang if we do not preserve the temples, Lao traditional buildings, and French colonial buildings.	1	2	3	4	5	6	7
4	S4	ຂ້າພະເຈົ້າຄິດວ່າ ມັນເປັນບັນຫາໃຫຍ່ຕໍ່ເມືອງຫຼວງພະບາງ ຖ້າວ່າ ວັດວາອາຮາມ, ສິ່ງປຸກສ້າງແບບພື້ນເມືອງລາວ ແລະ ແບບຝຼັ່ງ ຖືກທຳລາຍ / I think it is a serious problem to Town of Luang Prabang if the temples, Lao traditional buildings, and French colonial buildings are destroyed.	1	2	3	4	5	6	7
5	R1	ຂ້າພະເຈົ້າຄິດວ່າ ມໍລະດົກດັ້ງເດີມຂອງເມືອງຫຼວງພະບາງສາມາດຮັກສາໄດ້ ຖ້າວ່າພວກເຮົາປົກປັກຮັກສາວັດວາອາຮາມ, ສິ່ງປຸກສ້າງແບບພື້ນເມືອງລາວ ແລະ ແບບຝຼັ່ງໄວ້ / I think Town of Luang Prabang original heritage can be kept if we preserve the temples, Lao traditional buildings, and French colonial buildings.	1	2	3	4	5	6	7

6	R2	ຂ້າພະເຈົ້າຄິດວ່າ ການປົກປັກຮັກສາວັດວາອາຮາມ, ສິ່ງປຸກສ້າງແບບພື້ນເມືອງລາວ ແລະ ແບບຝຼັ່ງ ແມ່ນມີຜົນຕໍ່ ການບຳລຸງຮັກສາ ຫຼວງພະບາງເມືອງມໍລະດົກໂລກ I think preserving the temples, Lao traditional buildings, and French colonial buildings is effective to maintain Town of Luang Prabang World Heritage Site.	1	2	3	4	5	6	7
7	R3	ຂ້າພະເຈົ້າຄິດວ່າ ເມືອງຫຼວງພະບາງສາມາດຮັກສານາມມະຍົດ "ເມືອງມໍລະດົກໂລກ" ໄວ້ໄດ້ ຖ້າວ່າ ພວກເຮົາປົກປັກຮັກສາວັດວາອາຮາມ, ສິ່ງປຸກສ້າງແບບພື້ນເມືອງລາວ ແລະ ແບບຝຼັ່ງໄດ້ I think Town of Luang Prabang can maintain its "World Heritage Site" status if we preserve the temples, Lao traditional buildings, and French colonial buildings.	1	2	3	4	5	6	7
8	R4	ຂ້າພະເຈົ້າຄິດວ່າ ພວກເຮົາສາມາດປ້ອງກັນເມືອງຫຼວງພະບາງບໍ່ໃຫ້ສູນເສຍນາມມະຍົດ "ເມືອງມໍລະດົກໂລກໄດ້ຖ້າວ່າ ພວກເຮົາ ດຳເນີນການຢ່າງເໝາະສົມໃນການປົກປັກຮັກສາວັດວາອາຮາມ, ສິ່ງປຸກສ້າງແບບພື້ນເມືອງລາວ ແລະ ແບບຝຼັ່ງໄວ້ I think we can **prevent** Town of Luang Prabang from losing its "World Heritage Site" status if we take proper actions to preserve the temples, Lao traditional buildings, and French colonial buildings.	1	2	3	4	5	6	7
9	PCE1	ຂ້າພະເຈົ້າເຊື່ອວ່າ ຕົນເອງສາມາດເຮັດສິ່ງທີ່ດີເພື່ອປ້ອງກັນ ເມືອງມໍລະດົກໂລກຫຼວງພະບາງ I believe I can do something positive to protect Town of Luang Prabang World Heritage Site.	1	2	3	4	5	6	7
10	PCE2	ຂ້າພະເຈົ້າເຊື່ອວ່າການກະທຳຂອງແຕ່ລະຕົນສາມາດມີຜົນໃນແງ່ດີຕໍ່ເມືອງມໍລະດົກໂລກຫຼວງພະບາງ I believe each person's action can have a positive effect on Town of Luang Prabang World Heritage Site.	1	2	3	4	5	6	7
11	PCE3	ຂ້າພະເຈົ້າເຊື່ອວ່າ ຄວາມພະຍາຍາມຂອງຕົນເອງສາມາດນຳຜົນດີມາສູ່ເມືອງມໍລະດົກໂລກຫຼວງພະບາງ I believe my effort can bring positive effect on Town of Luang Prabang World Heritage Site.	1	2	3	4	5	6	7

