DESIGN OF PERSONALISED M-LEARNING CURRICULUM IMPLEMENTATION MODEL FOR DIPLOMA IN HOSPITALITY MANAGEMENT

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FACULTY OF EDUCATION
UNIVERSITY OF MALAYA
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2020

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THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

FACULTY OF EDUCATION
UNIVERSITY OF MALAYA
KUALA LUMPUR

2020

UNIVERSITY OF MALAYA

ORIGINAL LITERARY WORK DECLARATION

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Matric No: **PHA110034**

Name of Degree: **DOCTOR OF PHILOSOPHY**

Title of Project Paper/Research Report/Dissertation/Thesis ("this Work"):

DESIGN OF PERSONALISED M-LEARNING CURRICULUM IMPLEMENTATION MODEL FOR DIPLOMA IN HOSPITALITY MANAGEMENT

Field of Study: **CURRICULUM AND INSTRUCTIONAL TECHNOLOGY**

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ABSTRACT

Personalised m-learning allows learner to create learning experience around his mobile devices by tailoring learning materials according to his demand. This could be possible by incorporating personalised m-learning into formal education to assist students to fulfil their learning needs and learning outcomes. Therefore, this study was conducted to develop a personalised m-learning curriculum implementation model for students enrolled in Food and Beverage Service course in their diploma in hospitality programme. This study employed the Design and Development Research (DDR) approach. The Needs Analysis phases is the first phase which aimed to investigate problems and justifications for developing the personalised m-learning curriculum implementation model for Food and Beverage Service course in diploma in hospitality programme at a private higher education institution in Malaysia. The instrument used for this phase was a need analysis survey questionnaire which was constructed based on Unified Theory of Acceptance and Use of Technology (UTAUT). The survey was conducted among fifty (50) students enrolled in Food and Beverage Service course to get their feedback on the current situation of their learning and what they expected from the implementation of personalised m-learning in this course. The second phase was the development phase which adopted Nominal Group Technique (NGT) and Interpretive structural modeling (ISM) techniques to develop the proposed model. There were 31 personalised m-learning elements finalised through NGT process. The outcomes of this phase was the experts' view on personalised m-learning elements and the relationship among these elements. The third phase is the evaluation phase where it focuses on the suitability of the model to support formal face-to-face classroom teaching and learning. This phase employed a modified Fuzzy Delphi Method (FDM) to analyse a five-linguistic scale evaluation survey questionnaire to get consensus views and opinions from 25 selected panel of experts. The experts' consensus for questionnaire items determined by the threshold value 'd' while defuzzification (A_{max}) values for the items used to determine the agreement of the experts. The findings from Phase 1 showed the need to develop personalised m-learning model whereas the outcomes from Phase 2 was the development of the model. The experts proposed that the final ISM model for personalised m-learning to be divided into three domains: Device Adaptation domain, Learner Adaptation domain and Situated Adaptation domain. Based on elements' driving power and dependence power, the personalised m-learning elements are further classified according to clusters using MICMAC analysis. These four clusters are Autonomous elements; Dependent elements; Linkage elements; and Independent elements. The findings from Phase 3 revealed that all experts consensually agreed with the evaluation's questionnaire items. This can be viewed from the triangular fuzzy number and deffuzification process which shows that all the items have met the requirements needed. Finally, the findings of the study can be used as a guidelines when implementing personalised m-learning in formal teaching and learning process.

Keywords: Learning Preferences, Personalised m-learning, Content Adaptation

REKA BENTUK MODEL PERLAKSANAAN KURIKULUM *PERSONALISED M-LEARNING* UNTUK PROGRAM DIPLOMA PENGURUSAN HOSPITALITI

ABSTRAK

Pembelajaran mudah alih secara kendiri membolehkan pelajar mencapai pengalaman pembelajaran melalui peranti mudah alihnya. Pelajar turut inginkan bahan pembelajaran disesuaikan dengan kemahuaannya dan ianya boleh dicapai sekiranya pembelajaran mudah alih secara kendiri diintegrasikan dalam pendidikan formal. Untuk mencapai matlamat ini, kajian dijalankan untuk membangunkan reka bentuk model pelaksanaan kurikulum bagi pembelajaran mudah alih secara kendiri terhadap pelajar yang mengikuti kursus Food and Beverage Service dalam pengajian diploma hospitaliti mereka di salah satu pusat pengajian tinggi swata. Kajian ini menggunakan pendekatan Penyelidikan Reka Bentuk dan Pembangunan (DDR). Fasa pertama adalah fasa kajian Analisis Keperluan yang bertujuan untuk menyiasat masalah dan mengenalpasti keperluan untuk membangunkan reka bentuk model bagi pembelajaran mudah alih secara kendiri untuk pelajar yang mengikuti kursus Food and Beverage Service. Instrumen yang digunakan untuk fasa ini adalah satu set soal selidik analisis keperluan yang dibina berdasarkan teori penerimaan dan penggunaan teknologi "Unified Theory of Acceptance and Use of Technology" (UTAUT). Soal selidik ini melibatkan seramai 50 orang pelajar yang mengikuti kursus ini. Tujuannya adalah untuk mendapatkan maklum balas pelajar berkenaan kaedah pembelajaran semasa dan apa yang ingin dicapai dengan implementasi pembelajaran mudah alih secara kendiri. Fasa kedua melibatkan reka bentuk dan pembangunan model. Ini dilakukan dengan bantuan Nominal Group Technique (NGT) dan Interpretive Structural Modeling (ISM) techniques. Terdapat sebanyak 31 elemen pembelajaran mudah alih secara kendiri yang telah dikenalpasti melalui teknik NGT. Hasil fasa ini adalah pandangan kolektif

pakar mengenai elemen pembelajaran mudah alih secara kendiri tersebut dan hubungan antara elemen-elemennya. Fasa ketiga adalah fasa penilaian model. Fasa ini bertujuan untuk menentukan kesesuaian model dalam memberi sokongan kepada proses pengajaran dan pembelajaran bersemuka yang formal. Fasa penilaian ini menggunakan kaedah Fuzzy Delphi Method (FDM) yang diubahsuai untuk menentukan pendapat dan pandangan konsensus daripada 25 ahli panel pakar yang dipilih. Ini dilakukan dengan menjalankan kajian soal selidik berdasarkan skala lima linguistik untuk menilai kesesuaian model. Pandangan persetujuan secara konsensus pakar untuk semua item soal selidik ini ditentukan melalui nilai ambang 'd' sementara nilai defuzzification (Amax) untuk setiap item ini digunakan untuk menentukan persetujuan setiap pakar terhadap item tersebut. Hasil soal selidik fasa 1 menunjukkan terdapat keperluan untuk membangunkan model pembelajaran mudah alih secara kendiri sementara hasil fasa 2 adalah pembanguan model itu sendiri. Panel pakar mencadangkan model ISM yang dibangunkan ini dibahagikan kepada 3 domain iaitu domain penyesuaian peranti, domain penyesuaian pelajar dan domain penyesuaian kedudukan. Berdasarkan kuasa dorongan dan kuasa kebergantungan elemen-elemen pembelajaran mudah alih secara kendiri, model ini selanjutnya dibahagikan lagi kepada empat kluster dengan menggunakan teknik analisis Cross-Impact Matrix Multiplication Applied to Classification (MICMAC). Keempat-empat kluster ini adalah kluster element autonomous, element dependent, element linkage dan element independent. Hasil dari fasa tiga menunjukkan bahawa semua ahli pakar bersetuju secara konsensus terhadap semua items dalam soal selidik kajian penilaian. Ini dapat dilihat melalui nilai triangular fuzzy number dan process deffuzification yang menunjukkan bahawa semua item telah memenuhi syarat yang diperlukan. Akhir sekali, hasil kajian ini diharap dapat digunakan dan menjadi garis panduan untuk melaksanakan pembelajaran mudah alih secara kendiri dalam proses pengajaran dan pembelajaran yang formal.

Keywords: Learning Preferences, Personalised m-learning, Content Adaptation

ACKNOWLEDGEMENTS

Foremost, I would like to express my gratitude to God to enable me to complete my PhD thesis. My deepest appreciation to both my supervisors, Prof. Dr. Saedah Siraj and Dr. Siti Hajar Halili for their guidance, kindness, and supports along my PhD journey. Without their acknowledgement, patience, and commitment, it would not be possible to complete this thesis. I am blessed to have them in my life and may God grant them with the best reward.

I am honoured to express my utmost gratitude to my beloved wife, Malathy Patchymuthu, and my lovely kids: Mothagapriyan and Yakneshapriyan. Thank you so much for your continuous pray and encouragement. I am blessed to have your support and understanding in every minute of my life. My special gratitude also goes to my father, Mr. Ramalingam and my superior, Mr. Vijaya Kumaran Nair. Without all of you, this effort would be nothing and my PhD journey would be lonely.

Last, but not least, I would like to thank all my friends for their cooperation and participation in this study. Thank you so much and May God blessed all of you.

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LIST OF SYMBOLS AND ABBREVIATIONS

DDR	:	Design and Development Research
E-learning	:	Electronic Learning
FDM	:	Fuzzy Delphi Method
GPRS	:	General Packet Radio System
IMLIS	:	Intelligent Mobile Learning Interaction System
IoT	:	Internet of Things
ISM	:	Interpretive Structural Modeling
LMS	:	Learning Management System
MICMAC	:	Cross-Impact Matrix Multiplication Applied to Classification
m-Learning	:	Mobile Learning
MLPs	:	Mobile Learning Preferences
NGT	:	Nominal Group Technique
PALLAS	:	Personalised Language Learning on Mobile Devices
PDA	:	Personal Digital Assistant
PVLEs	:	Personalised Virtual Learning Environments
SMS	:	Short Message System
SPSS	:	Statistical Package for Social Sciences
SSIM	:	Structural Self-Interaction Matrix
UMTS	:	Universal Mobile Telecommunications System
UTAUT	:	Unified Theory of Acceptance and Use of Technology
WAP	:	Wireless Application Protocol
WWW	:	World Wide Web

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CHAPTER 1

INTRODUCTION

1.1 Introduction

We are living in a time of intense change in the area of digital technology and the way it affect every aspect our everyday life. Our education sectors are changing and being changed as a direct result of these technological innovations. Several trends have recently influenced the educational sector due to new advancements in information technology. Introduction of Short Messaging Service (SMS) gives whole new dimension to mobile communication. Popularity and drop in the mobile technology cost increase the usage of these devices in almost every aspect of our life. In the area of technology-assisted learning, mobile learning (m-learning) has become the buzzword in providing instant learning services. The need for information anywhere anytime has become a major factor to the growth of m-learning.

The current educational system does not cater to learners of different levels. The need for the adult learners to continuously learn is widely recognized and it is a one of the important factor for a corporation’s competitive advantage. Adult learners, especially people who want to learn on the move, find it difficult to go through the traditional learning process. Traditional lecture-oriented learning is not appropriate for adult learners especially for professionals as this requires them to allocate time and space. M-learning provides a solution for this problem. However, implementing m-learning is a challenging problem. M-learning is completely different from the current teaching and learning systems. It will involve major changes in the way we teach and learn. Learning outside the traditional educational context such as classroom, library labs and etc. required self-motivation to do so whenever the opportunities arise from any source. M-learning provide this opportunities by giving small and portable device as a learning tool for easy caring and better functionalities than other media. Designing and developing learning activities for these types of devices is complex and challenging.

Mobile devices become learning tool as soon as people used to send and/or receive learning content. It has greater advantage compare to other learning tools since the said device can be used anywhere and at anytime. Mobile devices are considered as 3rd generation technologies which allow learners to access their learning content while being away from computers and classrooms. However, creating mobile content is not an easy task and become more difficult when it involve various types of mobile devices.

New terms and concepts had been introduced in educational sector due to new advancement in technology. In the area of technology-assisted learning, e-learning (electronic learning) becomes the buzzword in providing instant learning services. However, in e-learning, students still need to find a networked computer to work with. This means that the students need to find specific time for learning at a specific location (Jun, Kyung-Seob, Vicki & Greg, 2001). The need for "information anywhere anytime" has been the driving force for the increasing growth in m-learning (Gupta & Srimani, 2000). Mobile education is defined as "any service or facility that supplies a learner with general electronic information and educational content aids in the acquisition of knowledge regardless of location and time" (Franz & Holger, 2002). M-learning is the intersection of mobile computing and e-learning, which includes anytime, anywhere resources; strong search capabilities; rich interaction; powerful support for effective learning; and performance-based assessment. Mobile devices also provide feeling of true ownership. Students who use lab must share them with others but the mobile devices on the other hand, can be a true “personal computer”. The students can use mobile devices to gather, store, and retrieve important information thus developing information literacy, which is at the heart of lifelong learning. By using the mobile devices, the student's educational experience expands beyond the teachers-centred classroom and they learn through their own experiences and ask own questions. Mobile devices actually, encourage the student to think, as stated in the theory of constructivism, humans generates knowledge and meaning from an interaction between their experiences and their ideas. In a boarder perspective, m-learning able to bring student experiences that occur in the educational process. So, it’s not necessarily dictate by the teachers. How student interact within the content or learning materials shapes the student’s experience in any learning process.

At first mobile devices were introduced in educational sector as a tool to get secondary information such as due date, deadlines, schedules, additional lectures and so on (Noor et al., 2018). Now, based on the capability of their mobile devices, students can retrieve lecture notes or query for their availability. This makes it possible for student to learn outside the classroom. Not all students with mobile devices (hand phone, personal digital assistant - PDA, handheld computer, Pocket PC and so on) can enjoy these facilities. This is because for every course teaching materials of different kinds are made available online. The range comprises simple scripts or lecture notes (e.g. in portable document format - PDF) as well as complete virtual lectures consisting of interactive hypermedia documents or video and foil presentation (Franz et al., 2002). Students with different model with different capabilities of mobile devices find it very difficult to get correct information or content.

When talk about content, distributing personalised learning content to wide range of mobile devices not an easy task. Creating different contents for different types of mobile devices will be never ending task. Besides that, developing content for m-learning to cater wide range of mobile devices is an expensive and time-consuming process which required at least a reasonable knowledge of the learning content, learning and teaching issues, software engineering and mobile device technologies. If the device is fixed and content is created around this device technology, any new device introduce in the market will required the developer to reinvent the wheel. So, in order to deliver multimedia rich content to different types of mobile devices, the content needs to go through series of adaptation and transformation processes based on the user's preferences and the mobile device capabilities.

Learning from the mobile devices especially from phone not necessary learning from YouTube, Facebook, LinkedIn and other social media linked to videos. It's beyond that. Just because the mobile devices are available to almost everyone especially every students, doesn't mean we can create a learning opportunity using these devices. Hugh Ujmazy (2014), gives a different perspective on m-learning. According to him, the "m" in m-learning is not for mobile as in technology but it is stands for the very important "me" as the participant. And of course the mobile devices are involved in the process. A learning process need to be driven by the needs of a participant. M-learning is about "me", the participant learning something specific at the moment I need it. The content should be just for me (the way I want it), just enough (not the entire chunks) and just in time (whenever I need it). With this in mind, we need to create m-learning, not because everybody has a mobile device but because the participant/user need this specific information in a format that he wants and when he wants. M-Learning become "alive" when the content encourage interaction or participation from the user. Personalisation of the content is important to attract the user and to make the user continue using them.

M-learning eliminate the barriers of time and space when introducing anytime and anywhere learning. For better teaching and learning experiences, m-learning should also look into personalisation of the learner's experience. In personalised m-learning, the learner determine the learning experience they want to create around their mobile device. The content delivery must tailored the learner's need/demand, taking into consideration their mobile device capabilities (Yih-Farn & Charles, 2003; Sampson, Karagiannidis & Kinshuk, 2002).

This study will focus on how mobile learning system can deliver the same content of information to a number of different devices using more than one media type such as text, sound, picture, video, and data sent in both directions. As Walker (2007) highlighted, m-learning is not just about learning using portable devices but learning across contexts. So, any device m-learning is what we are looking at and moving towards. Beside the mobile device, the content adaptation also will be based on the learners' preferences and learners' surroundings. With this, personalisation are added to mobile learning. To utilize the full potential of personalised m-learning, the application designers face many challenges and one of the major challenges are how should content be converted and adapted for delivering to mobile devices with limited hardware, software, and communication capabilities without changing the actual content of the material (Franz et al., 2002) and on top of that based on learners' preferences. Many technological challenges such as small display size, low resolution, less memory power, low bandwidth, and input technology also becomes obstacle in creating effective learning in a mobile environment (Yih-Farn et al., 2003).

This study will also examine the existing pedagogical methods and learning theories that related to personalised m-learning and come up with new framework on how these theories can be used to deliver learners' preferred content while taking into account the mobile device capabilities and the learners' surrounding during which the content is delivered/requested. By looking at how the Short Message Service (SMS) changed the communication culture, there is a need to change the learning culture when personalised m-learning was introduced in educational sector. The proposed work will study on personalised m-learning culture and will identify the best way to provide device-oriented content and presentation based on learners' preferences. The findings from this study will be used in designing curriculum model for personalised m-learning for diploma in hospitality programme.

In an m-learning system, there are no fixed learning path which appropriate for all learner. Every individual will have their own learning style which best works for them. This learning style does not decided by a single factor. In fact, the learner's learning style only can be decided based on what the learner want to learn at the time of engagement. Beside their ability to learn, the instrument they use for learning (in m-learning, their mobile device) also play an important roles in defining ones learning path. Personalised m-learning take into account the learner's preferences (also their ability), the environment (network) and the limitation of their mobile device (Geoffrey, 2001; Jahankhani, Yarandi & Tawil, 2011). When personalisation added to this m-learning, it create a flexible way of learning because it is readily accessible, anywhere, anytime, ubiquitous and based on learners' learning preferences which makes learning a rewarding lifelong process (Sharples, M., 2000).

Personalised m-learning is strives to improve the learning process by providing the learning content based on the learners' preferences. Tremendous growth in mobile and wireless technologies bringing new innovations and methods in teaching and learning processes. The high level interactions and functionalities gives another reason for the use of mobile devices in the education. This offers the opportunity of ubiquitous learning "anywhere" and "anytime" where learners do not have to wait for a fixed time and location for learning activities.

Design of personalised m-learning model is important because the learner's chances of success should not be limited and/or blocked by their choice of device, learning preferences, location and accessibility. Learner should be given freedom to access the content whenever they need, in whichever format and form that they want. This will promote the actual anywhere and anytime learning. The focus of this study is to design model for personalised m-learning environment for selected students from hospitality subject in a diploma programme. This will be done by identifying the students' preferences in receiving m-learning content for this hospitality subject. Besides their preferences, capabilities of the mobile devices that one's carry and common form of network which they use to access the mobile learning content besides the learners' surrounding, will be taken into consideration. The design aims to enhance personalisation aspects by using decision tree model (engine), which makes decisions based on learner's preferences at that point of time, the network environment and the capability of the device that being carried. The learning materials will go through series of adaptation and adjustment in order to support the personalisation that requested by the learner and by taking into account the mobile devices limitations. With dynamic transformation and flexible nature of the design, it is able to meet the specific needs of the learners and engage them in the learning activities with a great motivations.

1.2 Problem Statement

Personalised m-learning, putting the learner and his/her needs and preferences first, is the most important vision. When providing learning content, all learners should be supported to make a good progress and no learners should be left behind. Learners have different preferences based on their learning "mood", location, accessibility and their device. Personalised m-learning takes great effort to tailor teaching and learning to individual needs. Personalised teaching and learning as defined in the landmark report of the Teaching and Learning in 2020 which published in January 2007, quoted as:

“taking a highly structured and responsive approach to each child’s and young person’s learning, in order that all are able to progress, achieve and participate. It means strengthening the link between learning and teaching by engaging pupils – and their parents – as partners in learning”. (August et al., 2007, p. 6)

Personalisation in learning happens when it provide learning content according to the learner’s characteristics, abilities and behaviours. Every learner has their own characteristic, ability and behaviour. In order to increase their learning effectiveness, learning content need to be provided according to their characteristics, abilities and behaviours. However, there is very limited study on personalisation in m-learning. Rapid change in mobile devices features has further intensified the challenges to incorporate the features in the application (Joorabchi, Mesbah & Kruchten, 2013). (Xu, Wang & Wang, 2005) developed a conceptual model for personalised Virtual Learning Environment (PVLEs) and advocated that PLVEs should be modelled in terms of learning situations rather than in terms of knowledge structure. This model is based on user element such as learning plan, learning goal, and learner profile.

Over the years, the technology used to support m-learning has evolved. Learning content that made available was not able to cater to variety of mobile devices and many type of learners’ need. Aspects like content reusability and content adaptation become more and more important. Learning platforms or learning environment should better support variety of mobile devices and many needs of the learners will motivate the learners to have better understanding of the content and acquire the knowledge required. M-learning attained more importance in supporting and complementing the formal and informal learning especially among the young generation today. Extraordinary flexibility regarding time and location is the main characteristic of mobile devices which allow the learners learn anywhere at any time without the restriction of time and space. Personalised mobile learning (or personalised m-learning) in other hand, is the learning with the help of mobile devices which allow the learners to retrieve, view and repeat the learning content based on their need and preferences.

Learner-centred defined as the "whims and peculiarities of each individual learner are uniquely catered to" (Anderson, 2004, p. 47). Personalised mobile learning try to achieve what Anderson have argued where the learners especially the mobile learners are unique and they decide what they want to learn, when and how. Huge amount of learning contents are made available in learning environment but this is not guarantee that these content will be access by or use by the learners. This is because the learning environment/platform did not support the learners' need and preferences hence do not motivate them to access and learn. By personalising the learning content, the learners will gain a better understanding of the topics and achieve better results.