12*	PCE14	ຄົນຜູ້ໜຶ່ງບໍ່ສາມາດເຮັດຫຍັງໄດ້ຫຼາຍໃນການປົກປັກຮັກສາເມືອງມໍລະດົກໂລກຫຼວງພະບາງ There is nothing much a person can do to protect Town of Luang Prabang World Heritage Site. (negative phrase)	1	2	3	4	5	6	7
13	PBI1	ຂ້າພະເຈົ້າຄິດວ່າ ການຂຶ້ນບັນຊີຫຼວງພະບາງເປັນເມືອງມໍລະດົກໂລກໄດ້ນຳເອົາສິ່ງທີ່ດີມາສູ່ສັງຄົມໃນເມືອງຫຼວງພະບາງ I think the inscription of Town of Luang Prabang as a World Heritage Site brings along positive impact to the country and the society in the Town of Luang Prabang.	1	2	3	4	5	6	7
14	PBI2	ຂ້າພະເຈົ້າຄິດວ່າ ການຂຶ້ນບັນຊີຫຼວງພະບາງເປັນເມືອງມໍລະດົກໂລກໄດ້ນຳເອົາຜົນປະໂຫຍດມາສູ່ສັງຄົມ ຂອງ ເມືອງຫຼວງພະບາງ I think the inscription of Luang Prabang as a World Heritage Site brings along advantages to the country and the society of Town of Luang Prabang.	1	2	3	4	5	6	7
15	PBI3	ຂ້າພະເຈົ້າຄິດວ່າ ການຂຶ້ນບັນຊີຫຼວງພະບາງເປັນເມືອງມໍລະດົກໂລກແມ່ນເອື້ອອຳນວຍໃຫ້ແກ່ສັງຄົມຂອງເມືອງຫຼວງພະບາງ I think the inscription of Town of Luang Prabang as a World Heritage Site is favourable to the country and he society of Town of Luang Prabang.	1	2	3	4	5	6	7
16	PBI4	ຂ້າພະເຈົ້າຄິດວ່າ ສັງຄົມຂອງເມືອງຫຼວງພະບາງໄດ້ຮັບຜົນປະໂຫຍດຈາກການຂຶ້ນບັນຊີເປັນເມືອງມໍລະດົກໂລກ I think the country and the society of Town of Luang Prabang gains benefit from the inscription of World Heritage Site.	1	2	3	4	5	6	7

ສຳລັບຄຳຖາມທີ 17 -20, ຖ້າພວກເຮົາບໍ່ປົກປັກຮັກສາວັດວາອາຮາມ, ສິ່ງປຸກສ້າງແບບພື້ນເມືອງລາວ ແລະ ແບບຝຼັ່ງ ...

For questions 17 to Question 20, If we do not preserve the temples, Lao traditional buildings, and French colonial buildings …

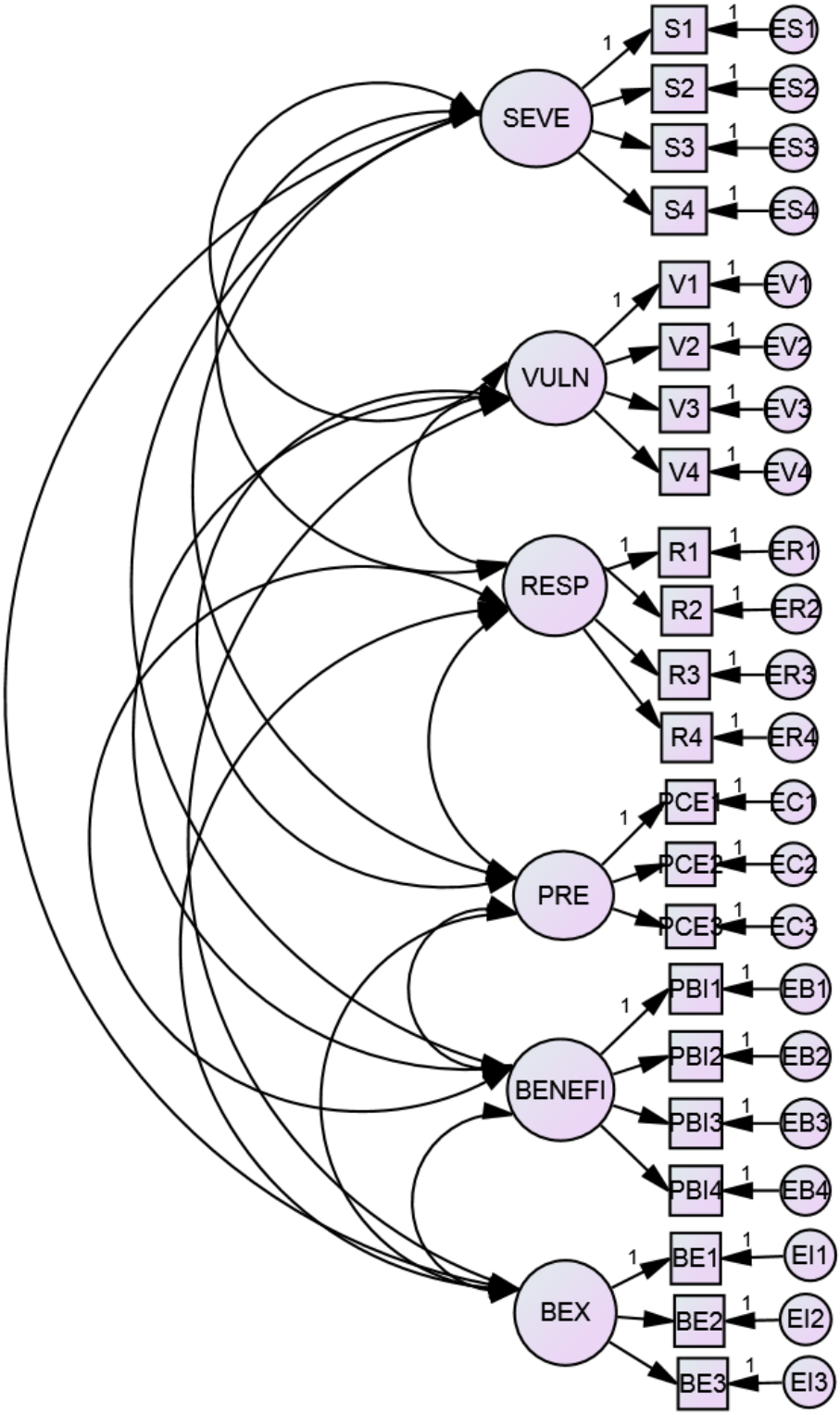
			ບໍ່ໜ້າຈະເປັນໄປໄດ້ Impossible						ອາດຈະເປັນໄປໄດ້ Possible
17	V1	ທ່ານຄິດວ່າມີຄວາມເປັນໄປໄດ້ຊໍ່າໃດ ທີ່ເມືອງຫຼວງພະບາງຈະສູນເສຍນາມມະຍົດ "ເມືອງມໍລະດົກໂລກ" How possible do you think that Town of Luang Prabang will lose its "World Heritage Site" status?	1	2	3	4	5	6	7
18	V2	ທ່ານຄິດວ່າມີຄວາມເປັນໄປໄດ້ຊໍ່າໃດ ທີ່ວ່າມີຜົນກະທົບດ້ານລົບຕໍ່ເມືອງຫຼວງພະບາງ How possible do you think that there will be a negative impact on Town of Luang Prabang?	1	2	3	4	5	6	7
19	V3	ທ່ານຄິດວ່າມີຄວາມເປັນໄປໄດ້ຊໍ່າໃດ ທີ່ວ່າມັນເປັນບັນຫາໃຫຍ່ສຳຫຼັບເມືອງຫຼວງພະບາງ How possible do you think that it will be serious problem for Town of Luang Prabang?	1	2	3	4	5	6	7
20	V4	ທ່ານຄິດວ່າມີຄວາມເປັນໄປໄດ້ຊໍ່າໃດ ທີ່ວ່າມໍລະດົກດັ້ງເດີມຂອງເມືອງຫຼວງພະບາງຈະຖືກສູນເສຍ How possible do you think that Town of Luang Prabang original heritage will be lost?	1	2	3	4	5	6	7
21	BE1	ມີຄວາມເປັນໄປໄດ້ຊໍ່າໃດ ທີ່ທ່ານຈະດຳເນີນການຊຶ່ງມີຜົນດີໃຫ້ແກ່ເມືອງມໍລະດົກໂລກຫຼວງພະບາງ How possible will you do something positive to the Town of Luang Prabang World Heritage Site?	1	2	3	4	5	6	7
22	BE2	ມີຄວາມເປັນໄປໄດ້ຊໍ່າໃດ ທີ່ທ່ານຈະດຳເນີນການຊຶ່ງສາມາດນຳເອົາຜົນປະໂຫຍດມາສູ່ເມືອງມໍລະດົກໂລກຫຼວງພະບາງ How possible will you do something good to Town of Luang Prabang World Heritage Site?	1	2	3	4	5	6	7
23	BE3	ມີຄວາມເປັນໄປໄດ້ຊໍ່າໃດ ທີ່ທ່ານຈະດຳເນີນການຊຶ່ງເປັນປະໂຫຍດໃຫ້ແກ່ເມືອງມໍລະດົກໂລກຫຼວງພະບາງ How possible will you do something beneficial to Town of Luang Prabang World Heritage Site?	1	2	3	4	5	6	7
24	BE4	ມີຄວາມເປັນໄປໄດ້ຊໍ່າໃດ ທີ່ທ່ານຈະດຳເນີນການຊຶ່ງຈະທຳລາຍມໍລະດົກດັ້ງເດີມຂອງເມືອງຫຼວງພະບາງ (ດ້ານລົບ) How possible will you destroy original heritage of Town of Luang Prabang? (Negative)	1	2	3	4	5	6	7
25	BE5	ມີຄວາມເປັນໄປໄດ້ຊໍ່າໃດ ທີ່ທ່ານຈະດຳເນີນການຊຶ່ງເປັນຜົນເສຍສຳຫຼັບເມືອງມໍລະດົກໂລກຫຼວງພະບາງ (ດ້ານລົບ) How possible will you do something harmful for Town of Luang Prabang World Heritage Site? (Negative)	1	2	3	4	5	6	7