M-learning been around for some time now but it's fail to achieve greater height. This is due to the fact that it does not cater for various type of learners, learning from different environment. (Loidl-Reisinger, 2006) describes the m-learning setting as anywhere, anytime, any data and any device, i.e., learning content can be retrieved, viewed or repeated via an arbitrary device from an arbitrary place. In order for a learner to access any data on any device, content adaptation and customisation plays a major part. These adaptation and customisation is needed for a learner with different devices and different preferences. The first step is the process of adaptation and customisation is by making the learning content reusable, interoperable, more easily accessible and more durable (Svensson, 2001; Loidl-Reisinger & Paramythis, 2003).

Context model also is being introduced in the proposed semantic e-learning framework of (Huang, Webster & Ishaya, 2006). This study presented a semantic e-learning framework that uses intelligent personal agents which could perform adequate personal information profiling and deliver personalised learning services according to the individual's personality and interests. Furthermore, personalised delivery system proposed by (Mittal, Krishnan & Altman, 2006) presented course materials based on contextual information. (Zhang, 2003) proposed a generic framework for delivering personalised and adaptive content to mobile users. It consists of user profile which is used for content personalisation. The user profile may include (a) user information including user ID, background information, personal interest represented by either keywords or information/service categories, preferences (e.g. media preference, summarization method, and priorities among data items); (b) target device information such as screen size, screen resolution, network, battery, memory; (c) service profile including service restrictions and user availability; (d) wireless network information such as network identity (network ID), topology, and configuration.

(Sá & Carriço, 2009) presented a study which takes advantage of mobile devices' features to supports end-users in pervasive learning and content personalisation. To provide access to different students with different disabilities, it included elements that allow teachers to create accessible artefacts. The accessibility elements included the various configurations and common interaction options that can be used to interact (e.g. text input, multiple-choices) or to visualize the content (e.g. images, video); text-to-speech features which recreate the content (text, image) through audio output; gesture-based navigation; voice-based navigation; the customization of the artefacts' behaviour. (Chen & Tsai, 2011) presented ontology in the mobile phone domain for the construction of knowledge base. The concept of mobile phone is divided into seven parts: model, hardware, software, standard, brand, shape and colour. (Tan, Zhang, Kinshuk & McGreal, 2011) presented a 5R adaptation framework for location-based mobile learning system. Its concept is at the right time, in the right location, through the right device, providing the right contents to the right learner. The time indicated two factors, the date-time and the learning progress. The location indicated the learner's current geographic location. The device referred to the learner's mobile device that is used to conduct m-learning. The contents included learning objects, learning activities, and learning instruction. The learner is the person who conducts learning through mobile device in the m-learning environment. (Al-Hmouz, 2012) presented Adaptive Mobile Learning Framework that depicts the process of adapting learning content to satisfy individual learner characteristics by taking into consideration the learner's need. It play an important role in delivering learning content to mobile learners, and their relationship with each other. Its Enhanced Learner Model focuses on how to model the learner and all possible contexts in an extensible way that can be used for personalisation in m-learning.

From the above past studies, we found that there are different elements that can be considered in m-learning domain. (Zhang et al., 2003) proposed a generic model for delivering personalised content to mobile users based on user profile. Sá et al. (2009) model takes advantage of mobile devices' features to supports end-users in content personalisation. Adaptation model presented by Tan et al. (2009) was for location-based m-learning system. From these past studies we can also conclude that user profile, mobile devices' features, and location are needed to offer personalisation in m-learning domain. Besides, Al-Hmouz et al. (2012) proposed personalised model for mobile learners was based on three aspects which are context based, content based, and learner based. Since there are lots of elements that can be included in m-learning domain, we need a comprehensive view on personalisation in m-learning. This can be used as guidance to develop a personalised m-learning model that is tailored to learner's needs.

1.3 Purpose of the Study

The general purpose of the study is to develop the personalised m-learning curriculum implementation model for Food and Beverage Service course in hospitality programme. The model aimed at proposing a guide on how personalised m-learning could be incorporated in a formal classroom not only as a complement but to augment formal learning in assisting students to accomplish their learning outcomes. Diploma students in hospitality programme who enrolled for the Food and Beverage Service course was selected as the research focus for the development of the model. Design and Development Research (DDR) approach (Richey & Klein, 2007) was employed in the development of the purposed model in this study. This approach consist of three phases, the needs analysis phase, the development phase, and the evaluation phase. First, the needs to implement personalised m-learning in the current teaching and learning setup being studied based on students views. Then, the personalised m-learning model was developed with the aid of experts' opinion and collective decision on choosing the appropriate personalised m-learning elements to be included in the model and the relationships among these elements in the model structure. This is followed by selecting another group of experts to evaluate the suitability of this model in implementing personalised m-learning to support formal face-to-face teaching and learning session.

1.4 Objectives of Study

The main objective of this study was to design and develop an interpretive structural model in implementing personalised m-learning for Food and Beverage Service course for diploma in hospitality programme students. The study consisted of three phases. The objectives of the proposed work are as follows:

a) To identify the needs for the development of the personalised m-learning curriculum implementation model for Food and Beverage Service course in diploma in hospitality programme based on the students' view.

b) To develop the personalised m-learning curriculum implementation model for Food and Beverage Service course in diploma in hospitality programme based experts' opinion and decision.

c) To evaluate the personalised m-learning curriculum implementation model for Food and Beverage Service course in diploma in hospitality programme based experts' opinion and decision.

1.5 Research Questions

The research questions for this study were formulated based on the objective of the study, the problem statement and the rationale of the study. These research questions were grouped according to the design and development research approach, which will be further described in chapter 3, the research methodology part.

In the needs analysis phase (phase 1), the main focus is to find out the actual needs for personalised m-learning to be introduced in the teaching and learning of

Food and Beverage Service course. In identifying the needs of personalised m-learning curriculum implementation model for diploma in hospitality management programme, the students' views were seek to answer the following research questions:

1.1 What are the mobile devices that the students carries and capabilities of these devices?

1.2 What are the students' perceptions on their current ways of teaching and learning setup for Food and Beverage Service course?

1.3 What are the students' perceptions on implementing personalised m-learning to support the teaching and learning of Food and Beverage Service course?

1.4 What are the students' level of acceptance and intention to use personalised m-learning if incorporated into the formal Food and Beverage Service course?

In the design and development phase (phase 2), the main focus is to find out what are the personalised m-learning elements to be included in the development of the model. In developing the personalised m-learning curriculum implementation model for hospitality programme, the development phase tried to answer the following questions:

2.1 What are the experts' collective views on personalised m-learning elements which should be included in the development of personalised m-learning curriculum implementation model?

2.2 Based on the experts' collective views, what are the relationships among the personalised m-learning elements in the development of the personalised m-learning curriculum implementation model?

2.3 Based on the experts' collective views, how should the personalised m-learning elements be classified in the interpretation of the personalised m-learning curriculum implementation model?

In the evaluation phase (phase 3), the main focus is to find out the suitability of the developed personalised m-learning curriculum implementation model. The personalised m-learning curriculum implementation model for hospitality programme evaluated based on experts' views. The evaluation phase was aimed to answer the following research questions:

3.1 What is the experts' agreement on the suitability of the personalised m-learning elements (learning preferences) proposed in the personalised m-learning curriculum implementation model?

3.2 What is the experts' agreement on the classification of the personalised m-learning elements based on the three domains (Device Adaptation elements, Learner Adaptation elements, and Situated Adaptation elements) as proposed in implementing personalised m-learning curriculum implementation model?

3.3 What is the experts' agreement on the list of personalised m-learning elements in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in implementing personalised m-learning curriculum implementation model?

3.4 What is the experts' agreement on the relationship among the personalised m-learning elements as proposed in implementing personalised m-learning curriculum implementation model?

3.5 What is the experts' agreement on the suitability of the personalised m-learning curriculum implementation model in the teaching and learning of Food and Beverage Service course in the hospitality programme?

1.6 Rationale of the Study

Personalised learning happens both in school and out of school. While classroom personalised learning dictate by the teacher's choice of new tech tools, the learner have their personal tech tools when they are out of school. Mobile devices are the popular choice for out of classroom learning because it is very personal to the learner and almost every learner carry minimum one of these devices. Curriculum designers have biggest challenges to design and implement personalised learning for mobile devices for two main reasons:

i) learner's preferences (personalise) may vary by individual
ii) capabilities of the mobile devices that the learner's carry and high frequency of mobile device model changes (by the learner)

Personalised m-learning is teaching a learner where they are (regardless of location), what they need in order to understand (preferences) and with the device of his/her choice. Traditional classroom learning to personalised learning is shift on what the learner do and the attitudes towards the learning process. Most learning system usually ignore personalisation feature such as learning styles, learner's ability (knowledge level), learner's current need and learner's learning environment (network). They tend to deliver the same learning content to every learner. Delivering personalised content to the learner's need (learner's specific domain) is the main purpose of this study.

Learners learn best when they are engaged with the content. In order to do that, the learning content must be delivered according to their needs and preferences. The personalised content gives the learner the "RIGHT" content. By doing this, the learning become flexible because the learner believe that he/she can manipulate the content. Personalised m-learning help learning become alive and real in time when learner exchange ideas with peers and instructors. The ultimate goal of this personalised m-learning approach is to create similar situation on how would learner respond to a one-to-one session with peers and teacher/professional educator. This is likely a strategy to achieve learning goals for all type of learners (Knowles, 1984; Julie, 2012).

This study focused on identifying and designing of an ideal curriculum model to distribute personalised learning content to various types of mobiles devices. This personalised content can be due to the learner's preferences, network condition and limitation of the learner's mobile devices. This study tried to accomplish and promote learning to happen regardless of type of mobile technology that one carries.

This study will suggest personalised approach to the teaching of hospitality programme. The suggested curriculum implementation model will ensure the learning contents are encompassed and adjusted to the mobile devices and according to the individual student's preferences. Learning content of this hospitality subject will be design such as way that every student can choose the optimal way of learning in accordance to their needs. Students who enrol to this hospitality programme will be able to access the learning content on their mobile device regardless of their whereabouts, or the moment in time they decide to learn. By the way the student approach the learning content, their m-learning becomes personalised m-learning.

Student may want to learn while waiting for bus, in between classes, just before exam and etc. For whatever reason which the student decided to use their mobile device for learning, he/she is able to choose his/her own way of learning which adjusted to his/her own needs. The personalised approach in this curriculum model provides the student with the possibility of choices and different combinations of learning styles to study and learn the requested content.

1.7 Significance of the Study

Every learner is different. The learner have different ability in learning a particular subject. Given the same content, some learners may easily understand it by reading but some learners may need illustration or example to understand it. On top of that, each and every learner has their own preferences in learning such as learning at quiet environment, learning by playing games, learning by communicate or cooperate with other people, and others. When the learner carry out learning process with their own preferences, they will understand the content easily and may extend or apply the knowledge they have learned. Hence, content that is personalised to each learner is needed to enhance the learning efficiency and effectiveness of the learner.

In this study, a personalised m-learning curriculum implementation model will be developed to support different types of learners with different learning preferences to meet the learning outcome of the subject. There are three elements that this study will look at when developing the model which are the learner's preferences, the mobile device capabilities and the learning environment (network). Each element has it's sub-elements that will play an important role in deciding the type of learning content that need to deliver to the learner. The success of this personalised m-learning curriculum implementation model depends on the ability to deliver learning content based on the learner's preferences and by taking into account their mobile device capabilities and learning environment. Learning content will go through series of adaptation and/or customisation that suites these 3 elements before reaching the intended learner. Different learner will have different focus on personalisation in the m-learning domain. Some will focus on learner's preferences, some on device's features and some on learning environment. It is difficult to have a consensus view when developing personalised m-learning application. This proposed study hence will provide a general and comprehensive view on the personalised m-learning curriculum model.

1.8 Limitation of the Study

The development of the personalised m-learning curriculum implementation model for diploma in hospitality programme was intended as example of proposing how personalised m-learning could be incorporated in formal learning to assist diploma students especially in this particular programme. The study chose diploma level hospitality programme offered in a private higher education institution as a focus of the study. Hence, the development of personalised m-learning curriculum model was context specific and where it was developed for a specific group of 50 (fifty) diploma students of a specific tertiary institution for a specific programme.

This study was based on the students' opinion in determining their need to develop the curriculum implementation model in the needs analysis phase. The model could be different if other stakeholders such as lecturers, institution administrators, content developers and experts from hospitality industry were robed in to determine the needs to develop the model. The development of the model was context specific hence the result may be differ if the study conducted using different group of students in different programme and different institution.

In the development phase, the study adopted the nominal group technique to determine the elements for the model, the interpretive structural modeling (ISM) in developing the personalised m-learning curriculum implementation model, and the fuzzy Delphi technique to evaluate the model. These methods of study primarily based on experts' opinion. Hence, the outcome of the study which is the curriculum implementation model was solely depend on the experts' selection and their opinions. The model may differ if the study was conducted using different number of experts and from different fields of expertise.

In the development phase, eight experts (three content experts, who were the course instructor from the private institution, two instructional technologist or m-learning experts, two curriculum design experts and one policy stakeholder of the institution) were used in the development of the model. If the same study would be conducted using different experts for different programme setting, the result might be different. So, this was not a generalised model to be used for other programme in all higher education institutions. However, this study could be used as a base for similar personalised m-learning curriculum implementation model for different set of students and for different programme. Due to rapid development in the field of m-learning and mobile devices, the developed model need to be examine from time to time for any updates on personalised m-learning elements.

1.9 Definition of Terms

Personalised learning: Personalised learning refers to instruction in which the pace of learning and the instructional approach are optimised for the needs of each learner (U.S. Department of Education, 2016). It also can simplified as an efforts to tailor education to meet the different needs of a learner.

M-learning: Mobile learning or m-learning refers to a continuous access to the learning process that happen with the help of mobile devices like smartphones, iPads, other tablets, and wearable technology (Crompton, 2013). This study will focus personalised m-learning to cater different types and needs of a learner.

Learning preference: A learning preference is the set of conditions related to learning which are most conducive to retaining information for an individual. These conditions may include environmental, emotional, psychological, physical and even social attributes (Pritchard, 2009).

Smartphone: A smartphone is a cellular telephone with an integrated computer and other features not originally associated with telephones, such as an operating system, web browsing and the ability to run software applications. Smartphones with highly advanced features are the new breed of mobile phones that have multiple functions similar to those you might expect from a regular computer (Reisinger, 2012). With smartphone, accessing learning content become relatively easy and some can perform basic customisation/adaptation (with right features). Smartphone have characteristics that make them useful for learning purposes such as portable, socially interactive, context-sensitive, connective and individual. The features of smartphone are constantly evolving to bring excitement and personalisation to the users (Nushi & Eqbali, 2017).

ISM: Interpretive structural modeling (ISM) is a well-established methodology for identifying relationships among specific items, which define a problem or an issue. In this technique, a set of different directly and indirectly related elements are structured into a comprehensive systematic model (Sage, 1977; Warfield, 1974; Jharkharia & Shankar, 2005). This study will use ISM model to investigate the relationship among learner's preferences and mobile device capabilities in order to extract structural model.

Delphi method: The Delphi method is a forecasting process framework based on the results of multiple rounds of questionnaires sent to a panel of experts. This method was originally developed as a systematic, interactive forecasting method which relies on a panel of experts. This method was introduced by Dalkey and Helmer (1963). It is a survey method with three features: anonymous response, iteration and controlled feedback and finally statistical group response (Hsu, Lee, & Kreng, 2010).

Development: Development as defined from the context of instructional development is the systematic study of designing, developing and evaluating instructional programs, processes and products that must meet the criteria of internal consistency and effectiveness (Seels & Richey, 1994). Based on this study, development is a process of identifying the appropriate personalised m-learning elements and the relationship among these elements to be included in the development of the personalised m-learning curriculum implementation model.

Experts: An expert is a person with extensive knowledge or ability based on research, experience, or occupation and in a particular area of study and as in the context of this study, mobile learning field. It is based on four 'expertise' requirements: 1) knowledge and experience with the issue under investigation; 2) capacity and willingness to participate; 3) sufficient time to participate in the study; and, 4) effective communication skills in both written and in expressing priorities through voting procedure (Adler & Ziglio, 1996).

Needs analysis: Needs analysis is a method to identify the gap between the current situation and targeted situation (Witkin, 1997). The needs analysis are often referred to as 'gaps', or the difference between what is currently done and what should be performed. McKillip (1987) defined needs analysis as a tool for decision making in the human services and education. Thus, in this context, needs for personalisation are the gap between what might happen as the process changes and what we would desire to happen. This study was based on the students' opinion in determining their need to develop the curriculum implementation model.

E-learning: Electronic learning or e-learning refers to teaching and learning using electronic media with the help of information and communication technologies (Simonson, Smaldino, Albright & Zvacek, 2000; Kok, 2013). In education, e-learning focuses on the student with the teacher serving as the learning facilitator. In this study, the drawbacks of e-learning highlighted and its' features are compared against m-learning.

Lifelong learning: Lifelong learning or LLL comprises all phases of learning, from pre-school to post-retirement, and covers the whole spectrum of formal, non-formal and informal learning. It means that learning is a process that occurs at all times in all places. (Green, 2002). The use of mobile devices in the learning process will promote information literacy which is the heart of lifelong learning.

Handheld computer: A handheld computer is a portable computer that can conveniently be stored in a pocket (of sufficient size) and small enough to be held in one's hand. Traditional handheld computers were personal digital assistant or PDAs and devices specifically designed to provide PIM (personal information manager) functions, such as a calendar and address book. This is a type of mobile devices that one can use in the learning process.

Handphone: A handphone is a wireless handheld device that allows users to make and receive calls and to send text messages, among other features. This device does not require the use of landlines. This is a basic mobile device one can use for learning and it will need lots of customisation and/or adaptation in order to receive the intended learning content.

SMS: SMS (Short Message Service), commonly referred to as "text messaging", is a service for sending short messages to mobile devices, including cellular phones, smartphones and PDAs (Ahonen, 2011). SMS is one of the oldest and most popular channel of wireless communication. It uses standardised communication protocols to enable mobile devices to exchange short text messages (Kelly, 2012).

1.10 Conclusion

This study begins with introducing m-learning and personalised m-learning which are the main concepts for this study. This study focus on incorporating personalised m-learning in formal classroom learning. In this context, personalised m-learning was described as tool which allow the learner to retrieve, view and repeat the learning content based on one's need and preferences. If the learning environment and content did not support learner's need and preferences, this will not motivate them to access and learn. The justification of the study on personalised m-learning was supported with the frequent use of mobile technologies in all sectors of life, especially for information sharing and knowledge seeking.

However, the study of personalised m-learning which incorporated in formal learning should be viewed as learning enabler. As an enabler, it cannot be used as a replacement for a formal learning but as a supporting tool in the formal learning process. The study focus on personalised m-learning in hospitality programme where its support the learner when one decided to learn and how he/she wanted to learn. The rationale section elaborated on the justification of the development of this personalised model. This section was used in constructing the objectives and the research questions of the study, which systematically guided the development of the model. A discussion on theoretical framework followed suit to help inform on the elements, which should be included in the development process of the model guided by learning theories and models. These learning theories and models are used as a guide in the implementation of personalised m-learning curriculum implementation model to support students in hospitality programme.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The main purpose of the study was to develop the personalised m-learning curriculum implementation model for diploma students in hospitality management programme. The study was aimed at proposing personalised m-learning curriculum model which could be incorporated into the formal classroom learning. By implementing personalised m-learning in this programme, students are able to received m-learning content based on their preferences at that point of request and the capabilities of their mobile devices. This chapter discusses the relevant concepts and theories of m-learning and personalised m-learning in providing formal learning experiences to the students. These theories will define how student learn and interact with the learning content to achieve their learning goal of this programme. These theories aimed at guiding the selection of student's preferences and transformation; and adaptation techniques used based on the mobile devices which the students carries in the development of the real anytime, anywhere and any device curriculum model. This chapter also discussed the following:

- Personalised m-learning can be used in the formal education to transform the formal learning content to m-learning environment based on existing personalised m-learning initiative and implementation. This is essential to look at an overview of personalised m-learning which provides learning services that adapt to learner's characteristics such as learning styles, requirement, preferences and profile. The study looked into how personalised m-learning has been implemented in mainstream education especially in developed countries where the mobile device penetration in education sector was quite impressive. This was followed by the feasibility of the study in employing personalised m-learning in classroom learning. The concept and definition of personalised m-learning also discussed here.

- The discussion of the concepts and definition of personalised m-learning add a new learning strategy to the e-learning and m-learning where it provides flexible and personalised learning which become the foundation for the development of personalised m-learning curriculum implementation model. Implementing innovative approaches like the personalised m-learning in formal education motivate the learner to have better understanding of the learning content and acquire the knowledge required.
- This will followed by discussion on personalised m-learning theories which was the underlying principles and guide in the development of personalised m-learning implementation model. Based on the concept, definition and theories of personalised m-learning, the theoretical foundation of this study will be presented.
- The theoretical framework focus on two main areas:
  - The first area focuses on learning theories and how these theories make a learner learn through personalised m-learning. Learning theories on personalised learning were presented to describe how students of hospitality programme learn through personalised m-learning by identifying the element needed in developing the preferred model. Based on these elements, the content customisation and adaptation will be identified.

- The second area uses the learning theories to characterise and categorise the mobile device limitation. With these categorisation, the ideal content customisation and adaptation will be identified in implementing the curriculum model. This section further elaborates the pedagogical framework and the adopted model in providing the personalised m-learning to the students.

- Based on the above findings and discussions, a conceptual framework for the development of personalised m-learning curriculum implementation model for hospitality programme is presented.

2.2 M-learning in Education

The advancement of mobile technologies encourage learning experiences outside of a teacher-managed classroom environment. Its' give anywhere, anytime learning capabilities. Mobile device can be used to access content, either stored locally on the mobile device or reachable through interconnection. Beside this it is also can be used to interact with other people especially other learners via voice, text messages, images and videos.