Appendix 2: List of quiz questions

"e1.Which year Pakhan Temple was built?",
"e2.Which year XiengThong Temple was built?",
"e3.Who was the leader who built Xiengthong temple?",
"e4.Which year Mai Temple was built?",
"e5.Who was the leader who built Mai temple?",
"e6.Which year Pafang Temple was built?",
"e7.Who was the leader who built Pafang temple?",
"e8.Which year Vixun Temple was built?",
"e9.Who was the leader who built Vixun temple?",
"e10.Which year That Mak Mo Stupa was built?",
"e11.Who was the leader who built That Mak Mo Stupa temple?",
"e12.Which year Chomsi stupa was built?",
"e13.Who was the leader who built Chomsi stupa?",
"e14.Which month is rocket festival?",
"e15.Which month is Lao New Year festival?",
"e16.Which month is Boat racing festival?",
"e17.Which country “Prabang” was made?”,
"e18.Which country was King fa ngoum took “Prabang” from?”,
"e19.When Luangprabang was inscribed to the world heritage list?",
"e20.In Luangprabang, how many building was inscribed to the world heritage list ?",
"e21.In Luangprabang, how many pond was inscribed to the world heritage list ?",
"e22.How wide is the area of Luangprabang World heritage site?",
"e23.Who proposed Luangprabang to be inscribed as world heritage site?",
"e24.Which costume is unique of Lao Women?",
"e25.Which material presents Luangprabang world heritage value?",
"e26.Luang Prabang was elected as <World Top City> by which magazine from which country?",
"e27.Who is the owner of Luangprabang World heritage city?",
"e28.Who is responsible for the preservation of Luang Prabang world heritage city?",
"e29.Who is harmful for Luang Prabang world heritage city?",
"e30.How to sustainably preserve Luang Prabang as world heritage city?"

Appendix 3: Learning content in mobile application (Lao language)

Appendix 4a: Measurement model



Appendix 4b: Measurement model sample covariance matrix

	R2	R4	S4	BE3	PBI4	PBI3	PBI2	PBI1	PCE3	PCE2	PCE1	R3	R1	V4	V3	V2	V1	S3	S2	S1	BE2	BE1
R2	1.620																					
R4	.120	.595																				
S4	.126	.269	1.557																			
BE3	.090	.117	.173	.848																		
PBI4	.148	.162	.360	.224	.723																	
PBI3	.187	.206	.129	.226	.410	.723																
PBI2	.111	.212	.182	.217	.408	.385	.618															
PBI1	.060	.209	.206	.156	.368	.372	.351	.694														
PCE3	-.021	.124	.011	.309	.135	.177	.181	.135	1.052													
PCE2	.118	.063	.072	.253	.145	.091	.117	.066	.584	1.214												
PCE1	.119	.136	.095	.322	.115	.153	.120	.122	.684	.751	1.176											
R3	.138	.283	.248	.064	.156	.169	.200	.259	.077	.159	.143	.616										
R1	.169	.339	.224	.079	.162	.180	.198	.246	.071	.154	.136	.274	.545									
V4	.033	.042	.157	-.042	.143	.096	.014	-.040	.047	-.100	.074	-.157	-.081	4.521								
V3	.065	-.007	.173	-.043	.072	-.065	.051	-.070	.039	.246	.145	.014	-.021	2.383	2.928							
V2	-.029	-.051	.203	.007	.154	.042	-.025	-.020	-.076	-.036	-.074	-.147	-.032	2.330	1.895	2.642						
V1	-.187	-.113	.031	-.155	.101	-.041	-.011	-.029	-.089	.013	-.121	-.108	-.016	2.986	2.153	2.297	3.691					
S3	.041	.330	.519	.163	.141	.125	.189	.226	.109	.105	.130	.233	.216	.300	.089	-.014	-.036	.846				
S2	.255	.288	.659	.127	.282	.208	.244	.262	.095	.156	.148	.301	.268	.176	.107	.065	-.077	.537	1.121			
S1	.080	.398	.714	.123	.183	.143	.230	.180	.029	.048	.046	.299	.247	.345	.179	.245	.195	.625	.641	1.265		
BE2	.119	.231	.146	.339	.152	.202	.181	.264	.252	.183	.326	.194	.211	.098	.021	.052	-.065	.165	.164	.230	.921	
BE1	.173	.179	.174	.357	.147	.147	.158	.221	.273	.216	.425	.205	.147	-.153	-.079	-.137	-.216	.133	.121	.142	.609	.853

Appendix 4c: Measurement model model-implied covariance matrix

	R2	R4	S4	BE3	PBI4	PBI3	PBI2	PBI1	PCE3	PCE2	PCE1	R3	R1	V4	V3	V2	V1	S3	S2	S1	BE2	BE1
R2	1.620																					
R4	.160	.595																				
S4	.137	.312	1.557																			
BE3	.054	.124	.099	.848																		
PBI4	.097	.219	.210	.119	.723																	
PBI3	.094	.215	.206	.116	.399	.723																
PBI2	.094	.213	.204	.115	.396	.387	.618															
PBI1	.089	.203	.195	.110	.377	.369	.366	.694														
PCE3	.049	.111	.079	.168	.109	.106	.105	.101	1.052													
PCE2	.052	.119	.085	.181	.117	.115	.114	.108	.554	1.214												
PCE1	.066	.149	.107	.227	.147	.144	.142	.136	.695	.749	1.176											
R3	.134	.304	.261	.103	.183	.180	.178	.170	.093	.100	.125	.616										
R1	.143	.325	.279	.111	.196	.192	.191	.182	.099	.107	.134	.272	.545									
V4	-.030	-.068	.143	-.059	.028	.028	.028	.026	-.011	-.012	-.015	-.057	-.061	4.521								
V3	-.023	-.051	.109	-.045	.022	.021	.021	.020	-.008	-.009	-.011	-.043	-.046	2.357	2.928							
V2	-.023	-.053	.111	-.046	.022	.022	.021	.020	-.008	-.009	-.011	-.044	-.047	2.413	1.835	2.642						
V1	-.028	-.064	.135	-.056	.027	.026	.026	.025	-.010	-.011	-.014	-.053	-.057	2.930	2.228	2.280	3.691					
S3	.121	.275	.553	.088	.186	.182	.180	.172	.070	.075	.094	.230	.246	.126	.096	.098	.119	.846				
S2	.133	.303	.609	.096	.204	.200	.198	.189	.077	.083	.104	.253	.271	.139	.106	.108	.131	.537	1.121			
S1	.152	.345	.694	.110	.233	.228	.226	.216	.088	.094	.118	.289	.309	.158	.120	.123	.150	.612	.673	1.265		
BE2	.088	.200	.161	.358	.192	.188	.187	.178	.272	.293	.367	.168	.179	-.096	-.073	-.075	-.091	.142	.156	.178	.921	
BE1	.091	.207	.166	.370	.199	.195	.193	.184	.281	.302	.379	.173	.185	-.099	-.075	-.077	-.094	.146	.161	.184	.600	.853

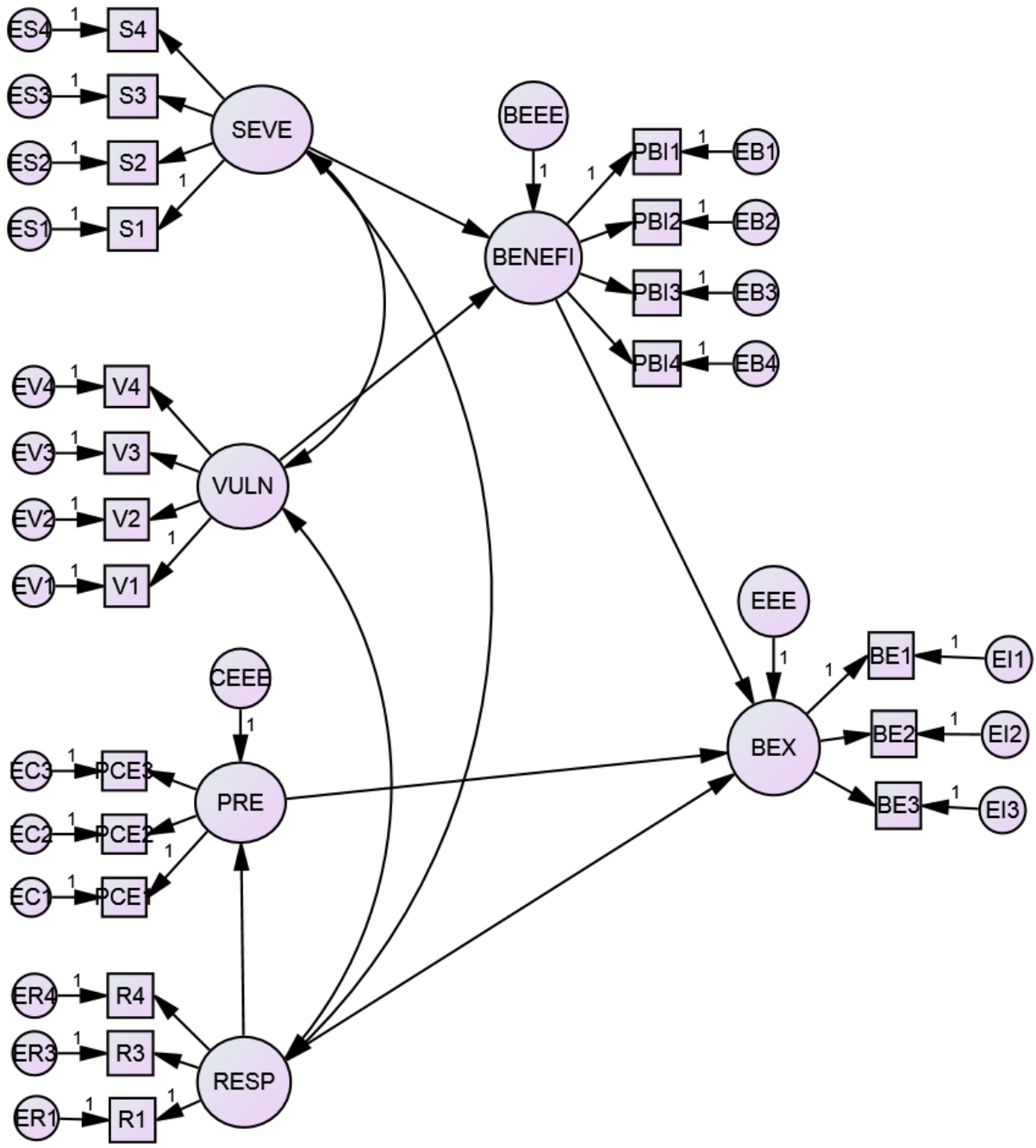
Appendix 4d: Measurement model residual matrix