Mobile devices especially smart phones are very popular device among teenagers because of capabilities and functionalities similar and something better than those offered by personal computer. Additionally, these smart phones' unique features of mobility and tiny make it suitable to be used at anywhere and anytime. Besides being used for communication, it also popular for leisure activities since it has multimedia functions incorporated such as audio, video, photography, games, etc. It also penetrate into educational sector to support in various educational activities. A research study by (Humanante, García, & Conde, 2016) highlighted the failure of learning management systems to reach its full potential in higher education due to lack of personal spaces where the student learn. This study proposed mobile Personal Learning Environments (mPLEs) where the students has freedom to select available learning resources based on their needs, preferences and learning styles. However, the selection of learning materials also influence by the environment and capabilities of the mobile device used when the students engage in the learning activities. They agreed that mPLE can perform personalised learning activities better with the support of mobile technology.

According to (Wang & Chou, 2016), mobile devices have been used successfully as a communication platform compare to content provision/access platform with the development of mobile social-networking applications (MSNAs). But later, there was increasing interest in developing m-learning applications for learning content provision and access (Bajdor & Dziembek, 2018). It started with providing student support service using mobile devices (Kajumbula, 2006; Brown, 2005). (Fisher & Baird, 2007; Uden, 2007; Woukeu et al., 2005; Griol, Molina, & Callejas, 2017, Van Wingerden, Wouda & Sterkenburg, 2019) suggested that mobile learners were able to construct their own knowledge with m-learning through collaboration and interaction among peers, teachers, and experts. Collaboration and interaction are the key components of constructivistic learning model. Thus it is important to incorporate collaboration and interaction in content based approaches to m-learning. Researchers like Goh and Kinshuk (2006), Motiwalla (2007), Nakabayashi et al. (2007), Toledano (2006), Trifonova and Ronchetti (2006), Yang (2007), Font, Contreras, Johnsson, & Linderman (2018) had incorporated content approaches in constructivistic learning model in their m-learning applications. Following are the possibilities and benefits that m-learning can offer to students:

- Idle Time: Mobile devices are the perfect tools that can help learners to make use of their idle times whenever they are away from their traditional classroom learning, to get motivated for learning and communicate with others (Rakhmawati, & Firdha, 2018). By doing so, m-learning can save learners' precious time and effort by providing learning content as well as support services such as assignment due dates, deadlines, timetable changes and similar secondary information (Noor et al., 2018). This saved time and effort can be channeled to other productive activities which can enhance learning.
- Reflection: Reflective learning possible with mobile devices especially on iPods, PDAs and even smartphones. Live lectures can be recorded and stored as podcasts which can be listened to anywhere and anytime (Sundgren, 2017).
- Rich Content: Advanced development in mobile networking technology are making it possible to deliver multimedia content on high end mobile devices. Mobile devices' ability to interoperate with desktop computer and Internet system increases flexibility in online learning. According to (Caudill, 2007), mobile devices with advance functionality can enable learner contextualisation and personalisation of learning content.
- Collaboration and interaction: Current mobile networking technology able to support group discussion where learners can share files and documents as they discuss. Mobile devices with Internet access able to support collaboration and interaction among learners in m-learning environment.
- Pedagogic Support: As suggested by (Luis de Marcos et al., 2006), m-learning can provide pedagogic support activities before, during and after a

lesson. Before a lesson, teacher can profile learners with their prior learning, learning styles, qualification and so on in order to create appropriate content that suit for the class. During a lesson, the learners can use their mobile devices to perform online activities such as online quizzes to evaluate their learning experiences. After a lesson, the teacher can do a follow up activities to measure the understanding of the lesson by the learners and to gauge the usage of the skills in the field of work.

Learning via mobile devices become more popular in recent years and millions of students and educators using it all over the world. Introduction of wireless mobile devices such as laptops, smartphones, Personal Digital Assistants (PDAs) and tablets allow students to learn in or out of the classroom. These mobile technologies with the support of online applications and tools, have transformed the way the students learn. Now, they can learn anytime and anywhere and this flexibility make it possible even for adult learners which may enhance their work-education balance.

Learner learn different things at different ways at different speeds and at different times. So, learning content need to be adapted in various ways according to the learner needs which needs to be further adapt based on the speed he/she wants to learn and the time of learning. Beside this, the surrounding where the learning take place also influence the type of content one want to receive. So the learner's contextual information (such as the learner's previous knowledge, interest, learning styles, learning goals and learner's current location) is an important factor in order to achieve success in the personalised and adaptive m-learning. Contextual information is any piece of information that characterises a learners' given situation. In an m-learning experience, each and every learner has to be treated differently according to the current situation of the learner where he/she is learning. This is considered as vital component of m-learning because without the context information, the same learning experience would be presented to every mobile learner. The context-aware term was first defined by Schilit et al. (1994) to describe the location, identities of nearby people, objects and changes to the objects. Since then, the term been used by researchers in various disciplines. The popular definition by Dey (2001, p. 3) define context as "any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between the user and the application, including the user and the applications themselves." Exploiting contextual information when developing an m-learning system can lead to a system that can dynamically adapt to the change in the learner's context during a learning process to give a more effective, convenient and enhanced m-learning experience. Dynamic adaptation of learning materials are needed to match the personalisation in m-learning. When learner engage in learning, either request or delivery, the current information of almost everything that involve in this personalised m-learning are needed such as device characteristics, network conditions, location, learner's behaviour (mood) and learner's preferences. These information can be used to perform personalisation to deliver the most suitable learning materials to learner.

2.3 Challenges and Advantages of M-learning

Mobile devices and mobile technologies provide new conditions for learning in different context. With this innovation tools and technologies, mobile learning offering brand new solutions to unsolved problems. Different researchers believe and gave different concept and/or name for this type of learning. (Keegan, 2005; Sharples et al., 2007) believe it's a situated learning and seamless learning by (Chan et al., 2006). M-learning allow learners to interact with others individually and in groups. According to (Ally, 2009; Woodill et al., 2008:2; Keegan, 2005), there are significant advantages and highlights of m-learning. The following section discussed the advantages and highlights of m-learning.

M-learning encourage learners to participate more in the learning process. Learners are able to access administrative functions, download learning content, and review their learning history via learning management system and lot more, only with a mobile device. This will indirectly increase the learners' productivity. Learners consider mobile device as a learning tool and the ownership of this device is important since it give students feeling of true ownership and opportunities to take control of their own learning. So, it gives learners the real ownership, control and self-confidence in learning. M-learning gives freedom to the learners so that they are not restricted to a specific physical location, a fixed set of times for learning and particular delivery channel. M-learning allow learners to choose where, when, how they want to learn. It cater for the learners selection of anywhere and anytime learning, allowing for a personalised learning experience for learners. M-learning able to support collaboration and interaction among learners, teachers and experts, from anywhere and anytime. It also allow learners to share files and documents as they discuss and facilitate on-demand access to learning resources (just-in-time learning). Teachers can make use of this m-learning to conduct online quizzes, forums and surveys to assess the learners' understanding.

(Ally, 2009; Woodill et al., 2008; Keegan, 2005) also highlighted the challenges of m-learning. The following are the drawbacks of m-learning:

a) majority of mobile devices are with small screens with limited information on screen
b) it has limited storage capacity

c) it lacks of operating system

d) it can make learners feel isolated from their peers

e) it can cause cheating in the learning process

f) it can cause problem in different learning platforms and devices

g) it has limitation in publishing learning resources in different devices

h) mobile devices can be outdated very fast

i) it has issue in wireless connectivity

j) it has problem in multi-device capabilities

M-learning opens new window in teaching and learning environment where learners have opportunities to view the course content, communicate with their peers, teachers and experts anywhere, anytime without the restrictions of fixed-location desktop computer (Malinowska, 2018; Kaliisa & Picard, 2017). Integration of mobile devices in the field of education offered learning flexibility to the learners and moreover its' suit their lifestyle. M-learning is one form of e-learning but with greater independence of location and time.

The definition of m-learning can be simplified as e-learning on a mobile device. Mobile devices can support both formal and informal learning through collaboration, chat services, and data transfers between learners directly on the mobile device. This simple device changes the nature of the relationship between teachers and learners. In a learning environment (school, college or university), the content creator (usually the teacher) makes content available for downloading. These contents are in the form of text to read, quizzes, links to more resources, calendar events for an assignment, discussion topics in a forum, email alerts and so on. When the learner (usually student) uses one of the above services, he/she become a mobile learner.

Over the years, many researchers in technology-enhanced learning have shown great interest in the field of adaptive and personalised learning (Maseleno et al., 2018; FitzGerald et al., 2018; Bartolomé, Castañeda & Adell, 2018; Salleh et al., 2019). This has triggered several research initiatives worldwide to investigate the shift from the traditional one-size-fits-all teaching approaches to adaptive and personalised learning (Alshalabi et al., 2018; Curum, Gumbheer, Khedo, & Cunairun, 2017; Benmesbah, Mahnane, & Hafidi, 2018; Lamia, Ouissem, & Mohamed, 2018). This new approach provide the learners with adaptive and personalised learning experiences which was tailored according to their needs and personal characteristics to fulfil their learning satisfaction and learning effectiveness. Meantime, the advancement in the mobile communication technologies and affordability of the mobile devices have benefitted the users especially the students in number of ways. According to (Ally, & Wark, 2018; Mbabazi et al., 2018), students now can enjoy (a) Internet access; (b) interpersonal and group text, voice, and/or video communication via wireless, cellular, and virtual private networks; (c) digital content sharing in various formats (text, image, audio, video); and (d) location-aware information delivery and personalized assistance according to their preferences, needs, and characteristics, all without place and device restrictions. Mobile devices are seen as an emerging technology which can be used to support teaching and learning. According to (Dias & Victor, 2017; Ali, 2017; Crompton, Burke, & Lin, 2019; Kukulska-Hulme & Traxler, 2019), mobile devices can support students in learning in number of ways, notably:

a) to give learning experience without the restriction of place, time, and device
b) to allow continuous learning process in and out of traditional classroom through their constant interaction and communication with their peers, teachers and experts

c) to support on-demand access to educational resources

d) to try out new skills or knowledge acquired

e) to allow the extension of teacher-led classroom with informal learning activities outside the classroom

As discussed by Diana Laurillard (2007), m-learning can offer wide range of learning activities through these small mobile devices. The following learning activities can happen in any physical environment in which the learner is placed with the help of mobile technologies.

a) Exploring – mobile device with Internet facilities have access to explore ideas, theories and concepts.

b) Investigating – learners are motivated to ask questions with their teachers, with their peers, and with experts to further their understanding in their learning.

c) Discussing – synchronous or asynchronous discussion can conduct with other learners especially in real time it can create excitement in their learning process.

d) Sharing – sharing content such as sound, image, video, audio, text, and so on, beside open up communication channel among a group of learners, it is also show their commitment toward learning. The learners will be motivated to improve their skills if they can share their finding with peers.

e) Reflecting – learners will be excited to enhance their practice and augment their conceptual understanding by reflecting their experience and share their outcomes with peers.

M-learning has opened up the opportunity for learners to acquire knowledge in any location (learning or non-learning environment). In learning environment (formal learning), the learning process will be driven by the teacher. In non-learning environment (informal learning), the learners are on their own and their learning process is driven by them with the help of mobile technologies. M-learning indeed changed the teachers/lectures role from being content experts to their new role as facilitators of learning. M-learning subscribes to learner-centred approach which focuses on their experiences, interests, and their preferences to develop critical thinking, interactive learning, communication skills and flexibility/freedom to learn.

M-learning in any device (mobile device) can bring greater advantages where a person can access information at any time without restriction of location and it will be better if this can be done without the restriction of the mobile device. With higher penetration of mobile device among student and majority of them carrying around most of the time, m-learning can become best tool for lifelong learning. With new generation of learners, the success of lifelong learning depends on the use of mobile technologies in education which removes the borders of time and place. M-learning move away learning activity from instructed-centred classroom teaching to constructivist learner-centred learning. There are a lots of tasks/jobs need continues learning outside the classroom and a very good example is nursing education and practice. Nursing education require the nurses especially trainee nurses to aware about the medical terms, processes and procedures all the time. As the amount of medical terms and information continue to grow, timely access information on any type of mobile device from any location can help patient or might even help save a life with these small devices that they carry around all the time (Willemse, 2018; A. Becker, 2019). M-learning in the field of nursing practice involves the use of handheld devices to deliver personalised, accurate and up-to-date content to learners in learning and/or non-learning environment. Nursing students especially those who are in training can benefit from this device's ability to access resources such as processes, procedures, drug guides and most of all the ability to communicate with their peers, teachers and experts who can help them confirm the value of information found online and their real-world environment. Nursing students with mobile devices have greater advantages and ability while using their devices to ask questions (with their peers, teachers and experts), instant access to nursing resources and software, and ability to access conceptual knowledge and practical skills while in classroom, laboratory or at clinical setting (Li et al., 2017). Meantime, the teachers use these devices to keep track/records of student assignments, moderate students' discussion/forums, and to document student progress in real time.

The use of mobile technology in classroom rapidly moving from an idea to a reality. Students access to mobile devices increases exponentially and this makes the teachers introduce mobile devices in the teaching and learning process in the classroom (Ali, 2017; Benmesbah, Mahnane, & Hafidi, 2018; Li et al., 2018; Dias & Victor, 2017; Adhikari, Mathrani, & Parsons, 2015). (Klimova, 2019; Kumar Basak, Wotto, & Bélanger, 2018; Pande, 2018) believe that availability and potential use of mobile devices in teaching and learning process will make large impact on education which indirectly will change the way the teachers teach and students learn. In order to learn independently at any location, mobile learning allow students to access information at a precise time and place by the order of topics that the student needs to be successful. Mobile devices and mobile technologies have created a new type of learners who think and learn differently than the previous generation (Gezgin, Adnan, & Guvendir, 2018). These digital generation make use of mobile learning as a learning tool whenever and however they desire. The learners especially the students very much interested in using mobile devices for education since it makes learning process easier and more engaging. According to (Parsons & Adhikari, 2016), this technology is mobile and connected, besides placing large amount of control in the hands of users (students), and allow them to share information in a variety of ways, anywhere and anytime. Personalisation as one of the key point allow learners to make choice and customisation in their individual learning. Besides classroom teaching and learning, learners now read, study, and communicate outside traditional classroom setup such as during their break, while they are on the move or whenever they want to engage in the learning process because they have their mobile device with them at all the times. According to (Ting, 2013), mobile devices allow students to access information when they really need them and at location that are ideal for the learner for a positive learning experience. Mobile devices allows learning to the greater depth by allowing the learners to interact with their peers, teachers, and experts at their own non-threatening learning space.

Even though m-learning provide certain kind of adaptation mainly at device level, it fail to provide personalisation and compels the learner to follow the same curriculum as others without making learning that best suits the individual learner. As a result, learner who was once classified as active learner become slow learner because learner do not learn the same ways as others and content did not cater for the learner's learning preferences (Cirasuolo, 2019).

2.4 Definition of Mobile Learning (M-learning)

The m-learning was inherited from distance learning and e-learning. The German scholar, Peters in 1973 wrote that the first trains, the first postal systems and the first correspondence courses commenced at the same time. The first distance educators separated the teacher and the learner, learner from the learning group, and used a form of communication mediated by technology and still claimed that the essence of the education process was maintained intact. In the year 1980's, the development in electronic revolution attributed e-learning. E-learning made it possible to teach face-to-face at a distance (electronically). For brief definition, E-learning means the provision of education and training electronically (via Compact Disk and World Wide Web). There is no doubt that the World Wide Web (WWW) is the most successful educational tool that has captured especially the young generation. Success of e-learning through WWW is because of its platform independent feature and global scale availability. After the successful development of Bluetooth, WAP (Wireless Application Protocol), GPRS (General Packet Radio System) and UMTS (Universal Mobile Telecommunications System), the wireless technologies started to move strong into other fields beside telecommunication. The popularity of wireless technologies changed the landscape of how people communication and conduct businesses. Wireless technologies slowly replacing wired technologies and applications. In the field of education and training, wireless technologies are still in its growing stage but it has started to set the building blocks of m-learning. Introduction of this new technologies in educational sector believed to overcome the “anywhere” limitation of e-learning.

M-learning is refer to the mobility of the distribution of any educational content using mobile technologies such as Pocket PC, PDA (personal digital assistant), Table PC, eBook, smart phones, mobile phones, and other portable devices. M-learning is different from e-learning, since it is not just electronic, it is mobile. M-learning is seen as the natural evolution of e-learning, according to (Hoppe, Joiner, Millard & Sharples, 2003), “m-learning is e-learning using a mobile device and wireless transmission.” Harris (2001) also writes, “m-learning is the point at which mobile computing and e-learning intersect to produce an anytime, anywhere learning experience.”

M-learning can be defined as the learning that takes place anytime, anywhere with the help of a mobile device, which is capable of presenting the learning content and providing two-way wireless communication between the learner(s) and the teacher(s). M-learning is both a new concept and that has some familiar connotations. It's concern with learners' mobility, in the sense that learners should be able to engage in educational activities without the constraints of having to do so in a tightly delimited physical location. Researchers and scholars have come out with several definitions for m-learning, and all these definitions focus on the aspect of anytime, anywhere learning using mobile devices (Klimova, 2019; Alhassan, 2016; Shorfuzzaman & Alhussein, 2016; Al-Hunaiyyan, Alhajri & Al-Sharhan 2018; Chaka & Govender, 2017).

The definition of m-learning can be simplified as e-learning on a mobile device. Mobile device is a computer-based device that one can carry around easily anytime, anywhere. Mobile device have the advantages over desktop computers that they are small enough to be carried anywhere and relatively inexpensive. In Malaysia, the number of mobile service subscribers in 2010 is approximately 31,456,000 (Malaysia Communications and Multimedia Commission - MCMC, 2010) with a penetration rate of around 106% due to multiple subscriptions. This tremendous penetration rate especially among youth is around 30% of the total mobile service subscriber in Malaysia. These data shows that there is a high potential for these devices to be used in teaching and learning. Educationist and content developers must take advantage of this situation since mobile phone usage among our students has become virtually universal.

M-learning is defined as e-learning through mobile computational devices. And mobile device define as any device that is small, autonomous and unobtrusive enough to accompany us in every moment in our every-day life, and that can be used for some form of learning. M-learning is learning through mobile computational devices. M-learning is just not electronic, but it's mobile. Mobility is the keyword for m-learning. Elkhateeb, Shehab & El-bakry (2019) identifies three important elements for mobility in teaching and learning activities namely: convenience, expediency and immediacy. These special features of mobility allow teachers and students to participate in informal teaching and learning activities outside the classroom. With additional mobility feature, m-learning can be referred to as an extension of the existing e-learning applications. Beside, m-learning enables learners the ability to receive learning on any device practically anywhere and anytime. While the e-learning permits learning beyond physical classroom, m-learning go one step further to allow learning in a context-awareness manner. M-learning offers possible solutions that address the shortcomings of the traditional classroom-based education. Since the use of mobile devices among students has dramatically increased, implementing m-learning in academic institutions is of common interest.

O'Malley et al. (2005) defined m-learning as "any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies". Based on the first part of the definition, m-learning can be defined as any type of learning that happens when the learner is not at a fixed location, with or without mobile devices. So, m-learning is not determine by the mobile devices and/or mobile technologies but it rather emphasis on the mobility of the learner who are on the move on their daily life. Therefore, the learning process in m-learning happens with or without the help of mobile devices as long as the learner has the time and willing to learn.

(Kukulska-Hulme & Traxler, 2019; Sung, Chang & Liu, 2016) defined mobile learning as the process of teaching and learning with the use of mobile devices. Mobile devices provide on-demand access to learning resources, communication and collaboration with peers, teachers, and experts, from anywhere and anytime. The benefits of mobile devices as reported by (Thomas, & Muñoz, 2016; Christensen, & Knezek 2017; Scott et al., 2017; Lai & Zheng 2018) are as below:

a) provides on-demand access to learning and resources and services
b) provides learning opportunities outside traditional teacher-led classroom
c) engage learners to experiential learning (learning by doing)
d) enables learning and performance support by exploiting real-life context
e) provide supports to access, communicate and exchange of knowledge with peers, teachers, experts, and communities of practice
f) create platform which allow teachers to personalise instruction
g) give learner the opportunity to self-regulate learning
h) increase learner's engagement and motivation for learning

2.5 Definition of Personalised Learning

Personalised learning can be defined in different ways. Svenningsen, Bottomley & Pear (2018) refer personalised learning as teaching which was catered for specific and immediate needs of an individual. They also refer personalised learning to a system which can automatically adjust to fulfil the learning needs of an individual student. Personalised learning can be further enhanced with the use of digital technology such as blended learning where online learning activities sync with in-class instruction. According to Easley (2017), there are two thoughts regarding personalised learning and the use of technology. There are educators who believe that successful personalised learning requires the use of technology. With technology, the personalisation tasks become much easier. Adaptive software were used to modify the content based on the user's interaction with the software. Another group of educators believe that technology is not required to perform personalised learning. They believe that the educators' expertise and human touch with the learners are the most important aspects of personalised learning. Present day classrooms are teeming with students of varying interests, backgrounds, abilities and learning needs. To engage with these students, learning must be just as different as they seem to be. Before we look into personalised learning, let us define differentiated learning and individualized learning and how these are related to personalised learning.

Differentiated learning is a type of learning where the instruction is tailored to meet the learning needs, preferences and goals of individual student in order to create different paths to understand the content (Carlyle III, 2018). The academic goals for groups students are same, yet the teacher has the liberty to use whatever resources and approaches that sees fit to engage with a student that have proved successful for similar students in the past. Despite what an educator chooses to separate whether it's topic, the learning procedure or even nature where learning happens, differentiation an awareness of and dynamic reaction to students' fluctuated learning styles. It includes practicing adaptability in evaluation, gathering and direction to make the most ideal learning knowledge. Here's how differentiation works: an educator reacts to a student's unique learning needs through the learning process, the learning content, or the particular learning vehicle, based on the student's interest, learning styles or readiness (Willacy & Calder, 2017; Carlyle III, 2018; Gynther, 2016; Frankling, Jarvis & Bell, 2017). In order to help students to understand and make sense of concepts and skills, educator differentiate by providing path for learning. They also provide suitable levels of challenges for all students, regardless of their competency. But educators do not differentiate by developing separate lesson plan for each student in a classroom which is a huge tasks for the educator. In providing best possible way of differentiated learning, the educator really need to know each and every student in the classroom who are with diverse interests and capacities and adapting the academic goals of the curriculum where possible. It involves the development of a comprehensive plan in using the available resources and time to facilitate the differentiated learning.

According to (Johnsen, 2016), the term personalised learning been referred by different terms in the past and present which have the similar meaning of how students wish to learn. Some of these terms are individualisation, customisation, differentiation, tailoring, adapting, and accommodating. These terms are focus on student's strengths, needs, and interest when it comes to learning. In order to engage better with students, educators choose to integrate technology into personalised learning by various modes and strategies. According to Muhammad, Mitova, & Woolridge (2016), the personalised learning approach taken into consideration the environment which the learning takes place, the characteristics of each learner and types of technology available at the time of learning. Similarly, this research taken into consideration the learners' preferences (characteristic and needs), the environment when they engage with learning and the mobile device (technology) which the learner use to send/receive learning content. Technology play an important part to enhance teaching and learning in and out of classroom. Students use mobile devices for communication and to access information online. With data showing 75% of teens have mobile device, schools are still reluctant to allow students to use these devices in the classroom (Maguth, 2013). There are schools which allow mobile devices in classroom but the students have to adhere specific rules to use them. Although use of mobile devices viewed as a distraction in the classroom, teachers still can allow students to use these personal technology devices so that students can explore further into the content and use appropriate learning tools to enrich their learning. With this, the teachers can embrace bring your own device (BYOD) approach to allow students to bring their own mobile device to be part of the teaching and learning activity (Wang, 2015). This promotes active and personalised learning among students.

According to (Willacy, West, Murphy, & Calder, 2017), students and teachers are able to engage in personalise learning due to the nature of the mobile technologies that allow customisation. This study explore the use of mobile technologies such as iPads to personalise learning experiences in students age seven to eleven in learning mathematics. Video recording evidences were used to illustrate number of ways mobile technologies can support personalised learning experiences. This study discovered four pathways for personalised learning: a) teacher-directed, b) customisable features, c) workplace selection, and d) student-led learning. In teacher-directed personalised learning, teachers identified specific learning needs of a student and create list of specific apps to cater for each student's needs. Then, the students use their own mobile devices to select apps according to their learning needs. In second personalised learning method, students use customisable features of mobile technologies such as fonts, images, colour, size and etc. to present their learning materials personal and relevant to them. In workspace selection of personalised learning method, the students were given a task on their iPad and the students use mobility of this device to move to the location most comfortable to them to complete the task which suit their personal preferences and needs. The student-led learning of personalised learning, teachers create an environment to allow students to control over what they want to learn, how they want to learn and how they want to present it.

This study focus on student's wants, preferences and needs to give personalised learning experiences. According to Hmelo-Silver & Chinn (2015), two important features of mobile technologies, mobility of the devices and their ability to continually change contexts can enhance personalised learning. The mobility feature allow learning to take place beyond the classroom and students are able to change location seamlessly (Calder & Campbell, 2016). As for the ability to change context feature, this can be performed by customisation at device and/or apps level. There are many apps available that can be personalised according to the student's specific learning needs with the help of mobile technologies (Calder & Campbell, 2016). This indicates that mobile technologies with customisation and mobility features have potential to personalise learning to cater for a different needs of students (Willacy, West, Murphy, & Calder, 2017). In this study, personalised learning experiences were created by the teachers based on their understanding of the students' knowledge and skills. Students were given options to select personalise learning pathway apps to suit their learning needs. But these pathways are limited to represent the idea of actual personalised learning that the students want. Furthermore its' based on the teachers' understanding of personalised learning in relation to student’s choice.

Individualised learning is where instruction calibrated to meet the unique pace of various students. If differentiated learning tackled the "how" then the individualised learning try to tackle the "when" (Song, 2017). With the academic goals remain the same for a group of students, the individualised learning provide approach so that the students can progress through the curriculum at different speeds, based on their own particular learning needs. This approach focus on the needs of the students. It serves students who may want to review previously covered content, students who don't want to waste time going through content they've mastered, or students who want to go through content slowly compare to other students or engage themselves in certain area of the content, or wants to repeatedly go through the same content until they really "get" it or mastered it. At first, the individualised instruction approach incorporated any instructing techniques that addressed an individual student's needs, however in reality, the term portrays students working through set of materials or educational modules at their own pace. With individualised learning, the strategies are depend on students' readiness, interests and best practices. This was intended to enable every students to master the skills that they need as defined by the academic standards. According to (Watts, 2018), since learning is unique to each learner, it should be handle in individualised manner even though it is rather difficult to understand how each learner learn. Individualised learning create a path which no other learner went so that the customisation will be unique for each learner. This is easier for learner to follow if the course content break down to suit the needs of individualised learner.

Adaptation is defined as act of changing or fitting to suit certain conditions. According to Opperman (1994) and Turner (2018), adaptable system can be defined in two ways:

a) Adaptable system is a system which can change its parameters to suit the user's needs. In this system, the user can change certain parameters and/or can modify the system in a specified ways to suit his needs.
b) An adaptive system is a system that can automatically tailor to cater to the needs of the user. In other word, the system automatically changes its behaviour according to the user's needs.

As defined by (Klašnja-Milićević et al. 2017), personalisation, in the other hand, represents both types of system which define above (adaptivity and adaptability). By tailoring the content or by visualisation of the system according to the user's needs and preferences, personalisation can be achieved. According to (Kumar & Desai, 2016), the term personalisation can be define in two different ways:

a) firstly, the process of gathering and delivering the relevant information to users

b) secondly, besides delivering relevant information to users, it also give recommendation to users based on the gathered information.

In the context of m-learning, it is important to deliver relevant information (learning content) for the learners. The adaptive system for m-learning adapt the content based on learner's preferences, previous knowledge and goals. On top of that, it also have ability of tailor its reaction depending on the learner.

Flexibility is the one of the best features in m-learning. With mobile device in hand, learners are able to learn by going through their learning materials on the go and at their own pace, and able to communicate and collaborate with peers, teachers and experts at anytime and from anywhere. Learning materials which are dynamic and digital can be used to great effect. In personalised learning, learners are able to use their mobile devices to access the learning materials which have been tailored according to their needs and preferences. Personalised learning is important to support learners who are diverse in nature, with different abilities and needs. Flexibility in m-learning to offer personalised learning is a great advantage in on-demand learning and point-of-need learning.

In student-centred environment, personalised learning required teachers to identify the students' needs and address them accordingly. Personalised learning is all about optimising learning every day and maximising the amount of learning per unit of time. The International Association for K-12 Online Learning (iNACOL), define personalised learning as:

“Tailoring learning for each student’s strengths, needs and interests–including enabling student voice and choice in what, how, when and where they learn–to provide flexibility and supports to ensure mastery of the highest standards possible” (Patrick, Kennedy, and Powell 2013, 4).

With personalised learning, the teachers' play their role as mentors, coaches and facilitators, and power and control shifts to the students. The students have full control and ownership over their learning which are based on their interests and needs, hence they feel valued and motivated. Our education system has been a one-size-fits-all model for too long. In this model, the same lessons are delivered to all the students at the same time. In personalised learning, the students are actually in the driver's seat, actively integrating their needs, strengths and interests into their learning.

Personalised learning, perhaps the most confusing term because some misuse the term by referring to the student's choice of how, what and where they learn according to their preferences and some confused with individualisation which refer to the lessons that are paced at different rates to accommodate different students. Personalised learning refers to combination of both; differentiated learning and individualised learning. It tailored according to the preferences and interests of various students and at the same time paced to a student's unique needs. In short, the academic goals, curriculum, content, learning styles and pace can be possibly vary in a personalised learning environment. In personalised learning, the students are involves in the creation of the learning activities and relies heavily on the student's personal interest. Personalised learning not always on something that happens to the students, but also something that happens as a result of what the student is doing. It's far from the traditional way in which the teaching and learning took place. Personalised learning makes the students to take control and ownership of it by responding to the students' needs and interests, and teaches them to manage their own learning. It's not something that is done to them but it's something that they participate in doing for themselves. As for the teachers, personalised learning is about facilitation more than dissemination. Since the best personalised learning method require one-on-one tutoring based on each student's interests, references, needs and pace, which is unrealistic, it's often considered of as an instructional method that incorporates adaptive technology to help various types of students to achieve high level of learning.

2.6 Perspective and Definition of Personalised M-learning

There are many attractions when learning comes with mobile and personalised. Current model of education do not cater to individual needs, and preferences and adopting personal mobile technology expected to supersede this one-size-fits-all education model (UNESCO, 2013). So, the need for personalisation due to the fact that the huge amount of information and learning content available online and lack of learning management system which can provide personalised content to the learner. Any m-learning initiative to be successful, physical and social environment must work along with teaching strategies and individual differences between learners are taken into account and appropriate alternative arrangements are put in place. Personalisation in mobile devices covers a wide range of possibilities. It covers from simple adjustment in the setting (such as font size, colour scheme or change of language) to assistance by intelligent software agents. In personalised teaching and learning, learners' differences and preferences must be taken into account in order to achieve their learning outcomes or goals. The key achievement in the development of m-learning depends on personalised learning. In general, m-learning is considered as 'personal learning' since the mobile devices are personally owned, m-learning focuses on personal goals of the learners and learners are able to make personal media choices on how he/she want to receive the content. According to Traxler (2011), there is a different between personalised and personal learning. The teachers play vital role in personalisation whereas the learners' role is on personal learning. For example, in formal classroom setup, the personalised learning approach "allows every different student a different way into the same learning" (Wiliam, n.d.) at the same time working towards the same goals. In informal learning, according to (Mikroyannidis, 2013), learners are able to set their own goal and build their own learning environments based on their needs and preferences and by doing this, they are able to make control over their own learning.

Initially, when handheld technologies was introduce into the market and consequently increase the ownership of mobile devices, the researchers are interested in this Technology-enhanced Learning (TeL). Later, they investigate how these technologies can be used for educational purposes in order to enhance learning experiences. This leads to discovery of research trend which commonly referred to as Mobile Learning (m-learning). In order to deliver suitable learning experiences to mobile learners, the researchers in this field were considering the learners personal mobility needs, the ubiquitous use of mobile technologies and the availability of information anywhere and anytime. A great effort was needed to investigate the potentials of an educational paradigm shift from the traditional one-size-fits-all teaching approaches to an adaptive and personalised learning that can be delivered via mobile devices. Mobile devices with variety of technological capabilities bring new services that works without the device constraints, location and time restrictions, ability to share digital content in any format (text, image, audio and video), delivery of location-aware information and personalised assistance based on users' preferences and needs (Gizaw, 2017; Griol, Molina, & Callejas, 2017; Lamia, Ouissem, & Mohamed, 2018). According to (Benmesbah, Mahnane, & Hafidi, 2018), the current focus of m-learning rely on delivering personalised and adapted m-learning experiences to learners with regards to:

a) the mobile device that been used to interact with
b) the learners' needs and preferences in learning situations which are different from a traditional classroom setup
c) the surrounding resources which are available that affect the interaction between learners with anywhere, anytime available information

The aspect of adaptivity and personalisation in m-learning become important in order to provide learners with adaptive and personalised learning experiences with their mobile devices (Madhubala & Akila, 2017; Badidi et al., 2019; Berkovsky, Kaptein & Zancanaro, 2016). According to (Ennouamani & Mahani, 2018), adaptive and personalised m-learning can be achieved with re-thought and re-designed of suitable educational scenarios in different learning situation, different personal learner's aspect such as learners' preferences and needs, and different contexts of resources and information presented (Benmesbah, Mahnane, & Hafidi, 2018). The development of m-learning systems should consider adaptivity and personalisation issues in order to present the learners with suitable environment which can be accessed anytime and anywhere, and according to the learners' context.

Personalised learning is an approach which can be implemented face-to-face in a classroom and over virtual learning. It also can support e-learning, m-learning and ubiquitous learning by adapting the learning content according to the learner's needs and preferences (Hongthong & Temdee, 2018). When personalised learning happens with the support of mobile devices, it called personalised m-learning. In order to promote anywhere and anytime learning, purpose built mobile applications with educational content were developed to improve learning efficiency (Huang, Yang, Chiang, & Su, 2016). Besides, m-learning of these kind able to support personalised learning (Noor & Khan, 2016; Hamada, Alshalabi, Elleithy & Badara 2016).

M-learning allow learner uses portable device to engage in learning at anywhere and anytime. However, it does not enhance the learner's experience due to the fact that the learning materials are not suit the learner's needs and preferences. To do that, content adaptation play an important role. In order to deliver the most suitable learning materials to the learner in a dynamic conditions, m-learning require to collect information from various sources to give the personalisation that the learner wanted. This study aims to discover the various sources in dynamic conditions that influence m-learning. Since, it gives the personalisation to m-learning, these sources are called personalised m-learning elements. The important of these elements are discovered so that necessary content adaptation can be performed. These important elements consist of information collected on the learner such as learning needs and preferences, the capabilities of the device used at the point of engagement and the information from the surrounding when the learning takes place. With this taken into consideration, the personalised m-learning will be able to deliver the best-adapted learning content that best suits an individual learner.

Even though, some of recent studies explored content adaptation for mobile devices, but still it does not match the capabilities of these devices. Furthermore, these adaptations are unable to match majority of mobile learner's vast interest under multiple learning conditions. Therefore, personalised m-learning become important to bring the learning approach further and to enhance the learner's learning trends and experiences. In fact (Curum et al. 2017) highlighted four distinct categories of sources for personalisation as a) the learner's identity; b) location and surrounding information; c) physical information such as noise level, touch, temperature and many others; and d) Time of the day, month, year, date. Likewise, this study also focus on contextual information gathered from other sources to be used for personalisation. These sources were from learner's needs and preferences; learner's mobile device capabilities; and learner's surrounding at the point of engagement (point of accessing, receiving and requesting learning materials). These are the most valued information collected for adaptation and/or customisation to offer personalised learning materials that matched the learner's preferences as closes as possible.

In order to present the most appropriate learning materials to the learner based on the learner's current contexts, the most valued factor is the personalisation of the learning materials to adapt the various mobile devices and the learner's preferences (Curum et al. 2017). According to (Curum et al. 2017), personalisation referred to learner's preferences which includes the learner's learning style, learning priorities and knowledge level. It also look at the learner's contextual features which includes level of concentration (mood), learner's cognitive load, the situating environment and the time when the learner engage in learning. Similarly, this study focus on important elements that need adaptation in personalised m-learning in order to deliver most appropriate learning materials to the learner.

Personalisation in m-learning systems refer to the process of enabling the system to fit its behaviour and functionalities to the educational needs (such as learning goals and interests), the personal characteristics (such as learning styles and different prior knowledge) and the particular circumstances (such as the current location and movements in the environment) of the individual learner or the group of interconnected learners (Maqsood et al., 2020). Many researchers have been repeatedly documented that, when learners are taught with specific approaches matching their learning styles/preferences as identified by the (Dunn & Dunn, 1978) model, they "demonstrate statically higher achievements and aptitude test scores than when they are taught with approaches that mismatch their preferences" (Dunn, 1990). The use of learning styles for the personalisation of web-based learning and m-learning applications have been developed by researchers including Saryar et al. (2019) and Alzain et al. (2017) respectively. (Zidoun et al., 2019) proposed that the use of learning preferences in m-learning applications is equally important due to the non-stationary nature of m-learning. In particular, they proposed a model of mobile learning preferences (MLPs), which accommodates some of the different MLPs that mobile learners may have. The construction of a personalised m-learning application deploys three dynamic MLP dimensions - location, perceived level of distractions, and time of day (Zidoun et al., 2019).

According to Jane and Mike (2011), learning preferences consist of 3 main components:

a) learning styles
b) learning strategies
c) learning characteristics

The learning styles are the students' preferred styles of learning and defined as a "description of the attitudes and behaviours that determine our preferred way of learning" (Honey, 2001). Kinshuk and Lin (2004) have make use of learning styles to develop personalisation in web-based learning. Park (2005) have used the same to develop m-learning application. The learning strategies emphases the learners' preferred strategies of learning such as deep, surface or strategic learning. As for the learning characteristics, it related to learner's personality and how these may affect the way the learner prefer to learn. Learner's interests, motivation, strengths and weaknesses are few of the learner's characteristics which fall under this category.

The learning styles play an important role in learner’s preferences when it comes to developing personalised m-learning system. According to (Felder & Silverman, 1988), learning styles referred as ways in which learners perceived understand and conceptualise information. Learners learn better when instructional learning activities designed and developed according to the diverse learning styles of the learners (Pashler, McDaniel, Rohrer & Bjork, 2009). With many learning styles studies and models, Felder and Silverman’s Learning Style Model, FSLSM (Felder & Silverman, 1988) was the best choice for this study. Other learning styles models tend to classify each student into one single category. But, FSLSM defines learning styles using a four-dimension approach where each dimension consist of two bipolar categories, one assigned to a student based on his/her behaviours and second, it recognises learning style model for online learning in terms of learning differences and individual needs. The four dimensions of individual's learning styles in FSLSM:

a) Processing information: active or reflective dimension

b) Perceiving information: sensing or intuitive dimension

c) Receiving information: visual or verbal

d) Understanding information: sequential or global

According to (Yankulov & Lu, 2017), based on research and study conducted, they concluded that majority of professional educators believe that there are benefits of using learning styles in teaching methods. However, there are also group of experts who believe that there is no high-quality scientific evidence to support this and called it a “neuromyth” (Hood et al., 2017). While there is lack of evidence to support benefit of learning styles, there is also no hard evidence to against this. But one must agree that each student has his/her preferred ways to learn. Some prefer to have images to easy understanding while others prefer texts and readings. Some want to go through experiments and examples for better understanding. As for this study, learning styles cannot be fixed based on learning preferences of the individual learner in general. Besides looking at the learner's behaviour, needs and preferences, one need to look at the learner's mood, surrounding and device used to engage in the learning activities. Learner's learning styles only can be precisely determine based on the above factor at the time of engagement in learning activities.

When technology utilised appropriately and meaningfully, it can enable teachers to convey differentiated, individualized and personalized instruction. It can help in timely interventional responses, involve parents in their children's learning, break down a complex problem, and all these based on the students individual needs. Teachers with right tools in personalised learning allow students to make suggestions and control their own educational experiences. The teacher must evaluate every individual's needs, and then recommend the correct solution for that student by making an appropriate curriculum and conveying it in a way that is significant and meaningful. At the same time, students at one point can identify what teaching-learning style works best for them and contribute in the development of their own personalised curriculum. Teachers, in the current learning environment must equipped with the right tools to address a vibrant spectrum of student differences and develop dynamic educational experiences.

Mobile technology gives students opportunities for taking ownership of their own learning. Personalised learning with the help of mobile technology able to pace to the students' needs, tailored to their learning preferences at that time and customised to a specific interests of different learners. It will take tremendous effort and wide range of resources to help the students reach their optimum potentials in their learning.

Communication and convenience are not the only reasons why mobile devices are popular among students. The same device can be used to transform traditional classroom paradigm to incorporate more personalised learning. Students use mobile devices especially smartphones to do research online (with internet connection), record observations and presentation using video and still cameras, record classes to revisit later and also can use to communicate and collaborate with peers and teachers.

Even in today's classroom, the teaching methodologies such as lectures, tutorials, homework, assignments, group project are remain the same. But the digital technology plays an important role by innovating each one of these activity. Student still can enjoy lectures but now it's in form of podcasts, online videos or audio, and visually appealing presentation. Students still can sit in a class or library to complete their assignments and at the same time they too also able to complete them using their mobile devices. Students are exposed to a wealth of technological tools in today's world. New devices and apps are introduced almost daily and it can generalised into four categories: smartphones, tablets, wearable technology, and laptops/netbooks.

a) Smart Phone: With smart phone ownership among students continue to climb, it will be a good idea for the teacher to embrace this little device in the classroom. That's because the standard smart phone can support a multitude of apps, and the academic-oriented apps has exploded in the recent years.
b) Tablets: According to the report in The Journal.com (2014), tablets such as iPads is booming and attracting many especially students. Its' too can support numerous academic apps. Unlike smart phone, tablet lends itself to

learning better because of its bigger screen which make them easier to use, especially for young children and students with special needs.

c) Wearable Tech: Wearable technology refers to clothing and fashion items that that can be worn on the body as implants or accessories (Donovan, 2009; WearableDevices.com 2013) with embedded micro-controllers. Its main advantage is its ability to connect to the internet, enabling data to be exchanged between a network and the device without requiring human intervention. This ability to both send and receive data has pushed wearable technology to the forefront of the Internet of Things (IoT). Wearable tech items such as activity trackers can be used in the classroom to measure student movement, so that it can collect and document their own activities and analyse the data.

d) Laptop and Notebooks: The use of laptops and notebooks in the classroom has educators divided. Some say they are distractions that detract from learning, while others say they enhance classroom learning. But researchers (Mueller & Oppenheimer, 2014) found that college students who took notes on laptops didn't do as well as students who took longhand notes. Laptops and all technological devices can obstruct discussions while students multitask across multiple devices. Any technological device, when used properly, can enhance teaching and learning in the classroom.

We are not asking whether m-learning are feasible but we have gone one step ahead by pondering whether m-learning can be efficiently incorporated into an educational program especially in formal education. Personalised learning, at the other end capitalises on students' ability to use technology especially mobile technology. It can blend instruction to combine face-to-face teaching, technology-assisted instruction and student-to-student collaboration to leverage each student's learning style and interests for deeper learning.