	R2	R4	S4	BE3	PBI4	PBI3	PBI2	PBI1	PCE3	PCE2	PCE1	R3	R1	V4	V3	V2	V1	S3	S2	S1	BE2	BE1
R2	.000																					
R4	-.039	.000																				
S4	-.011	-.043	.000																			
BE3	.036	-.007	.074	.000																		
PBI4	.052	-.057	.150	.106	.000																	
PBI3	.093	-.008	-.077	.110	.011	.000																
PBI2	.017	-.001	-.022	.102	.013	-.002	.000															
PBI1	-.029	.006	.011	.046	-.010	.002	-.016	.000														
PCE3	-.069	.014	-.068	.141	.026	.070	.075	.034	.000													
PCE2	.065	-.056	-.013	.072	.028	-.023	.004	-.043	.030	.000												
PCE1	.054	-.014	-.012	.095	-.032	.009	-.022	-.014	-.011	.002	.000											
R3	.004	-.020	-.013	-.040	-.027	-.010	.022	.089	-.015	.059	.018	.000										
R1	.026	.014	-.055	-.032	-.034	-.012	.008	.064	-.028	.047	.002	.002	.000									
V4	.062	.109	.014	.017	.115	.068	-.013	-.067	.058	-.089	.089	-.100	-.020	.000								
V3	.087	.045	.064	.002	.050	-.086	.030	-.090	.047	.254	.156	.057	.025	.025	.000							
V2	-.006	.002	.092	.053	.132	.020	-.047	-.040	-.067	-.027	-.063	-.103	.015	-.084	.061	.000						
V1	-.158	-.049	-.104	-.099	.074	-.068	-.037	-.054	-.079	.023	-.107	-.055	.041	.056	-.075	.017	.000					
S3	-.080	.055	-.034	.076	-.045	-.056	.009	.054	.039	.030	.036	.003	-.030	.174	-.006	-.112	-.155	.000				
S2	.122	-.015	.051	.030	.078	.008	.045	.072	.018	.073	.044	.047	-.003	.037	.001	-.043	-.208	.000	.000			
S1	-.072	.053	.020	.013	-.050	-.085	.004	-.036	-.058	-.046	-.072	.011	-.062	.186	.058	.122	.046	.013	-.032	.000		
BE2	.031	.030	-.015	-.020	-.040	.014	-.006	.086	-.019	-.109	-.040	.026	.031	.193	.094	.126	.025	.023	.008	.052	.000	
BE1	.082	-.028	.008	-.014	-.051	-.047	-.035	.037	-.007	-.087	.046	.032	-.038	-.054	-.004	-.060	-.122	-.013	-.040	-.042	.009	.000

Appendix 4e: Measurement model standardized residual matrix

	R2	R4	S4	BE3	PBI4	PBI3	PBI2	PBI1	PCE3	PCE2	PCE1	R3	R1	V4	V3	V2	V1	S3	S2	S1	BE2	BE1
R2	.000																					
R4	-.544	.000																				
S4	-.093	-.578	.000																			
BE3	.417	-.126	.882	.000																		
PBI4	.652	-1.132	1.906	1.833	.000																	
PBI3	1.172	-.162	-.976	1.904	.179	.000																
PBI2	.231	-.014	-.303	1.905	.222	-.038	.000															
PBI1	-.375	.120	.147	.814	-.166	.041	-.288	.000														
PCE3	-.730	.238	-.734	2.026	.412	1.103	1.274	.549	.000													
PCE2	.640	-.892	-.131	.958	.414	-.340	.060	-.635	.325	.000												
PCE1	.534	-.219	-.120	1.278	-.470	.139	-.355	-.213	-.117	.021	.000											
R3	.058	-.415	-.175	-.752	-.543	-.203	.474	1.807	-.263	.939	.285	.000										
R1	.381	.284	-.789	-.635	-.719	-.257	.175	1.370	-.511	.784	.039	.043	.000									
V4	.316	.916	.074	.120	.871	.519	-.110	-.518	.364	-.520	.528	-.827	-.178	.000								
V3	.551	.465	.413	.017	.472	-.812	.307	-.870	.367	1.855	1.157	.584	.267	.079	.000							
V2	-.042	.021	.620	.488	1.314	.201	-.502	-.411	-.555	-.207	-.492	-1.107	.177	-.273	.250	.000						
V1	-.890	-.453	-.594	-.766	.623	-.569	-.334	-.465	-.549	.153	-.705	-.498	.399	.154	-.258	.059	.000					
S3	-.929	1.003	-.366	1.222	-.766	-.968	.171	.948	.574	.401	.495	.058	-.579	1.218	-.056	-1.029	-1.201	.000				
S2	1.237	-.236	.480	.425	1.157	.123	.726	1.103	.230	.860	.525	.750	-.050	.224	.009	-.340	-1.401	-.001	.000			
S1	-.687	.777	.179	.168	-.701	-1.186	.055	-.514	-.691	-.513	-.808	.156	-.956	1.069	.417	.912	.290	.153	-.325	.000		
BE2	.345	.546	-.172	-.283	-.656	.233	-.106	1.445	-.260	-1.368	-.503	.471	.589	1.301	.786	1.113	.188	.359	.108	.651	.000	
BE1	.958	-.517	.090	-.201	-.872	-.801	-.641	.644	-.104	-1.121	.588	.593	-.739	-.375	-.033	-.547	-.946	-.213	-.558	-.544	.114	.000

Appendix 5a: Structural model



Appendix 5b: Structural model sample covariance matrix

	BE3	PBI4	PBI3	PBI2	PBI1	PCE3	PCE2	PCE1	R4	R3	R1	V4	V3	V2	V1	S4	S3	S2	S1	BE2	BE1
BE3	.848																				
PBI4	.224	.723																			
PBI3	.226	.410	.723																		
PBI2	.217	.408	.385	.618																	
PBI1	.156	.368	.372	.351	.694																
PCE3	.309	.135	.177	.181	.135	1.052															
PCE2	.253	.145	.091	.117	.066	.584	1.214														
PCE1	.322	.115	.153	.120	.122	.684	.751	1.176													
R4	.117	.162	.206	.212	.209	.124	.063	.136	.595												
R3	.064	.156	.169	.200	.259	.077	.159	.143	.283	.616											
R1	.079	.162	.180	.198	.246	.071	.154	.136	.339	.274	.545										
V4	-.042	.143	.096	.014	-.040	.047	-.100	.074	.042	-.157	-.081	4.521									
V3	-.043	.072	-.065	.051	-.070	.039	.246	.145	-.007	.014	-.021	2.383	2.928								
V2	.007	.154	.042	-.025	-.020	-.076	-.036	-.074	-.051	-.147	-.032	2.330	1.895	2.642							
V1	-.155	.101	-.041	-.011	-.029	-.089	.013	-.121	-.113	-.108	-.016	2.986	2.153	2.297	3.691						
S4	.173	.360	.129	.182	.206	.011	.072	.095	.269	.248	.224	.157	.173	.203	.031	1.557					
S3	.163	.141	.125	.189	.226	.109	.105	.130	.330	.233	.216	.300	.089	-.014	-.036	.519	.846				
S2	.127	.282	.208	.244	.262	.095	.156	.148	.288	.301	.268	.176	.107	.065	-.077	.659	.537	1.121			
S1	.123	.183	.143	.230	.180	.029	.048	.046	.398	.299	.247	.345	.179	.245	.195	.714	.625	.641	1.265		
BE2	.339	.152	.202	.181	.264	.252	.183	.326	.231	.194	.211	.098	.021	.052	-.065	.146	.165	.164	.230	.921	
BE1	.357	.147	.147	.158	.221	.273	.216	.425	.179	.205	.147	-.153	-.079	-.137	-.216	.174	.133	.121	.142	.609	.853

Appendix 5c: Structural model model-implied covariance matrix

	BE3	PBI4	PBI3	PBI2	PBI1	PCE3	PCE2	PCE1	R4	R3	R1	V4	V3	V2	V1	S4	S3	S2	S1	BE2	BE1
BE3	.841																				
PBI4	.092	.723																			
PBI3	.088	.403	.723																		
PBI2	.088	.402	.385	.618																	
PBI1	.083	.379	.363	.362	.694																
PCE3	.158	.037	.035	.035	.033	1.052															
PCE2	.171	.040	.038	.038	.036	.547	1.214														
PCE1	.217	.050	.048	.048	.045	.694	.751	1.176													
R4	.113	.129	.123	.123	.116	.108	.117	.149	.595												
R3	.091	.104	.099	.099	.093	.087	.094	.119	.306	.616											
R1	.098	.111	.107	.106	.100	.094	.101	.129	.330	.264	.545										
V4	-.015	.023	.022	.022	.021	-.020	-.022	-.028	-.072	-.058	-.062	4.521									
V3	-.011	.018	.017	.017	.016	-.016	-.017	-.021	-.055	-.044	-.047	2.358	2.928								
V2	-.011	.018	.017	.017	.016	-.016	-.017	-.022	-.056	-.045	-.048	2.414	1.836	2.642							
V1	-.014	.022	.021	.021	.020	-.019	-.021	-.026	-.068	-.054	-.059	2.929	2.227	2.280	3.691						
S4	.116	.238	.228	.227	.214	.094	.102	.129	.331	.265	.286	.142	.108	.111	.134	1.557					
S3	.103	.211	.201	.201	.189	.083	.090	.114	.292	.234	.252	.126	.096	.098	.119	.546	.846				
S2	.114	.233	.223	.222	.210	.092	.100	.126	.324	.260	.280	.139	.106	.108	.132	.605	.534	1.121			
S1	.128	.262	.250	.250	.235	.103	.112	.142	.363	.291	.314	.156	.119	.122	.148	.679	.599	.664	1.265		
BE2	.351	.150	.144	.143	.135	.257	.278	.353	.184	.148	.159	-.024	-.018	-.018	-.022	.189	.167	.185	.208	.904	
BE1	.358	.154	.147	.147	.138	.263	.285	.361	.188	.151	.163	-.024	-.018	-.019	-.023	.193	.171	.189	.212	.582	.835