Personalised learning system can be designed either for personal computer in e-learning or mobile devices in m-learning. In order to design personalised m-learning environment, we need to perform certain adaptation to the content that intent to deliver so that the learning content that need to be delivered meets the needs of the learners. There are no fixed learning path which appropriate for all learner. Every individual will have their own learning style which best works for them. Beside their ability to learn, the instrument they use for learning (in m-learning, their mobile device) also play an import roles in defining ones learning path. Personalised m-learning take into account the learner's preferences (also their ability), the environment (network) and the limitation of their mobile device. Features of personalised m-learning:

a) Learner's preferences
b) Learner's device
c) Location
d) Accessibility
e) Learner's need
f) Enhanced/extended Curriculum

In characterising the key features of personalised mobile learning it is impossible to identify different aspects which are mutually exclusive.

Effective development of personalised m-learning seeks to engage and support all the learners inside and outside the classroom. The key challenge for personalised m-learning inside and outside the classroom is how to cater simultaneously for all the different needs of the learners. The priority is to support learners beyond the traditional classroom teaching and learning so that they can keep up with the pace of learning and make good progress.

Students should be reminded of the pedagogical justification when implementing personalised m-learning. For students, personalised m-learning is an innovative approach introduced in teaching and learning. Rogers (1995, p. 35) introduced five conditions that need to be met when implementing any innovative adaptation:

a) Relative advantage: for every new innovation to be implemented, if the users perceive this innovation better than the idea or practice it replaces, then the adaptation of this new innovation will be faster.
b) Compatibility: the newly adopted innovation needs to be compatible with the existing values and practices in order to adapt it fast.
c) Complexity: if the new innovation perceived as difficult to understand and use, the user will require to develop new skill else it will be adapted fast.
d) Trial ability: every new innovation need to be tested and proven on limited evidence to convince and successfully adopted.
e) Observability: if the results of the new innovation are more visible than others and easier to be notices by the individual, it is more likely for them to adopt it.

The rationale to implement personalised m-learning is to increase the access and to enable new pedagogical methods. Correct approach in the design and implementation of personalised m-learning will provides flexible access to learning and can overcome some of the limits of the Human-Computer Interaction Community (Gay, Stefanone, Grace-Martin, & Hembrooke, 2001). Kinshuk, Chang, Graf & Yang (2009) described two adaptive approaches in personalised m-learning. The first approach adapts the learner and the other approach adapts to the learner's surroundings. There are many learning technologies that use different mobility devices which aim to support anywhere and anytime learning.

Balogh, Turcáni, & Burianová (2019) study was on personalised e-learning for IT related subjects using constructivist approach. In general, this study focus on providing personalised learning materials, self-tests and questionnaires via e-learning environment. Specific course in an IT programme was selected to evaluate the effectiveness of the study. The selection of e-learning removes the borders of time and space in the implementation of learning activities. The personalised e-learning was to provide learning solution that tailored according to the student's needs and learning style for better result. The connectivism learning theory was implemented where the students self-learn with the help of computer technologies online to access learning materials and to communicate with their peers and experts. Their personalised e-learning system tailored the learning materials of the subject according to the student's needs and interests, knowledge, skills, personal and social characteristics, and preferred learning styles. These details were collected from various methods such as questionnaires, interviews and observations at the beginning of the semester. However, the student's current conditions and status such as mood and knowledge level at the time of learning not considered in this study. Even though it uses e-learning, for freedom of movement and personal space, mobile technology devices need to be considered in this study. The surrounding of the student when engage in the learning activities play an important factor as well. A better solution for this might be personalised m-learning where it considered all the above factors to provide a personalised learning.

English language teaching and learning through m-learning been popular among mobile system developers and m-learning researchers. The designs and personalisation approach in English language learning are another aspect of m-learning application development. This is important to offer flexible ways of learning English based on learning materials and interactions between learners and according to the learners' needs and preferences. A big number of mobile applications and resources related to the teaching and learning of English language are prepared for classroom setup and also to be used outside class and then discussed with teacher in class. As for the personal learning, learning outside and beyond formal classroom setting is what the learners are look forward because it gives the learners more freedom to work with on their own interests and goals. One example of mobile language learning application was developed by (Hsu, Hwang and Chang, 2013) to provide reading materials recommendations which would guide the students who took EFL (English as a Foreign Language) to read articles that match the students preferences and knowledge levels. The mobile application allow students to make notes in the reading materials which later to be shared with other learners or kept for themselves. Teachers were required to prepare and evaluate additional reading materials based on the topics. Later, the mobile application will recommend these learning materials to students. Questionnaire will be prepared to understand the learners' general preferences with regards to the topics. Whereas a pre-test will be conducted to evaluate the students' learning proficiency. The mobile application's recommendation mechanism then take the gathered information on learners' preferences and proficiency before suggesting the reading materials to the students for better learning experiences.

Recommendation system with computational techniques used to personalised products and services for customers based on their interest and history. However, the same recommendation process cannot be used in educational field. The study by (Prisco, Santos, Botelho, Tonin, & Bez, 2017) suggested cognitive pedagogical model to be incorporated into the recommendation system to improve the learning potential. They use Piaget's learning model in the development of their proposed recommendation system. The model of this system uses similar concept applied in gaming so that the learning object is not too easy where it offer little learning opportunity or too hard where it beyond the learner's ability which will demotivating the learner. According to (Prisco, Santos, Botelho, Tonin, & Bez, 2017), in non-student-cantered approach, even when the student undergoes repetition process of same learning content, despite knowing the content, the student won't have certain skills related to the concept learned from the content. However, in personalised or student-cantered approach, student has to go through a challenging customised learning process but within the student abilities, able to improve the learning of the student.

Another personalised m-learning application for language learning is called MASELTOV (Mobile assistance for social inclusion and empowerment of immigrants with persuasive learning technologies and social network services). This European MASELTOV project was initiated to assist immigrants in the process of social integration and language learning. It provides a set of tools and services to be used by the recent immigrants at any time and based on their needs. The prototype MASELTOV App called MApp focused to support immigrants to improve their language learning and to develop their understanding of the local cultural context. According to (Halfman, 1998), current immigrants faces risks of social exclusion from the information society especially within the first months of arrival. Their background such as their socio-cultural contexts and language may be fundamentally differ and can cause extreme challenges especially for the immigrants with low education and illiteracy. Immediate support to anywhere and anytime for these immigrant to access necessary information is crucial especially when facing with critical situations. The MApp focuses on 10 most relevant services via mobile device including forum, help radar, information service, pedestrian and transportation navigation, places of interest, translation tool, language learning, serious game, and recommendation service. This application was tested in major cities across Europe (Gaved et al., 2012). The design of MApp are based on learning activities which interpret incidental learning which covers unplanned and social learning in the course of everyday life. According to (Kukulska-Hulme et al., 2015), this will eventually support the development of communication skills, situated learning of the target language and culture, and will prevent cultural hyperghettoisation.

In another doctoral research project at the University of Toronto, an adaptive smartphone application called VocabNomad (a Context-Sensitive Application for Mobile Assisted Language Learning) was developed. This application aims to support English language learners in the area of communication and vocabulary. Based on the learners' needs, the application dynamically generate support material for their learning from Internet-based resources (Demmans Epp, 2015). This application also developed to cater on demand request for vocabulary support by providing additional materials in unplanned situations. Based on frequently learned vocabulary items, synonyms item will be displayed to expand the learners' knowledge. A similar personalised m-learning research project was developed by Hongthong & Temdee (2018) aimed to develop personalised digital literacy lesson for Thai youth based on the students' preference and performance. Mobile application was used to provide personalisation support appropriately and individually to enhance the learning efficiency of the students.

In recent years, games was introduced in learning environment to further enhance the personalised m-learning. Gamification is the term used to define the process of integrating elements and techniques used in the game design to an otherwise non-game setting. This is because learners learn best when they are having fun in the learning process. Gamification becoming excellent tool to support learners engage with learning materials and this is making the learners easier to retain information. According to (Rishi Raj, 2017), following are several ways that can be utilised to drive personalised learning using games:

a) Customised games: Learners have different needs and preferences at any point in their learning process. The content creator can personalised games by simplifying the complicated academic concepts into bite-sized content for the learner to understand at their own pace.
b) Interactive learning: Educators are need to use games' approach to make learning fun by creating content in more engaging ways to impart knowledge to the learners. Content creator can make use of this interactive learning approach by breaking course content into smaller pieces and use team and blended learning techniques.
c) Instant feedback: In games, instant feedback such as scoring systems, notifications, and leaderboards exist to create element of competition among gamers. Similarly, feedback is a crucial element of learning where the educators can use it to evaluate learners' progress and engagement.

There are lots of areas to be covered in personalised learning. All the aspects of personalised learning such as learners' interest, needs, preferences, previous knowledge, skill levels, behaviours, movement and so on, does not necessarily taken into consideration when designing a mobile application. According to Kukulska-Hulme (2016), personalised learning is not about using a certain mobile application. This is because the learning activities actually takes place within a complex environment which include digital and analogue technologies or media; physical and virtual setting; learning materials; activity and interaction designs; systems of emotional support; and educational challenge and guidance. Personalisation can be achieved through various means but the unique features of m-learning such as easily own and accessible device; support for learning across various setting; available on demand; support collaboration; and discussion and sharing with peers, teachers and experts can make personalised learning more reachable to wide range of learners.

2.7 Theorising Personalised M-learning

Mobile devices on its own do not guarantee effective teaching and learning. When using technology in education, the methods of teaching and the teacher's views of the learning process are the essential part to make teaching and learning successful. For every educational effort, there are always a theory or idea that will describe how the learner's mind works and how the learner should be taught (Hakkarainen, Lonka & Lipponen 1999). The way to use the mobile devices to support learning strongly linked pedagogical theories and its' strategies. The important of learning theories in m-learning quoted by Herrington and Herrington (2007) as "Adopting more recent theories of learning has the potential to exploit the affordances of the technologies in more valuable ways".

Many m-learning researchers have explored the relationship between existing learning theories and m-learning by looking at different theoretical perspective.

Naismith, Lonsdale, Vavoula & Sharples (2004) who compared m-learning against learning theories such as behaviourist, constructivist, situated, collaborate, informal and lifelong learning. And also presented the ways how m-learning can be implemented into learning activities. Keskín and Metcalf (2011) discussed the same in their literature review. M-learning theories that they discovered are behaviourism, cognitivism, constructivism, situated learning, problem based learning, context awareness learning, socio-cultural theory, collaborative learning, conversational learning, lifelong learning, informal learning, activity theory, connectivism, navigationism, and location-based learning. With all these theories associated with m-learning, this study not going separate them into more detailed groups because some of these theories are subsections of broader theories. So, this study only focused on various learning theories that supported personalised m-learning. The basic principle of personalised learning belief that each student is unique and learns in different ways. Personalised learning is originated from Howard Gardner's theory of multiple intelligence (G. H., 2004; Johnson 2004) and focused on individual student's interests, their needs and abilities, and the identification of the best learning style for each student (Good & Brophy, 1990). Personalised learning strategies are in line with constructivist learning theories (Savery & Duffy, 1995; Pritchard 2013), which underline that learning is active and knowledge is built on top of own experiences.

In this study, the following broad theories have been identified to support the teaching and learning process with the help of mobile technologies:

2.7.1 Behaviourist Learning Theory:

This theory suggest that learning is thought through the reinforcement of an association between a particular stimulus and a response. When applying this to learning through mobile technologies, a problem is presented (stimulus) followed by the learner contribution (response) and when the system provides feedback, it become reinforcement. In m-learning context, project such as ‘Classtalk’ (Dufresne, Gerace, Leonard, Mestre & Wenk, 1996) and ‘Qwizdom’ (2003) fall in this category. Another research and project example was the content delivery by text message to mobile phones for language learning (Thornton & Houser, 2004).

2.7.2 Constructivist Learning Theory:

Researcher and educationist are integrating traditional and new hybrid learning theories to support m-learning. Constructivist learning theory is leading the charge by demonstrating how a traditional learning theory can impact a new innovative technology (Thomas Craig & Michelle Van Lom, 2010). Many researchers have introduced and implemented m-technology into teaching by using model of instruction suggested by constructivist theories. A research example of constructivist learning theory called "The Virus Game" (Colella, 2000) was applied in teaching. It was a simulation game which required students to participate and experience the spread of a virus. Louisiana State University students utilized mobile devices in their learning process (Cisco System, 2003) and University of South Dakota require students to use mobile devices for their school assignments (Oliver & Wright, 2002). A Dutch project GIPSY with motto "pick up your school and learn" introduce anytime and anywhere learning which require the students to be self-directed constructivist learners. M-learning is more efficient when utilizing constructivist learning theory because it allows the students ability to experiment and learn and this is the main principle of constructivist theory. Integrating mobile technologies into the learning process using constructivist learning theory is a challenging task. It requires commitment from faculty, students and content developers. Constructivist learning theory does not change when applied to these mobile devices, but these mobile devices allow for increased functionality and access. Content developers play a major role when it comes to anytime, anywhere and any device m-learning. Beside this, use of mobile technology on daily basis by the student in their curricula activities gives them more ownership of their learning.

2.7.3 Situated Learning Theory:

Situated learning promotes learning within an authentic context and culture. Mobile devices are well suited to context-aware application as the learners can be in different contexts. A good example are the application at the museum and gallery where it can provide additional information about the exhibits based on the visitor's location in their mobile device. Among the examples of situated learning application are the Ambient Wood which require the learners to use their PDAs to explore environmental habitats (Rogers, Price, Harris, Phelps, Underwood, Wilde, Smith, Muller, Randell, Stanton, Neale, Thompson, Weal, & Michaelides, 2002) and the use of pocket PCs for their multimedia tours offered at the Tate Modern (Proctor & Burton, 2003).

2.7.4 Collaborative Learning:

Collaborative learning emphasis learning through social interaction assisted by mobile devices disregard of time and location. Mobile-computer-supported learning conducted by Cortez, Nussbaum, Santelices, Rodriguez, Zurita, Correa & Cautivo is an example of collaborative learning which involved dissemination of activities, collaboration and analysis of result using hand held devices.

2.7.5 Informal and Lifelong Learning:

Informal and lifelong learning involve activities that support learning outside a dedicated learning environment and formal curriculum. Research regarding this learning theory recognises learning that happen at any time with the influence from both by the environment and particular situations faced by the learners. The learning can be intentional or accidental that happens through daily conversations, electronic media or any experiences outside the classroom. Mobile devices, being portable and always available, are the valuable devices in supporting the type of learning. Attewell and Savill-Smith (2003) conducted study on disadvantaged youth who use mobile phones to deliver interactive stories and quizzes among themselves. Another example is a system where breast cancer patients were able to access information about their condition, to communicate with other patients, and to keep track of the issues that concern them via their PDAs (Wood, Keen, Basu & Robertshaw, 2003).

2.7.6 Learning and Teaching Support:

This involves any activities that assist in the coordination of learners and resources for learning activities. The availability of mobile devices improves the learning support such as providing course materials, information on course timetable and assignment due dates, and tracking of learning activities. Example of teachers using mobile technologies to manage students attendance, reviewing student marks, and organising lesson plan discussed by Perry (2003). As for the student support, Riordan & Traxler (2003) highlighted example where students at risk receive SMS messages on appointments, teacher's review on their learning, venue changes study tips.

Some think that learning theories are ancient theories that only impact the education of the olden days where the development of knowledge was at very slow rate and not suitable in theorising m-learning at present where the development of knowledge is rapid. However, the learning theories evolved together with time and it covers all aspect of traditional learning and technologies oriented learning. For example, behaviourism theory is used to describe how students learn to improve performance on a specific job or task using mobile phones or PDAs. At the end, in theorising m-learning, the m-learning communities would choose a more general and abstract theories based on the fact that many of them exist to guide the teaching and learning processes.

2.8 Theoretical Framework of the Study

The study employed constructivism learning theory in its theoretical framework. The constructivist learning theory was used as the basis for integration of mobile technologies into traditional learning. Constructivist theories propose that "knowledge is being actively constructed by the individual and knowing is an adaptive process, which organizes the individual's experiential world" (Mayer, 1992, p. 18). Constructivist theories suggest that learners develop and build understanding from their own personal experiences. They relate and use their own experiences into their learning and through this enhance their learning by gaining more knowledge. Implementing constructivist learning theory in learning not necessarily make the students/learner learn. The student must have opportunity to experiment and relate his/her previous experiences to build new understanding of the learning materials.

Constructivist learning theory enables the mobile technology to focus on the student's ability to be self-directed and draw conclusions (Karagiorgi, & Symeou, 2005). M-learning theory consists of both learning through mobile devices and learning in an era characterised by mobility of people and knowledge (Rheingold, 2002). Implementing constructivist learning theory into m-learning (or learning with mobile technologies) differs from other traditional learning theories. This theory required the students to work independently with the help of teacher as a facilitator. The students must know that they are moving away from teacher-centred learning to student-centred learning. In student-centred learning which supported by constructivist learning theory, the students learn more when they have to explore and experiment by themselves rather than being told why something works. When the student relate and use what they learn in real world situation into their learning experience, they have better understanding of what they have learned and this knowledge stays with them for longer period of time.

Another learning theory that has been used in this study is connectivism learning theory. This theory explains how technologies have created new opportunities for people to learn and share information across. These technologies can be any tool which enables the users to learn and share information with other people (Siemens, 2005; Downes, 2010). In connectivist learning, a teacher will guide students to information and answer key questions as needed, in order to support students learning and sharing on their own. Connectivism presents how people work and function is altered when new tools are utilized. The field of education has been slow to recognize both the impact of new learning tools and the environmental changes in what it means to learn. Connectivism provides insight into learning skills and tasks needed for learners to flourish in a digital era (Siemens et al., 2005). In this study, mobile devices are the tools to be used in the learning process. It has the ability to connect with information and resources when the student need them most. This theory described that the learning connections can happen at various location whenever needed such as in classroom, at home or on the go (Stoerger, 2013). The following Figure 2.1 shows the theoretical framework for this study.

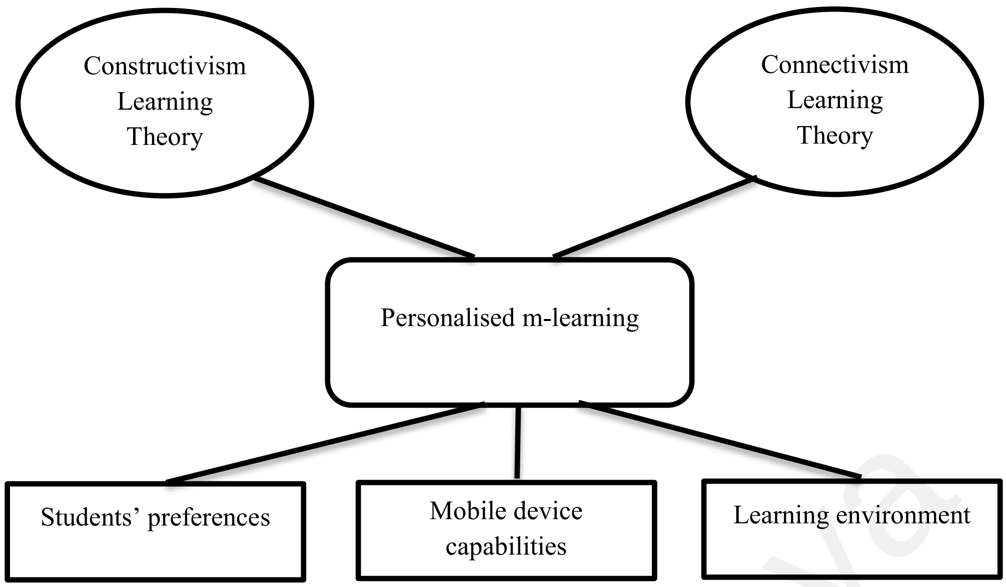

Figure 2.1 Theoretical Framework

This section discusses the theoretical foundation for the current study. This theoretical foundation section divided into two parts which guided by several learning theories and models. The first part elaborates the theories and models involved in achieving the intended learning outcomes from personalised m-learning. The second part focuses into the development of curriculum implementation model for diploma student in hospitality programme.

The first part starts with describing the selected learning theories based on the scope of the study. These selected learning theories describe how students learn in formal learning setting mediated by personalised m-learning and how it could be assisted in the learning of this particular hospitality programme. Based on the selected learning theories, a suitable learning theories in personalised m-learning environment would be identified and discussed in view of the learning framework. Before these learning theories were selected and discussed, a brief discussion is presented on how diploma students in this hospitality programme learned and followed by how personalised m-learning could help the students to achieve their learning outcomes and programme goal. The second part of this theoretical foundation dealt with the development of curriculum implementation model. The discussion consists of elaboration of models in determining the suitable model in personalised m-learning environment.

2.9 Learning Theories

Mobile educational frameworks have begun to rise as potential educational setting supporting life-long learning. However, these conditions still experience drawback from various technological and access related issues in many parts of the world. For example, slow in accessing learning materials, content does not adapt to individual learners, limitation in the real time interaction because of connectivity and bandwidth limitations. This study focuses on delivering personalised learning content anywhere, anytime to the learners. In m-learning environment, the learners able to receive learning materials provided by the m-learning system according to where they are when they want to learn (Chang & Chang, 2006). This m-learning strategy has successfully achieved its goal in supporting learning at anytime and anywhere. However, personalised m-learning is becoming an interesting and important issue whereby it focusing on enabling mobile learners receive content based on their preferences using various mobile devices (Syvanen, Beale, Sharples, Ahonen, & Lonsdale, 2005).

In general, personalisation can be achieved via two adaptation methods. The first adaptation method require the learning service to adapt to learners' characteristic such as learning styles, requirements, status, performances, and profiles. The second method require the learning service to adapt to the context surrounding the learners (Kinshuk et al. 2009). They have also suggested two solutions based on the above mentioned adaptive approaches for realizing personalisation in m-learning. The first solution uses the learners' characteristics to provide learners with personalised learning experiences. The second solution uses context awareness knowledge to generate personalised learning according to the relevant domain knowledge that exist in the surroundings of the learners.

In traditional learning environment, teachers and learners meet face to face at the same time and in same place. The learners are only get the learning material prepared by the teacher. And, as result, the learning are only limited to the material prepared in advance by the teacher which rather difficult to adapt to the individual learner's learning requirements and preferences. E-learning, on the other hand exist with the advancement in the computer technologies and Internet to assist teachers and learners in the process of teaching and learning (Brodersen, Christensen, Dindler, Grønbæk & Sundararajah, 2005). The advantages of e-learning is that it facilitates learning without requiring the teacher and learners to be present at one location (Martin, 1994). But, both traditional and e-learning based learning unable to assist for those courses where authentic learning demands observation in real environment, for example, butterfly watching and plant observation in a biology course (Chang & Chang, 2006).

M-learning offers extension to the learning from indoors to outdoors with greater flexibility by giving the learners the opportunities to understand the learning material through touch, feel and observe the learning objects in real environment (Kuo, Wu, Chang, Chang, & Heh, 2007; Yatani, Sugimoto, & Kusunoki, 2004). Furthermore, m-learning also allow learners to apply what they have learned in real environment (Darmarin, 1993). However, both e-learning and m-learning unable to tackle issue of flexibility learning. Adaptability towards the learners and the surrounding environment were not considered and the teaching and learning processes are remain limited to specific learning environment where the specific domain knowledge has been arrange in advance by the teacher. Adaptability towards individual learner and surrounding environment is important since the learners are not passive receivers of the learning materials from teacher during learning.

The personalised learning depends on both effective teacher differentiation of a set curriculum to address diversity of learner needs, and the development of independent learner capacities. This approach is necessary to reform the 'fixed content and fixed timing' of traditional curricula. Personalised learning aims to motivate students and produce more effective learning by developing a curriculum that acknowledges and addresses individual differences. Jackson and Davis (2000, p. 287) and Tomlinson (1999, p. 120) suggest that differentiation can occur across three dimensions:

a) Content: What students should know and be able to do, and the materials that will support them in their learning;
b) Processes: The activities that help students make sense of their learning
c) Products: the range of evidence students provide of their learning

A personalised learning approach require constructing a curriculum that is robust enough to meet the needs, and develop the capacities, of all students. Tomlinson (2005) suggests that course content needs to accommodate individual differences within a set of learning activities that ensures all students learn in ways that match their readiness, interests and learning profiles, with support from peers and teachers.

M-learning appears to have very diverse theoretical perspectives and approaches (Keskín et al., 2011; Viberg & Grönlund, 2012). In m-learning research, Viberg et al. (2012) discovered large number of different approaches and theories that have been used. Most of the learning theories and model applied in m-learning were originated from previous theories of learning like constructivism and situated learning theory. It is important to acknowledge that past learning theories may have limited application in current technology enhanced environments (Stoerger et al., 2013). Siemens (2004) describes behaviourism, cognitivism, and constructivism as three broad learning theories that most often used when developing instructional environments. The following section discuss two learning theories that are often connected with m-learning specifically personalised m-learning:

2.10 Constructivist Learning Theory

Constructivism learning theory places learners in an open-ended learning environment in which they build their own meaning from knowledge and content. This theory emphasised the learning process where learners actively build new knowledge based on current and previous experiences and knowledge. The environmental factor are seen critical in this theory because what create the knowledge is the specific interaction between the learner and environment. It is also important for learning to take place in realistic settings and for the learning tasks to be relevant to the learner (Ertmer, & Newby, 1993). Therefore, constructivist learning environment should provide rich experiences that encourage students to learn. This can be used to teach big concepts using student activity, social interaction, and authentic assessments (Schunk, 2012). Thus, learners are encouraged to be active constructors of knowledge at the same time they are embedded in a realistic context and offered access to supporting tools like mobile devices (Naismith, Lonsdale, Vavoula & Sharples, 2005). According to Piaget's and Vygotsky's theories, constructivist learning theories can be seen at the background of their learning theories. They both also view actions as starting blocks for further development. An example is a system where the learner(s) is involved in a realistic situation, and uses support tools to deal with the situation at hand and communicates, interacts and shares his or her knowledge with other learners. Examples of the use of the constructivist approach in mobile learning can be found in (Colella et al. 2000; Klopfer, Squire & Jenkins, 2004; Patokorpi, Tétard, Qiao, & Nick, 2007).

In constructivism, students are suggested to be an active creator of knowledge instead of passively accepting it. In order for the students to discover new ideas, they need to be trained to take new information, processing it based in their own experiences and knowledge before shaping it into an understanding. Many authors believed that mobile technology can be used as learning tool to develop higher thinking skills (Brooks & Brooks, 1999) and constructivism theory support this mobile technology's role in the teaching and learning process (Quinn, 2000). According to Jonassen, Peck and Wilson (1999), based on the theory of constructivism, students cannot simply learn from teachers and technologies. In order to learn new knowledge or understanding, the students are required to think about what they do and the thinking processes will lead to learning new things. The teachers and the technologies support these processes by stimulating and supporting the activities that engage learners in thinking which might result in the actual learning.

The adoption of constructivist approach in rich-technology learning environment can be best discussed using Mobile Assisted Language Learning (MALL). MALL has different definitions and most of these definitions are surrounded around learning on the move or learning with the help of mobile devices (Hashim, Embi & Ozir, 2017). The history of MALL started in the 80s as telephone assisted language study to provide distant language learning with assistance and feedback via telephone (Twarog & Preszlenyi Pinter, 1988). Over the past decade, it developed into Mobile Assisted Langague Learning (MALL) where formal and informal learning can happen both inside and outside of classroom via handheld devices to support anytime and anywhere learning. MALL uses the theory of constructivism approach where it required students to be independent and became self-directed learners (Davie & Hilber, 2015). This theory also allow students to develop critical thinking ability, enhance learning motivation and increase their learning outcomes. According to (Avci & Adiguzel, 2017), integration of mobile technology into formal education are supported by the theory of constructivism.

Another m-learning study which deal with constructivism theory was conducted by Wang and Suwanthep (2017) for English vocabulary learning. This study revealed that 68% of the students in this study preferred to use mobile applications for English as a Foreign Language (EPF) vocabulary learning compared to traditional methods. They used qualitative and quantitative data collection techniques to evaluate the effectiveness of constructivism based English vocabulary learning via mobile application. The result revealed that the use of constructivism theory in English vocabulary learning gives positive result to the students. Students use mobile application to construct vocabulary and apply those vocabulary knowledge in new context. With this, the students become the knowledge constructors in their learning process anywhere and anytime.

2.11 Connectivism Learning Theory

George Siemens (2004) introduce connectivism as a learning theory especially for this digital age. It provides the insights into the learning skills and tasks needed in a digital era. This theory integrates the principles of chaos, network, complexity, and selforganization theories. It also acknowledges that learning is no longer an internal, individualistic activity and that the ways in which people work and function are altered when new tools are utilized (Siemens, 2004). This approach stressed the importance of information and how this information is linked it to the right people. Mobile devices have this ability to connect with information and resources when they need them most. This theory described that the learning connections can happen at various location whenever needed such as in classroom, at home or on the go (Stoergeret al., 2013).

2.12 Theoretical Framework of Personalised M-learning Curriculum Model

This section discusses the theoretical framework of personalised m-learning curriculum implementation model for students from diploma in hospitality programme. This section elaborates further on frameworks and model used in developing m-learning especially personalised m-learning curriculum model which will be used as guide in this study.

The growing mobile usage, drop in the mobile device price and connectivity had introduced new ways of instructing and receiving knowledge that is not just cost-effective but is also customized to suit the individual needs of a learner. A growing adoption of smartphones, tablets, and other handheld devices by individuals has made it possible for an interactive learning platform to thrive. Introducing mobile devices in educational environment enable learning to occur at any place, time, and pace, allowing for a personalised learning experience for learners. M-learning able to offer flexibility and convenience to access learning material at the learner's own pace, personalised and interactive learning; and an ease of disbursing feedback, among others.

K-12 learners exposed to m-learning experience by allowing them to organized content for relevant concepts or skills they'd like to learn to achieve better learning outcomes. This m-learning application provide a tailored experience to each learner, drawing upon their areas of interest and preferences. Google Classroom and MagicBox (Mohammad Salahuddin, 2017) are providing personalised learning route which efficiently leverage their mobile devices and offer a complete learning solution. Students are now using technology to not just improve performance on assessments but also to direct their own learning using emerging tools and build a collaborative learning environment. Following are methods that been used to by the educators to leverage mobile applications for creating personalized mobile learning solutions:

a) Combining native content and collaborative tools for peer-to-peer learning: Students gain a significant part of their knowledge from informal and social learning. This is by combining native content with collaborative tools in the mobile apps to increase user engagement. With this learners able to consume resources and interpret content while sharing it with their peers and teachers. Students are able to start, stop and pick up learning where they last left by using tracker.

b) Tracking content preferences: Teachers can track how students are interacting with a particular learning material, an insight that allows them to personalise learning experiences for individuals. With the mobile apps records students every move in their learning journey, teachers can use this information to understand students' interaction with the learning content, how easy or difficult in digesting the material.

c) Access to notes and resources added by teachers: Students are empowered to learn at their own pace by using a self-directed mode. They are able to access to the teacher's personalised materials and resources, as well as the ability to communicate with peers on an app, makes for a holistic learning experience. Content also can be easily shared in available social media-sharing features with just a simple click.

Personalisation of learning systems is an effort towards making education more learner-centred. In order to make it happen, the system must conforms to the learner rather than the learner to the system. Personalisation is about finding ways to understand the skills, resources and interests of the learner outside the classroom and distribute the learning resources accordingly. M-learning happen when the learner is on the go or when the learner is mobile (Sharples, Taylor & Vavoula, 2005). M-learning system should be adapted due to the fact that mobile learner have varied learning backgrounds and levels (Chen & Kinshuk, 2005). Thus personalisation is crucial for m-learning. Personalised m-learning not intended to replace classroom learning but to complement and add value to existing learning models, (Motiwalla, 2007), such as the socio-constructivist approach to learning (Vygotsy, 1978).

Using mobile technologies for language learning especially English has been popular. Initially, these mobile language learning services focused on providing instant help in either obtaining the meaning of a word (M. Morita, 2003) or help in pronouncing a word. Very little or no emphasis was given to providing personalised learning. Due to the importance of personalised m-learning, improved support has been provided recently to support pronunciation of specific sounds for specific user groups, e.g. (M. Uther, 2005). PALLAS (Personalised Language Learning on Mobile Devices) was developed to support to a mobile language learner by providing personalised and contextualised access to learning resources. In this system, personalisation of learning resources considered as a part of contextualisation and distinguish between personalisation and contextualisation (Sobah & Jan-Kristian, 2008). Personalisation of resources is considered as providing content to the learner according to the learner's needs and interests and presenting it to the learner rather than the learner having to look for it. The PALLAS system considers dynamic and static parameters for personalisation where the dynamic parameters are updated automatically by the system and the static parameters are provided by the learner (Curum et al. 2017).

Personalisation of learning systems is often based on making them context-aware, where the definition of context has varied from the location of the learner (Hsieh, Chen, & Hong, 2007; Kuo, 2007) to learner's leisure time and individual abilities (Chen, Li & Chen, 2007). The following task context has been identified to capture the learner's activities and goal:

a) Social context: describes the user's relationships and roles;
b) Personal context: encompasses the mental and physical properties of the user;
c) Spatiotemporal context: represents concepts such as time and location and
d) Environmental context: deals with the surroundings and the entities present.

A framework for the context of a mobile learner in an ambient intelligent environment is proposed in (Petersen & Kofod-Petersen, 2006). In PALLAS system, personalisation is considered as part of contextualisation and it was achieved using the profile of the learner and environmental parameters. The learner's profile contains information such as the learner's age, skill level, native language, interests and courses taken. Environmental parameters include location, time and day and the mobile device that is used by the learner. Figure 2.2 below shows the above parameters where a symbol is shown to the right of the parameter to indicate the dynamic parameters; i.e.

the ones that are updated automatically. The static such as the age of the learner are updated manually by the learner. This supports two ways of adaptability by the system; by using some knowledge about the learner in a system controlled way and by using knowledge provided by the learner manually (Chen & Kinshuk, 2005).

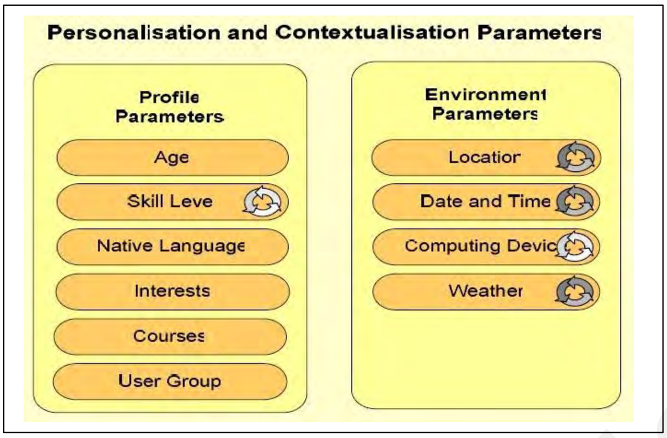

Figure 2.2 Dynamic personalisation and contextualisation parameters in PALLAS (Sobah & Jan-Kristian, 2008)

(Economides, 2009; Graf and Kinshuk, 2008) suggested two main categories of adaptation in context-aware adaptive and personalised mobile learning systems. The first category related to educational resources and the second category related to learning activities. Following are the details of these categories and overview of context-aware mobile learning system related to these categories:

a) Types of adaptation based on educational resources:

i. Selection: In this type of adaptation, educational resources delivered to the learners based on selection criteria derived from learners' contextual elements. According to (Yau and Joy, 2008; Chen and Li, 2010), the selection criteria include the combination of learners' current location, availability, learners' previous knowledge, scheduled tasks, and duration of tasks. Based on this type of adaptation, Yau and Joy, 2008, developed Mobile Context-Aware and Adaptive Learning Schedule (mCALS), which is a context-aware mobile learning system. This system developed to support the learning of Java programming. The selection of the educational resources for this system are based on combination of learners' current location, availability, and learners' previous knowledge. Another similar system developed by (Chen and Li, 2010) named Personalized Context-aware Ubiquitous Learning System (PCULS). PCULS is a context-aware mobile learning system and it aims to support English vocabulary learning. The selection of the educational resources for this system are based on combination of learners' current location, availability, scheduled tasks, duration of tasks, and learners' previous knowledge.

ii. Presentation: As proposed by Bomsdorf (2005), in this type of adaptation, educational resources that need to be accessed via mobile devices will consider parameters related to the type of mobile device that the learner use and the learner's profile such as the learner's preferences and learning style. (Graf et al., 2008; Gómez and Fabregat, 2010) proposed another set of parameters for this type of adaptation which are related to learner's location, physical conditions, and the learner's temporal information. (Zhao et al., 2008; Bomsdorf 2005) suggested different presentation forms of educational resources which include changing the format of the educational resources (such as wav files to mp3 files), changing the type of the educational resources (such as textual presentation to visual or audio presentation), and finally the changing the dimensions of the educational resources (such as scaling up or scaling down the dimensions of the educational resources). Based on this type of adaptation, Bomsdorf (2005) suggested a context-aware mobile learning system which will present educational resources by transforming the format, type, and the dimension of the educational resources based on learner's mobile device, preferences and their learning style. (Graf et al., 2008 and Gómez and Fabregat, 2010) proposed context-aware mobile learning system with similar transformations plus the learner's location, physical conditions, and the learner's temporal information.

iii. Navigation and sequencing: In this adaptation type, it rearranges the navigation and sequencing possibilities of different educational resources which linked to each other in order to create a personalised learning paths. This is performed based on learners' contextual elements such as the combination of learner's current location, availability and learner's previous knowledge as suggested by Cui and Bull (2005). Nguyen et al. (2010) proposed learners' contextual elements such as the combination of learner's current location, availability, needs, preferences, learner's previous knowledge, and learner's temporal information. The context-aware mobile learning system for this type of adaptation and personalisation was used to develop mobile Intelligent Tutoring Systems (ITS) for the use of tense in English (TenseITS). This context-aware mobile learning system which was proposed by (Cui and Bull, 2005) aims to support English language learning primarily for Chinese learners of English. The educational resources for this adaptation are presented based on the combination of learner's current location, availability and learner's previous knowledge. Another context-aware mobile learning system under this adaption and personalisation criteria is Context-Aware Mobile Learning English System (CAMLES). This is a personalised context–aware adaptive system in mobile learning to support students to learn English as a foreign language in order to prepare for the TOEFL (Test of English as a foreign language) test in Vietnam. This system presented educational resources based on the combination of learner's current location, availability, learner's needs, preferences, learner's previous knowledge, and temporal information.

b) Types of adaptation based on learning activities:

i. General adaptation: This type of adaptation and personalisation generate individual learning activities based on learners' contextual elements such as adaptations to the educational resources, tools, and services that support learning activities. The context-aware mobile learning system for this type of adaptation and personalisation developed by (Gómez et al., 2012). This prototype context-aware mobile learning system semi automatically present the adapted individual learning activities based on learner's contextual information.

ii. Feedback and support (scaffolding): This type of adaptation suggest suitable learning activities based on learner's contextual elements. As suggested by (Ogata et al., 2005; Paredes et al., 2005) the typical criteria for this includes learner's location and (Al-Mekhla fi et al., 2009; Liu, 2009; Yin et al., 2010) suggested the combination of learner's location and learner's previous knowledge. The context-aware mobile learning system for this type of adaptation and personalisation as developed by (Ogata et al. 2005) is TANGO (Tag Added learNinG Objects). TANGO detects the objects around the learner using RFID (Radio Frequency Identification) tags, and asks the learner appropriate questions for vocabulary learning in daily life with PDA. Generally, this system aims to support English language learning and provides adaptive feedback and support based on the learner's location. Another similar system is LOCH (Language learning Outside the Classroom with Handhelds) which was developed by (Paredes et al. 2005) to support Japanese language learning. Similarly, another system by (Al-Mekhla fi et al., 2009) was developed based on learner's location and learner's previous knowledge and this system is called CAMCLL (Context-aware Mobile Chinese Language Learning). This context-aware mobile learning system aims to support Chinese language learning. Another similar famous context-aware mobile learning system proposed by (Liu, 2009) is HELLO (Handheld English Language Learning Organization). This English language learning system is based on learner's location and learner's previous knowledge.

iii. Navigation to locations: In this adaptation type, the educational resources are delivered based on location awareness in real-world situation such as planning for learning activities during a museum visit. The educational resources especially the learning activities are guided and performed based on the location (location-dependent). According to (Hwang et al., 2008), in this type of adaptation, the learning activities are constructed based on the learner's current location. (Tan et al., 2009; Hwang et al., 2009) suggested that the learning activities are constructed based on the combination of learner's current location and learner's previous knowledge. Hwang et al. (2008) proposed a context-aware mobile learning system which will automatically constructs a navigation path to perform certain learning activities based on learner's location. Tan et al. (2009) proposed a similar context-aware mobile learning system based on learner's location and learner's previous knowledge. Similar system which navigate learners to perform learning activities within a laboratory proposed by Hwang et al. (2009) and this context-aware mobile learning system is based on learner's location and learner's previous knowledge.

iv. Communication and interaction: During the execution of learning activities, the learners are facilitated in finding peers based on their location to build virtual learning groups to share knowledge or to communicate with experts to ask for advice or help for specific issues (Martin, S. et al., 2008; Tan et al., 2009). Economides (2008) suggested that this type adaptation can facilitates learners in selecting appropriate communication and collaboration tools based on learner's needs and preferences. Martin et al. (2008) proposed a context-aware mobile learning system which gives information about people who are close to the learner based on learner's location.

Economides (2008) context-aware mobile learning system proposed automatic selection of communication and collaboration tools based on learner's preferences and needs.

Researches in software design field tend to associate personalisation with individualisation (Clarke, 2003). According to (Clarke, 2003) the difference between personalisation and individualisation lies in the end-user's ability to control the device and its related data. In individualisation, teachers and software designers adapt the learning materials to match scaled assessments of learner's interest. Whereas in personalisation, the learner interact with the learning material on the device. In essence, individualisation is a one-way process from teacher to learners while personalisation is two-way (Figure 2.3). In personalisation, the learning content tailored and presented according to the individual learner's needs and interactions to match learner abilities. In customisation, the control of process is from the learner side and learners select material and learning processes according to their own interests.