Appendix 5d: Structural model residual covariance matrix

	BE3	PBI4	PBI3	PBI2	PBI1	PCE3	PCE2	PCE1	R4	R3	R1	V4	V3	V2	V1	S4	S3	S2	S1	BE2	BE1
BE3	.006																				
PBI4	.132	.000																			
PBI3	.137	.006	.000																		
PBI2	.129	.006	.000	.000																	
PBI1	.073	-.012	.009	-.011	.000																
PCE3	.151	.098	.142	.146	.102	.000															
PCE2	.081	.106	.053	.080	.030	.037	.000														
PCE1	.104	.064	.105	.072	.076	-.010	.000	.000													
R4	.004	.033	.083	.089	.093	.016	-.054	-.013	.000												
R3	-.027	.053	.070	.102	.166	-.010	.065	.023	-.023	.000											
R1	-.019	.051	.073	.092	.145	-.023	.052	.007	.009	.010	.000										
V4	-.028	.120	.074	-.008	-.061	.067	-.078	.102	.114	-.099	-.019	.000									
V3	-.032	.054	-.082	.034	-.086	.054	.262	.166	.048	.058	.026	.024	.000								
V2	.018	.136	.024	-.043	-.036	-.060	-.019	-.053	.005	-.102	.017	-.085	.060	.000							
V1	-.141	.079	-.062	-.032	-.049	-.070	.033	-.094	-.045	-.054	.043	.058	-.074	.017	.000						
S4	.057	.122	-.099	-.045	-.008	-.083	-.030	-.034	-.062	-.018	-.062	.015	.065	.092	-.103	.000					
S3	.060	-.070	-.076	-.011	.037	.026	.015	.016	.038	-.001	-.037	.174	-.006	-.112	-.154	-.027	.000				
S2	.013	.049	-.015	.021	.052	.003	.056	.021	-.036	.041	-.012	.036	.001	-.043	-.208	.054	.002	.000			
S1	-.005	-.079	-.107	-.020	-.056	-.074	-.064	-.095	.034	.008	-.066	.188	.060	.123	.048	.035	.026	-.023	.000		
BE2	-.012	.002	.059	.037	.129	-.005	-.095	-.027	.046	.046	.052	.121	.039	.070	-.043	-.044	-.002	-.021	.022	.017	
BE1	-.001	-.006	.000	.011	.083	.010	-.069	.064	-.009	.054	-.015	-.128	-.061	-.118	-.193	-.020	-.038	-.068	-.070	.026	.018

Appendix 5e: Structural model standardized residual covariance matrix

	BE3	PBI4	PBI3	PBI2	PBI1	PCE3	PCE2	PCE1	R4	R3	R1	V4	V3	V2	V1	S4	S3	S2	S1	BE2	BE1
BE3	.074																				
PBI4	2.308	.000																			
PBI3	2.407	.107	.000																		
PBI2	2.435	.105	.008	.000																	
PBI1	1.299	-.201	.155	-.207	.000																
PCE3	2.174	1.548	2.233	2.484	1.639	.000															
PCE2	1.089	1.551	.781	1.262	.449	.404	.000														
PCE1	1.411	.959	1.562	1.161	1.161	-.106	-.004	.000													
R4	.071	.684	1.712	1.980	1.954	.274	-.865	-.211	.000												
R3	-.518	1.072	1.435	2.234	3.447	-.169	1.027	.374	-.457	.000											
R1	-.381	1.091	1.586	2.148	3.211	-.415	.874	.127	.192	.213	.000										
V4	-.194	.910	.561	-.067	-.477	.425	-.459	.608	.952	-.818	-.165	.000									
V3	-.280	.508	-.772	.348	-.831	.424	1.913	1.233	.498	.592	.280	.077	.000								
V2	.170	1.353	.244	-.457	-.369	-.493	-.144	-.410	.058	-1.098	.191	-.276	.246	.000							
V1	-1.098	.664	-.525	-.288	-.422	-.486	.217	-.621	-.416	-.489	.413	.158	-.254	.061	.000						
S4	.680	1.543	-1.251	-.616	-.108	-.893	-.296	-.344	-.836	-.237	-.883	.077	.416	.623	-.590	.000					
S3	.978	-1.182	-1.296	-.207	.638	.381	.202	.224	.683	-.021	-.696	1.221	-.054	-1.027	-1.197	-.295	.000				
S2	.180	.722	-.218	.337	.785	.039	.661	.256	-.566	.647	-.193	.221	.006	-.343	-1.403	.512	.029	.000			
S1	-.068	-1.095	-1.489	-.297	-.793	-.876	-.704	-1.069	.502	.115	-1.030	1.080	.427	.923	.302	.309	.293	-.234	.000		
BE2	-.172	.034	.983	.675	2.206	-.066	-1.204	-.335	.844	.836	.984	.824	.330	.625	-.323	-.498	-.029	-.281	.278	.181	
BE1	-.023	-.108	.008	.213	1.473	.147	-.903	.835	-.176	1.018	-.303	-.909	-.533	-1.093	-1.511	-.234	-.602	-.950	-.919	.345	.20