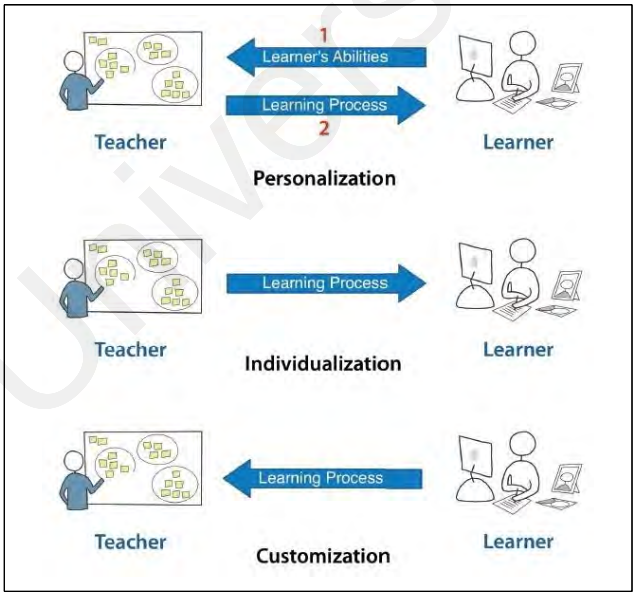

Figure 2.3 Differences between personalization, individualization, and customization (Clarke, 2003)

Another project called, Intelligent Mobile Learning Interaction System (IMLIS), is a project to develop a concept for an m-learning system, which provides a personalised learning process for people with mental/learning disabilities based on their specific abilities (Saeed Zare, 2010). According to (Lave & Wenger, 1991), situated learning focuses on the individual's needs and limitations. M-learning system needs to provide functionalities that adapt continuously to the needs of the user as well as avoiding to stress the user's mental capacity. This system was built to support m-learning activities for people with cognitive disabilities within different contexts. The first target group is school children from six and seventeen years old, and young workers between twenty and forty years old were being studied. Their aim is to make sure learners with physical impairments to be able to use this system, unless they cannot move their hands. And this system was not designed for the blind. The second target group is teachers and instructors of students with cognitive disabilities. These teachers need to prepare individualised learning material for each student. This mobile system supports them to prepare material in a virtual environment and helps them to reuse the implemented materials over a longer period. The IMLIS system design aims to enhance personalisation aspects by using a decision engine, which makes decisions based on the user's abilities, learning history and reactions to processes. It's works on adaptation, adjustment and personalisation of content, learning activities, and the user interface on different levels in a context where learners and teachers are targeting autonomous learning by personalised lessons and feedback.

A study by Jane and Mike (2011) discussed data analysis of interview study on learners' individual m-learning preferences. These includes the learners' preferred location of study, noise/distraction level and time of day for the learning process to take place. These preferences was used in the development of personalised m-learning applications which cater for the learners' individual m-learning needs (Curum et al. 2017). The study used six scenarios to illustrate the m-learning preferences of six different types of mobile learners. The scenarios are: a) strong preferences to study in quiet environments where there are no distractions i.e. library; b) strong preferences to study in noisy environment where there are people around and noisy, i.e. cafe; c) medium preferences to study in quiet environment but can accommodate noise, i.e. computer lab; d) medium preferences to study in noisy environment but can also accommodate quiet surrounding, i.e. library cafe; e) weak preferences to study in quiet surrounding and can accommodate most locations; and f) weak preferences to study in noisy surrounding and can accommodate most locations. Based on these scenarios, the proposed personalised m-learning application will determine which learning materials are appropriate to which learner. They believe that this will motivate learners to study especially in different m-learning environments since their m-learning preferences are taken into consideration.

Iva, Lidija, and Mario (2011) suggested personalised m-leaning system for mathematic class. They have suggested way of classroom and learning units' formation, i.e. addition to the learning content, is designed as the personalised approach to the teaching of mathematics. Learning contents are encompassed and adjusted to the mobile learning, and therefore available to all students as an approach to the lesson which is, at the moment and according to their individual reasons, in student's focus, regardless of their age or school grade. Learning content of mathematics is methodically designed in such way that the students can, in accordance to their individual needs, choose the optimal way of learning. Their proposed system ensure the learning contents are encompassed and adjusted to the m-learning. This learning content will be available to all students at the moment and according to their individual reasons, in student's focus, regardless of their age or school grade. In order to make the students learn this mathematics in an optimal way, the learning content is methodically designed in accordance to their individual needs.

For those students who are unable to access the computer, or out of the classroom for extra curriculum activities, the mathematic learning content were divided into lesson and make available as demanded by the students. The idea is to provide approach to learning content via the media which can be as mobile as the students. This system provide learning content to every student regardless of their whereabouts, or moment in time they decide to learn or study mathematics. M-learning becomes personalised by the way students interact with the learning content, which content to learn and in which way. In this system (using Moodle), each mathematic lesson divided according to the following same methodic model:

a) Theory
b) Video clips of classroom lecture
c) Mathematic problem
d) Solving mathematical problem with video clip of teacher's explanation in the classroom
e) Interactive play

The students have various possible ways and methods to study certain mathematic content. Figure 2.4 below shows the suggestion of the methodic model of personalised m-learning mathematic class:

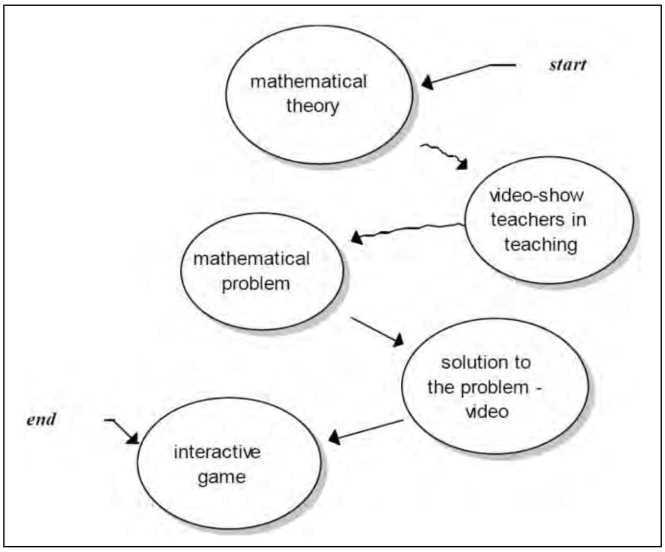

Figure 2.4 Methodic model of personalised m-learning mathematic class (Iva, Lidija, and Mario, 2011)

Students, regardless of their age, year, background knowledge and current interests for math, use the part of the methodic model which suites their learning style, regardless of the repetition, recall, fixing or systematisation of learning content.

2.13 Conceptual Framework of the Study

M-learning becomes popular in recent years due the advances in wireless technology and hand-held devices. With this, students able to learn anywhere and at anytime. But m-learning environment did not fully cater for different user preferences and various mobile devices with different capabilities, where not all of the information is relevant or critical to each learning environment. To address this issue, this section presents a framework that describes the process of personalisation of learning content to satisfy individual learner characteristics by taking into consideration each learner's learning context. The main objective of this framework is to provide personalise learning content according to the learner's preferences, device capabilities and environment.

This section is aimed at conceptualizing the implementation of personalised m-learning for students in hospitality programme through the development of a curriculum implementation model. The conceptual framework is shown in Figure 2.6 and the elaboration of this framework as follows. In general, the purpose of this study is to investigate how personalised m-learning should be incorporated in formal learning. This will be elaborated using the main objective of this study which is to design the personalised m-learning curriculum implementation model for diploma in hospitality management. This serve to contribute on how personalised m-learning could be incorporated in a formal education in assisting students to fulfil both learning needs and target learning outcomes. The suggested curriculum implementation model will be used as a support to the students in formal classroom learning and this will not in any way used to replace the formal learning. Based on the aim and scope of the study, the problem statement, and guided by the research questions, personalised m-learning is proposed to be implemented based on three aspects as describe by (Koole, 2009) in the FRAME model (Figure 2.5) where the three aspects (device, learner and social) overlap with three intersections (context learning, social computing and interaction learning). This model describes a mode of learning in which learners may move within different physical and virtual locations thereby participate and interact with other learner, information, or systems - anywhere, anytime. M-learning experiences occur within a context of information. Learners are consuming and at the same time creating information collectively and individually and the interaction with information is mediated through technology (Koole. 2009).

The FRAME model refers theories such as activity theory and it also place emphasis on constructivism. The FRAME model also takes into consideration the technical characteristics of mobile devices. The concepts used in the FRAME model are similar to those found in the activity theory (Kaptelinin & Nardi 2006). Activity theory can be used to evaluate learning as a cultural historical development facilitated by technological tools to enhance and support learners to acquire information and skills in education. However, the activity theory does not conceptualise the connection between the learner and the tool used for learning within a facilitated activity. But the FRAME model puts emphasis on the aspect of technology and on the concept of learning by doing (constructivism) where the learners have the flexibility to learn in any location and to socially interact with other people.

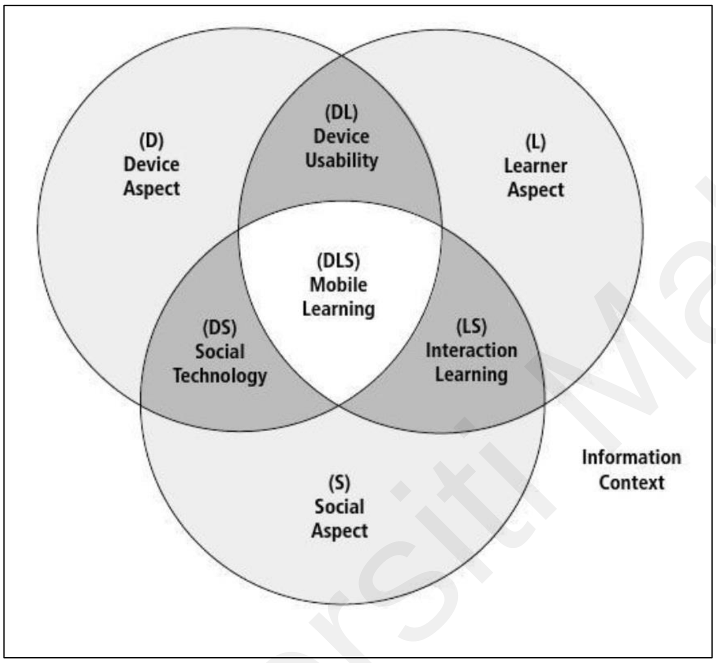

Figure 2.5 The Frame Model (Koole, 2009)

The conceptual framework also included the models and approaches adopted in each phase of the methodology to guide in the development of the proposed curriculum implementation model. For example, the unified theory of acceptance and use of technology (UTAUT) model is adopted to guide in the needs analysis of the study. The justification of the adoption of the model is presented in Chapter 3. The interpretive structural modeling (ISM) technique is connected to Phase 2 of the methodology as main tool in development of the model. Finally, the model is evaluated using Fuzzy Delphi technique as shown in the framework. Overall, the conceptual model presented here aims to illustrate how the purpose of the study is fulfilled through the connection of the parameters, theories, framework, and models to develop the personalised m-learning curriculum implementation model. This model will serve as a guide in the effective incorporation of personalised m-learning in formal education.

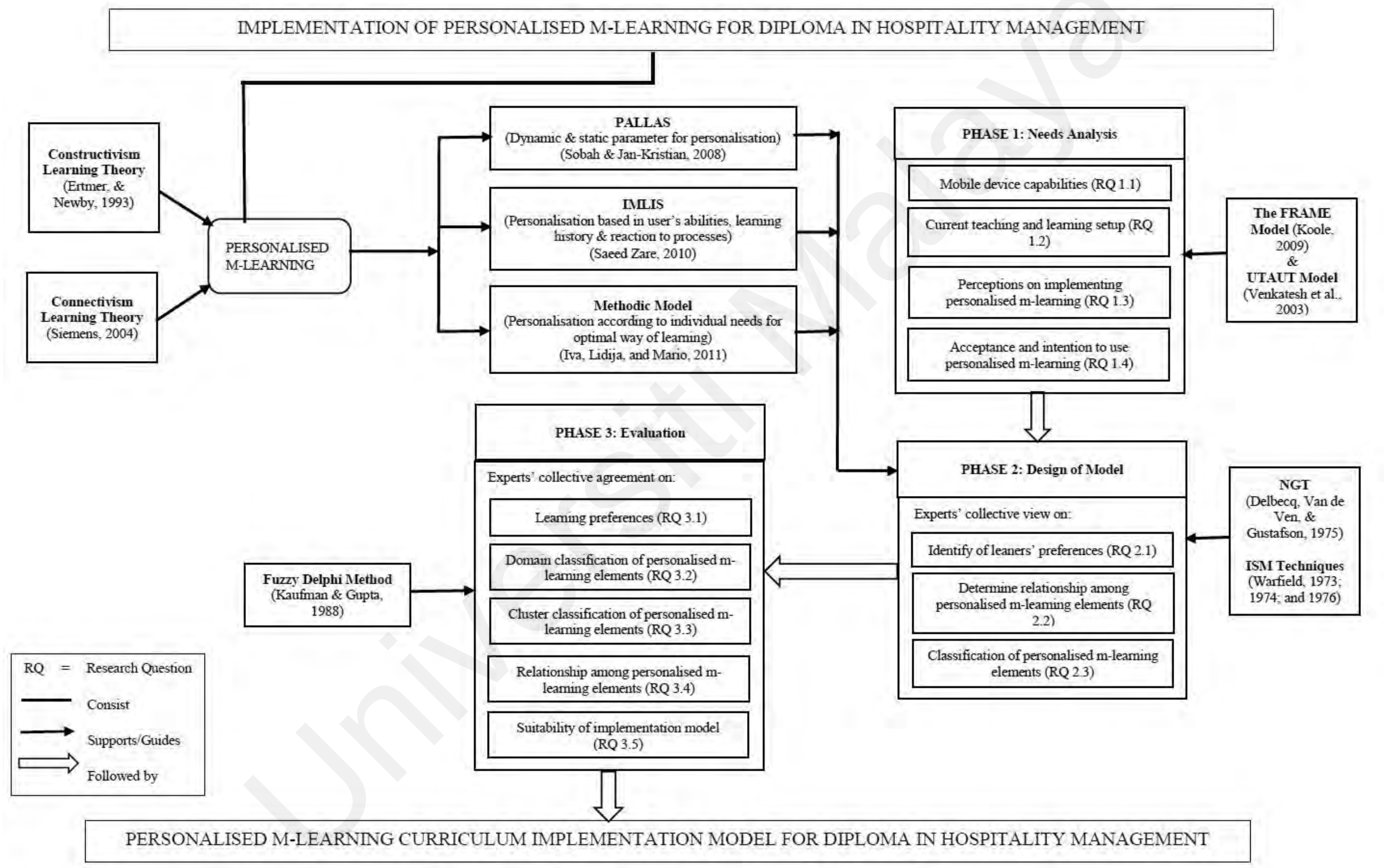

Figure 2.6: Conceptual framework of personalised m-learning curriculum implementation model for diploma in hospitality programme

2.14 Conclusion

The main of this chapter was to describe in detail the relevant concepts and theories involved in m-learning and personalised m-learning to guide in the development and incorporation of personalised m-learning curriculum implementation model for diploma students in hospitality programme. The theories were adopted to be used in determining the appropriate personalised m-learning activities and integrating these activities as elements in the development of the preferred model. This chapter began with m-learning in formal education in general and how it can used to promote learning that takes place anytime, anywhere with the help of a mobile device. This is followed by presenting concept of personalised m-learning which aims to tailor the learning content according to the preferences and interests of various students and at the same time paced to a student's unique needs. This discussion was further supported by the past m-learning and personalised m-learning initiatives in formal education to justify the feasibility of the study in employing personalised m-learning as a support for formal classroom learning.

The second part of the literature review presented the concepts and definition of personalised m-learning. First the concepts of differentiated learning and individualized learning were discussed and then relate these concepts to personalised learning. This led to the discussion on theoretical framework of the study. Constructivism learning theory was adopted students actively build new knowledge based on current and previous experiences and knowledge. Also presented was the connectivism learning theory which introduce especially for this digital age. This theory described that the learning connections can happen at various location whenever needed such as in classroom, at home or on the go with the help of digital devices and in this case mobile devices. Theoretical framework of personalised m-learning implementation was also presented in this chapter. In this section, the FRAME model was introduced where the three aspects: device, learner and social can be used in personalised m-learning implementation model. Finally, based on the above discussions, a conceptual framework for personalised m-learning curriculum implementation model for diploma students in hospitality programme was presented at the end of this chapter.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Mobile phones or cell phones, or just mobiles for short, facilitate voice conversations as well as text messaging. Today's mobile devices are work like multi-functional but tiny computer capable of hosting a broad range of applications for both business and consumer use. The ever-growing category of mobile devices with vast capabilities allow the users to access the Internet for e-mail, instant messaging, text messaging and Web browsing, as well as work documents, contact list and more. For students, mobile devices are often seen as an extension of their desktop even laptop computers. For them, work can be done anywhere and at anytime even though there are away from classroom which later can be synchronised with their desktop computers. With mobile technology changing almost daily, the users have various options to select their personal mobile devices based on their requirement. With the correct choice, the users can have a productive day while being away from classroom. A smart mobile technology choice enable the learners carry around their classroom with them. Mobile device blend the functionality of a desktop computer, cell-phone, email access and web browser into one device.

This chapter discusses the methodology and procedure applied in the development of personalised m-learning curriculum implementation model for students in hospitality programme. The major part of this methodology focuses on the experts' panel participation in the interpretive structural modeling (ISM) session to assist in the development of the curriculum implementation model for this study. Beside the above, this chapter also discuss on how the ISM were used in the past, details on how the panel of experts are selected, and the use of instruments and the analysis of data.

3.2 Method of the Study

The main focus of this study is to develop personalised m-learning curriculum implementation model for diploma students in hospitality programme. The development was solely based on views and opinions of selected panel of experts. Based on the theoretical framework presented in Chapter 2, this study adopted the PALLAS, IMLIS and Methodic models for the development of the personalised m-learning curriculum implementation model. The objectives of the study discussed in Chapter 1 are as follow:

a) To identify the needs for the development of the personalised m-learning curriculum implementation model for Food and Beverage Service course in diploma in hospitality programme based on the students' view.

b) To develop the personalised m-learning curriculum implementation model for Food and Beverage Service course in diploma in hospitality programme based experts' opinion and decision.

c) To evaluate the personalised m-learning curriculum implementation model for Food and Beverage Service course in diploma in hospitality programme based experts' opinion and decision.

3.3 Design and Development Research (DDR)

There are many instructional design model available for the researcher to select from based on their field of research and research type. An effective instructional design model is important to facilitate the development of online education such as e-learning and m-learning. According to (Chen, 2016), the most frequently used instructional systematic design (ISD) models are the ADDIE model and Dick, Carey, and Carey's model. ADDIE is one of the instructional design model also known as Instructional System Design (ISD). It consist five phases: Analysis, Design, Development, Implementation and Evaluation (Molenda, 2003). This model was first introduced by Florida State University in 1970. It is an iterative method for developing and enhancing skills and knowledge to create learning experience. The model has great focus on implementation and evaluation. However, this study did not use this instructional design model because this study did not involve in the development and implementation stages of personalised m-learning system. These stages will be handled in the future development of the study. Beside this, ADDIE also very systematic and time consuming to implement because it follow linear model where one stage must be completed before moving to next. Even though Dick, Carey, and Carey's model focuses on learners' needs and able to assess learners' prior knowledge levels to be used in the design, it was criticised by many educators for being rigid, cumbersome and driven by predetermined objectives (Morrison, 2013; Dick, Carey & Carey, 2014).

Creating personalised m-learning curriculum implementation model is a quite a complex process. A suitable methodology is needed to simplify and design systematically the model development process. Hence, this study employed Design and Development Research (DDR) approach because it can be used to test theory and validate its practices (Richey & Klein, 2007). As discussed and listed by (Rejab, Chuprat, & Azmi, 2018), there are three criteria which researchers can use DDR approach: the research been conducted to solve a problem; the research been conducted based on literature and empirical study; and the research been conducted to contribute to the body of knowledge. As for criteria one, this study was conducted to solve a problem. Huge amount of learning materials are available online for the students but it did not cater the student's specific needs and preferences of a student. Hence, this study proposed a model for personalised m-learning. As highlighted by criteria two, this study was conducted based on literature and empirical study. Using existing literature and empirical study, this research was conducted to discover the problem faced by student in accessing learning materials based on the needs and preferences of each students. Criteria three highlighted that the research was conducted to contribute to the body of knowledge. The contribution can be used in many areas of research to expand and to improve exiting knowledge and practices in instructional learning. As described by (Kamarulzaman, Mahmor, & Sailin, 2018), DDR approach suits well in this study because it helps in developing creative approaches in the teaching and learning of personalised m-learning. Besides, it also helps in contributing knowledge to the existing m-learning area by incorporating personalisation into the teaching and learning.

In order to develop personalised m-learning curriculum implementation model, this study has employed design and development research (DDR) approach (Richey & Klein, 2007). According to (Richey, Klein & Nelson, 2004), there are two categories of developmental research, Type 1 and Type 2. These two types of developmental research can be differentiated based on its final outcomes either generalizable conclusions or contextually specific. The following table (Table 3.1) shows the relationships between Type 1 and Type 2 of developmental research.

Table 3.1
A Summary of the Two Types of Developmental Research

	Type 1 (Product and Tool Research)	**Type 2 (Model Research)**
Emphasis	Study on the specific product, program design, development or evaluation project	Study of design, development or evaluation process, tools, or model.
Product	Lesson learned from developing specific products and analysing the conditions that facilitate their use	New design, development and evaluation procedures or models and conditions that facilitate their use
	Context-specific Conclusion ⟹ ⟹	⟹ Generalized Conclusions

Adapted from "Developmental Research: Studies of Instructional Design and Development" by Richey, Klein, & Nelson (2004)

In Type 1 category, the product development process used is described, analysed and evaluated. The result from Type 1 study typically context and product specific. The Type 2 category of developmental study is align toward a general analysis of design, development, or evaluation processes. The outcome of this type of study typically support the use of general conclusions. Multiple research methodologies often used for different phases in developmental research project. In Type 1 studies, case study methods are used in the design and development processes where interviews, observations and document analysis are techniques used to gather the case study data. In order to determine the effectiveness of a product, evaluation research techniques are often used in Type 1 studies. As for evaluation research, in-depth interviews and document analysis techniques are employed in Type 1 studies.

In Type 2 studies, research models are constructed in a variety of ways for full design and development process, or of a particular part of the process:

a) by surveys methods on designers and developers of a project in which they have been involved,
b) by synthesizing models from the literature,

c) by arriving at a consensus of opinion of experts in the field using Delphi techniques,

d) by conducting experiments to validate particular design and development models.

The following table (Table 3.2) shows summary of research methods most frequently used at the various types and phases of developmental research. This table also reflects types of people commonly participate according to phases conducted in developmental research.

Table 3.2
Common Participants and Research Method Employed in Developmental Research Studies

Developmental Research	**Function/Phase**	**Type of Participants**	**Research Methodologies Employed**
Type 1	Product design & development	Designers, Developers, Clients	Case study, In-depth interview, Field observation, Document analysis
	Product evaluation	Evaluators, Clients, Learners, Instructors, Organizations	Evaluation, Case study, Survey, In-depth interview, Document analysis
	Validation of tools or technique	Designers, Developers, Evaluators, Users	Evaluation, Experimental, Expert review, In-depth interview, Survey
Type 2	Model development	Designers, Developers, Evaluators, Researchers, Theorists	Literature review, Case study, Survey, Delphi, Think-aloud protocols
	Model use	Designers, Developers, Evaluators, Clients	Survey, In-depth interview, Case study, Field observation, Document analysis
	Model validation	Designers, Developers, Evaluators, Clients, Learners, Instructors, Organizations	Experimental, In-depth interview, Expert review, Replication

Adapted from "Developmental Research: Studies of Instructional Design and Development" by Richey, Klein, & Nelson (2004)

As for the participants, there are multiple types of participants involved in a given developmental research project and the participants may vary according to the phases of the study. The nature of the participating populations also vary depending on the type of developmental research being conducted. In relation to developmental research type, the design of personalised m-learning curriculum implementation model research falls under Type 2 study. This a model development study and the participants (experts) were the content developers, content designers, researchers and lecturers who has vast experience in the field of m-learning, curriculum and instructional technology, learning management system and personalised learning.

The design and development research (DDR) approach by (Richey & Klein, 2007) become the guideline in the development of personalised m-learning curriculum implementation model for students in hospitality programme. As presented by (Richey & Klein, 2007, p. 1), the design and development research is

‘‘the systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools and new or enhanced models that govern their development’’

The DDR approach is a practical form of research that attempts to test theory and validate practise (Richey & Klein, 2007). There are numerous models exist in the field of instructional design that assist researchers working in a variety of settings (Gustafson & Branch, 2002). The selection of DDR approach is justified in this study by its pragmatism in testing the theory and validating the practicality. It also described as a way to establish new procedures, techniques and tools based on specific needs analysis (Richey & Klein, 2007). This DDR methodology is previously known as developmental research (Richey, Klein & Nelson, 2004), designed case (Reigeluth & Frick, 1999), design-based research (Reeves, 2006; Herrington, McKenney, Reeves &

Oliver 2007), formative research (Nieveen, 2007), and design research (Bannan-Ritland, 2003; Van der Akker, 2007). Many terms have been used to describe this research methods, but it was first proposed by Brown and Collins in 1992 as an extension to other educational research methods (Wang & Hannafin, 2005; Markauskaite, & Reimann, 2008) and to test theory and validate its practices (Richey & Klein, 2007). An intervention (such as programs, teaching-learning strategies and materials, products and systems) was employed to design and develop which aim to solve a complex educational problem and to advance our knowledge on the characteristics of these interventions and the processes to design and develop them (Plomp, 2007). (Wang & Hannafin, 2005) describe it "as a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories". This rationalises the use of research method in this study to fulfil the aim in the design and development of personalised m-learning curriculum implementation model. This model was aimed at supporting diploma students in hospitality programme to have learning materials adapted according to their preferences, location and device they use. This is in line with (Wang & Hannafin, 2005)'s view that the method is flexible but systematic which could be implemented to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world setting. Based on the above description, this study was conducted in three phases: analysis, design and development, and evaluation.

Phase 1 is the needs analysis phase where it investigate the need for personalised m-learning for students in hospitality programme. It was also important to investigate learner's readiness, acceptance, satisfaction, learning speed, and learning effectiveness in using personalised m-learning in their learning needs. The outcome of this phase used as a basis for the development of personalised m-learning curriculum implementation model for a greater learning experience for students in hospitality programme. Phase 2 describes the design and development of the implementation model. A panel of experts in the related fields was selected to assist in the model development. The panel of experts identified the learning preferences, mobile devices categories and delivery of the learning content in the development of personalised m-learning curriculum implementation model. In phase 3, the curriculum implementation model was evaluated by the experts. The details of the purpose, samples selection, instrument and procedure used for data collection discussed in the coming sections.

3.4 Phase 1: Needs Analysis

The main focus of this phase is to find out the actual needs for personalised m-learning to be introduced in the teaching and learning of Food and Beverage Service course. The following sections explained in detail the process and the procedures involve in this phase.

3.4.1 Purpose

Students in an integrative or inclusive learning environment require teaching interventions according to context and situation. Having one's own device allows for flexibility in the learning situation. The study begin with a needs analysis that aimed to identify the purpose of the development of personalised m-learning curriculum implementation model based on the student's perspective. To achieve this aim, the needs analysis phase attempt to answer the following research questions:

1. What are the mobile devices that the students carries and capabilities of these devices?
2. What are the students' perceptions on their current ways of teaching and learning setup for Food and Beverage Service course?
3. What are the students' perceptions on implementing personalised m-learning to support the teaching and learning of Food and Beverage Service course?
4. What are the students' level of acceptance and intention to use personalised m-learning if incorporated into the formal Food and Beverage Service course?

The aim of this study is to develop a personalised m-learning curriculum implementation model and answering these research questions recognise the needs for this study in order to improve the students learning opportunities. There are many challenges in implementing learning process based on mobile technology and these research questions attempts to cover the most important aspects of personalisation on m-learning. By answering these questions in this phase justified the development of personalised m-learning curriculum implementation model for hospitality programme.

3.4.2 Sample of the Study

The sample for this phase involved fifty (50) students from private college in Malaysia who are enrolled in diploma in hospitality programme. As discussed by (Cohen, Manion, & Morrison, 2007), thirty (30) and above sample size are suitable for research study employing statistical analysis. It's a 'rule of thumb' to use sample size of thirty as minimum number of cases if the researchers plan to use some form of statistical analysis on their data. This diploma in hospitality programme is a 2.5 years programme where students will go through two years of theory and practical sessions at the college. The last six (6) months of study, the students need to do internship programme at hotel or travel agency. During this period, students will practice what they have learned in their two years of studies at the college. This programme provides students with the requisite knowledge and skills required for developing a career in hospitality, event management, and tourism with a managerial perspective in this field. The subject selected for this personalised m-learning curriculum implementation model is HM 2.03 Food and Beverage Service. This is a fourteen weeks of compulsory subject for student enrolled in this diploma in hospitality programme. The objective of this subject is to provide student with the basic skill and techniques to serve in food and beverage service. This will enables the student to understand, applying the skill and subsequently specializing in food and beverage operation. The outcome of this subject will make the students understand the food and beverage operation and serve in the right and professional way. The subject introduces the basic technical and conceptual skill of food and beverage service to all students. It also emphasized the correct and professional way of serving food and beverages.

Purposive sampling method was used to select the students for this study which attempted to develop the personalised m-learning curriculum implementation model for hospitality subject. As its name suggests, the sample has been chosen for a specific purpose. Purposive sampling is a sampling technique in which researchers relies on their own judgment when choosing members of population to participate in the study and they build up a sample that is satisfactory to their specific needs (Cohen, Manion, & Morrison, 2007). Purposive sampling is a non-probability sampling method and it occurs when "elements selected for the sample are chosen by the judgment of the researcher. Researchers often believe that they can obtain a representative sample by using a sound judgment, which will result in saving time and money" (Black, 2010).

In many cases purposive sampling is used in order to access ‘knowledgeable people’, i.e. those who have in-depth knowledge about particular issues, maybe by virtue of their professional role, power, access to networks, expertise or experience (Ball, 1990). In a random sampling, there is only a little benefit because most of the random sample may be largely ignorant of particular issues and unable to comment on matters of interest to the researcher, in which case a purposive sample is vital. Even though they may not be representative and their comments may not be generalizable, this is not the primary concern in purposive sampling; rather the concern is to acquire in-depth information from those who are in a position to give it. In this case, the sample are the students who enrolled for Food and Beverage Service course in hospitality programme. These students have "knowledge" about the course they have enrolled and issues they are facing with the current teaching and learning setup for this course.

The reason for selecting Food and Beverage service subject is because this subject required students to have theory and practical knowledge of the subject during class session and when they are out for internship. Practical knowledge of this subject is the hard skill needed by the students to successfully complete the given tasks. The set of hard skills that student learn from this subject are could be from formal classroom teaching and this can be reinforced via training program, online course as well as by on-the-job training. The specific hard skills that the student required to master for this subjects are the table setting and sequence of services (sequence of table service and sequence of dining service). The learning material of this subject which consist of theory and practical knowledge, could be delivered to students whether when they are on the move, before the practical session, during their internship or whenever they required via their mobile devices in accordance to their individual needs for optimal way of learning.

3.4.3 Instrument of the Study

In this phase, a needs analysis survey questionnaire (refer to Appendix A) was prepared to be used as study instrument. The survey questionnaire consist a total of 60 questions divided into five parts:

a) Students' demographic details and mobile device profile
b) Students' use of mobile device
c) Students' perception on the current teaching and learning setup
d) Students' perception on personalised m-learning and Food and Beverage Service course
e) Students' acceptance and intention to use personalised m-learning to learn this course

Before the actual survey was carried out, a pilot study was conducted on students enrolled for the Food and Beverage Service course. Pilot study is one of the important stage in research in order to discover the potential problem areas and deficiencies in the research instruments, procedures and protocol before the actual research is carried out. Pilot study is the best way to assess feasibility of a large and expensive full-scale study into the likelihood of success which else will be expensive failure of the main study. It is a small scale study to test the effectiveness and success of the methods and procedures which will be used on a larger scale. It is also called a mini research project which conducted before the final full-scale research project. This is to assess how the research project will progress and what are the changes in the procedures that need to take place, if any, before conduct the final research project. It is a trial run where researcher can get feedback to redefine the research questions, discover the right and suitable methods to pursuing the research and estimating the resources needed to complete the final research project.

The results of pilot study are used to assist in defining the research questions, improving the procedures involved, and assisting the reliability and validity of the proposed study. The outcome of the pilot study is from one of the following four: i) stop the main study because not feasible; ii) continue only after modification; iii) continue without modification but constant monitoring needed and iv) continue without any modification (Thabane et al., 2010). Success of a main study not depend on the pilot study but a proper pilot study will increase the likelihood of the main study's success. A research project does not always go as planned, hence a pilot study is conducted to optimise the process so that it could minimise the unforeseen events. Expensive mistakes and research project failure could have been discovered and corrected accordingly by conducting a pilot study. This is important to save resources being wasted on studies that may not be feasible. Pilot study is used to improve the quality and efficiency of the main study. In short, the pilot study will give clearer indication whether the researcher should proceed with the study.

When conducting a research, having the same participants in pilot and main study or having different participants depending on the selection criteria of the participants and time taken to find the suitable participants. Teijlingen and Hundley (2001) not in favour to have the same participants for both pilot and main study since it might affect the sample size because it will be difficult to find enough participants for pilot and main study. They suggested sub-group analysis to be conducted to assess the influence of the pilot sample size and the intervention effect. On the other hand, Janghorban et al. (2014) agreed to this idea to have same participants for pilot and main study which they think will creates familiarity between the researcher and the participants. They believed that, this will make the participants to act more naturally if they were involved in both pilot and main study. However, Jakobovits and Lambert

(1962) claimed that asking same or similar questions in pilot and main study even though in different setting may lead to loss of interest for the participant in a phenomenon called "semantic satiation". In order to avoid this situation, this study have used different set of the participants for pilot and main study. But to keep the conditions similar as possible with the pilot study, this study used participants from the same cluster, in this case, students from the same private higher institution enrolled for the same subject, Food and Beverage Service course. With this, both groups of participants for this study share the same background such as education level and current semester they are in to enroll for this Food and Beverage Service course.

Pilot study for this research project was conducted on 30 diploma students from hospitality programme from the same higher education institution who enrolled for Food and Beverage Service course. However, these students will not take part in the actual needs analysis study. This survey questionnaire is a quantitative survey method to investigate the students' level of acceptance on the implementation of m-learning into their curriculum. Before the survey questionnaire was carried out, the students were given a briefing on the purpose of this survey. The face and content validity of the questionnaire instrument were evaluated by a team of six (6) experts from curriculum design and instructional technology. Cronbach alpha technique was used to conduct the reliability test on the survey questionnaire. The need analysis questionnaire items registered a Cronbach alpha coefficient of 0.865 as shown in Table 3.3. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability or internal consistency. In simple term, "reliability" is how well a test measures what it should. Cronbach's alpha method was develop by Lee Cronbach in 1951. It tests to see if multiple-question Likert scale surveys are reliable. These questions measure latent variables, hidden or unobservable variables like: a person's conscientiousness, neurosis or openness. These are very difficult to measure in real life. Cronbach's alpha will tell if the test that has been designed is accurately measuring the variable of interest.

Table 3.3
Reliability test on need analysis questionnaire

Cronbach's Alpha	Cronbach's Alpha based on Standardised items	N of Items
.865	.832	60

The objectives of this questionnaire is to access the students' opinion on the current state of the learning as well as their level of acceptance on the implementation of m-learning into their curriculum and most importantly the delivery of the learning content based on their learning preferences, their mobile devices and the environment (surrounding). Although personalised m-learning could be used to support the learning by giving the learner the control to access the learning materials at their convenient, control the pace and style of their learning, but the learner's attitudes toward the technology whether they are keen and eager to use this determine the successful of this implementation (Sharples et al., 2005). According to (Abas, Peng, & Mansor, 2009), readiness of learners can be categorised into two: (i) readiness of changes acceptance and (ii) readiness for new learning innovation. The study by (Abas et al., 2009; Kennedy, Judd, Churchward, Gray, & Lee- Krause 2008) investigated the students' readiness for technology usage and m-learning. In the study conducted by (Jairak, Praneetpolgrang, & Mekhabunchakij, 2009), the m-learning acceptance and influential factors of its usage in higher education in Thailand was considered. The study result indicate that the most referred three factors in m-learning were: (i) ease of use, (ii) capabilities of usage without time and place constrains, and (iii) its interesting interface. The study by (Issham Ismail, Siti Norbaya Azizan & Thenmolli

Gunasegaran, 2016) conducted in Malaysian universities to find out whether students are ready to integrate mobile technologies in the education system within their learning institutions. The result indicates that the students are moderately ready and interested to know more about use of mobile technologies in their learning. As for this study, Unified Theory of Acceptance and Use of Technology (UTAUT) model by (Venkatesh, Morris, Davis, & Davis, 2003) was used to identify the items for the survey questionnaire. This model suggests that four (4) constructs will play a significant role as direct determinants of user acceptance and usage behaviour (Venkatesh et al., 2003) as illustrated in Figure 3.1. As explained below, attitude toward using technology, self-efficacy, anxiety, and behavioural intention to use m-learning are not direct determinants of intention.

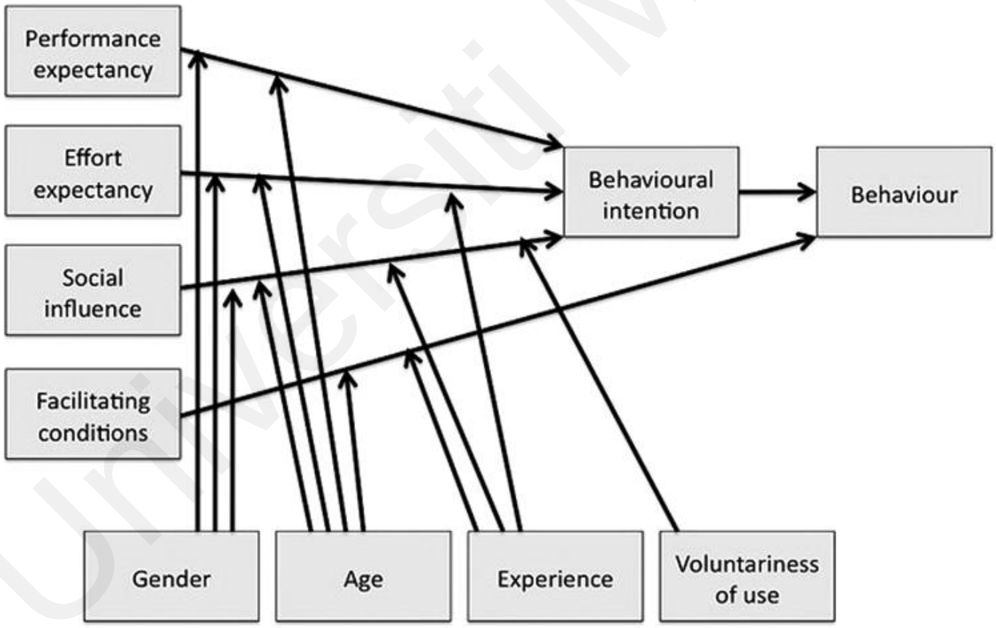

Figure 3.1 Unified Theory of Acceptance and Use of Technology (UTAUT), Venkatesh et al., 2003

Based on the key constructs, the questionnaire items were divided into eight expectancies:

a) Performance expectancy: This factor measures the degree to which a person perceives that using the system could help improve their performance (Venkatesh et al., 2003). In this study, performance expectancy indicates the effectiveness of personalised m-learning to support the learning of Food and Beverage Service course. For example, how the students perceive using personalised m-learning would enable them to accomplish learning tasks more quickly, how personalised m-learning would improve their learning process and increase their learning productivity or how personalised m-learning improve their chances in getting better grade for the course.

b) Effort expectancy: This factor measures the degree to which a person perceives the system will be easy to use (Kijsanayotin, Pannarunothai, & Speedie, 2009). In this study, it measures how easy the interaction to access learning materials in personalised m-learning and how easy to be skillful in using personalised m-learning.

c) Social influences: It measures the degree to which a person perceives that important others believe he or she should use the new system (Venkatesh et al., 2003). This study measures who influence the behaviour of the learner in using the personalised m-learning.

d) Facilitating conditions: This factor measures the degree to which a person perceives that the technical and organisational infrastructure are available to support their use of the system (Williams, 2009). In this study, it measures the learners' know-how and necessary device to use the personalised m-learning and support is available if they face difficulty.

e) Attitude toward using technology: A person's attitudes are the driving force for the adoption of the technology (Straub, 2009). If the person have a positive attitude towards the technology, then the belief is that the technology become easy to use and will be useful to the person (Saadé, & Kira, 2007). As for this study, it measures how comfortable is the learner in using this personalised m-learning, whether the learning is exiting and fun, and it's a good idea to use personalised m-learning to learning this course.

f) Self-efficacy: It is defined as the degree to which a person perceives that important others believe he or she should use the new system (Miller, 2003). In this study, it deals with the learner's confident and ability to use personalised m-learning and how their decision influenced by others.

g) Anxiety: It's refers to an emotional response usually resulting from a fear that using the mobile technology may have a negative outcome, such as damaging the equipment or looking foolish (Barbeite, & Weiss, 2004). In this study, it measures the learners' response on how the personalised m-learning can be seen as threatening and intimidating the learner.

h) Behavioural intention to use personalised m-learning: Its deal with students' eagerness and intention to use the personalised m-learning. In this study, it measures how soon the student want to use this personalised m-learning.

3.4.4 Data Collection Procedures

In order to assess the need to develop the personalised m-learning implementation model, a needs analysis survey was conducted on diploma students who enrol in Food and Beverage Service course. As defined by Witkin (1997), needs analysis is a method to identify the gap between the current situation and targeted situation. This is important because it helps to determine the gaps that are preventing it from reaching its desired goals. (McKillip, 1987) highlighted that a need can be seen as a problem that can be solved or as a gap between current outcomes and desired outcomes (Kaufman and English, 1979). Thus, in this context, needs for personalisation are the gap between what might happen as the process changes and what we would desire to happen. Hutchinson and Waters (1987) identified three useful classifications of needs: necessities, lack, and wants. 'Necessities" refer to what needs to be learned to function effectively in a targeted situation. 'Lacks' refer to the gap between what the learners already knew and the targeted proficiency while 'wants' is associated with subjective needs of the learners. (McKillip, 1987) also provide three types of models for needs analysis, Discrepancy Model, Marketing Model and Decision-Making Model. Out of these three models, Discrepancy Model is the widely used and most straightforward model, especially in education. This model emphasises on normative expectations and it divided into three phases:

a) Phase 1: Goal setting - this is to identify what ought to be
b) Phase 2: Performance measurement - this is to determine what is
c) Phase 3: Discrepancy identification - this is to identify the differences between what ought to be and what is

In making personalised m-learning an effective learning experience, one need to engage with each learner to determine how exactly they want their learning content.

The needs analysis is a top priority task and need to be conducted in order to gather the learners' interest and preferences to provide personalised curriculum that tailor the content learners interact with to make learning as relevant as possible. At the end, the learners are the end receivers of teaching and learning, and the design of the personalised m-learning curriculum model must consider the views and needs of the learners.

The needs analysis was conducted among fifty (50) students from hospitality programme who enrol for Food and Beverage Service course by giving away the questionnaires to get their feedback on the current situation of their learning of this course and what they expect from the implementation of personalised m-learning i.e. their targeted situation. Hence, the students' response and findings are expected to justify the development of the personalised m-learning curriculum implementation model for this study.

3.4.5 Analysis of Data

The collected data were analysed using descriptive statistics via the Statistical Package for Social Sciences (SPSS) software version 25.0. The mode and mean scores from this analysis were used to determine the students' view on the needs of personalised m-learning for this Food and Beverage Service course. The main aim of the result from the data analysis will justify the need for the development of personalised m-learning curriculum implementation model. The result from the data analysis justified the need for the development of personalised m-learning curriculum implementation model and the level of acceptance of the students if the personalised m-learning were used in teaching and learning. Finding from this analysis were used as an input to justify the need to develop the personalised m-learning curriculum implementation model in the following design and development phase. The following figure (Figure 3.2) shows the steps conducted in this needs analysis phase.

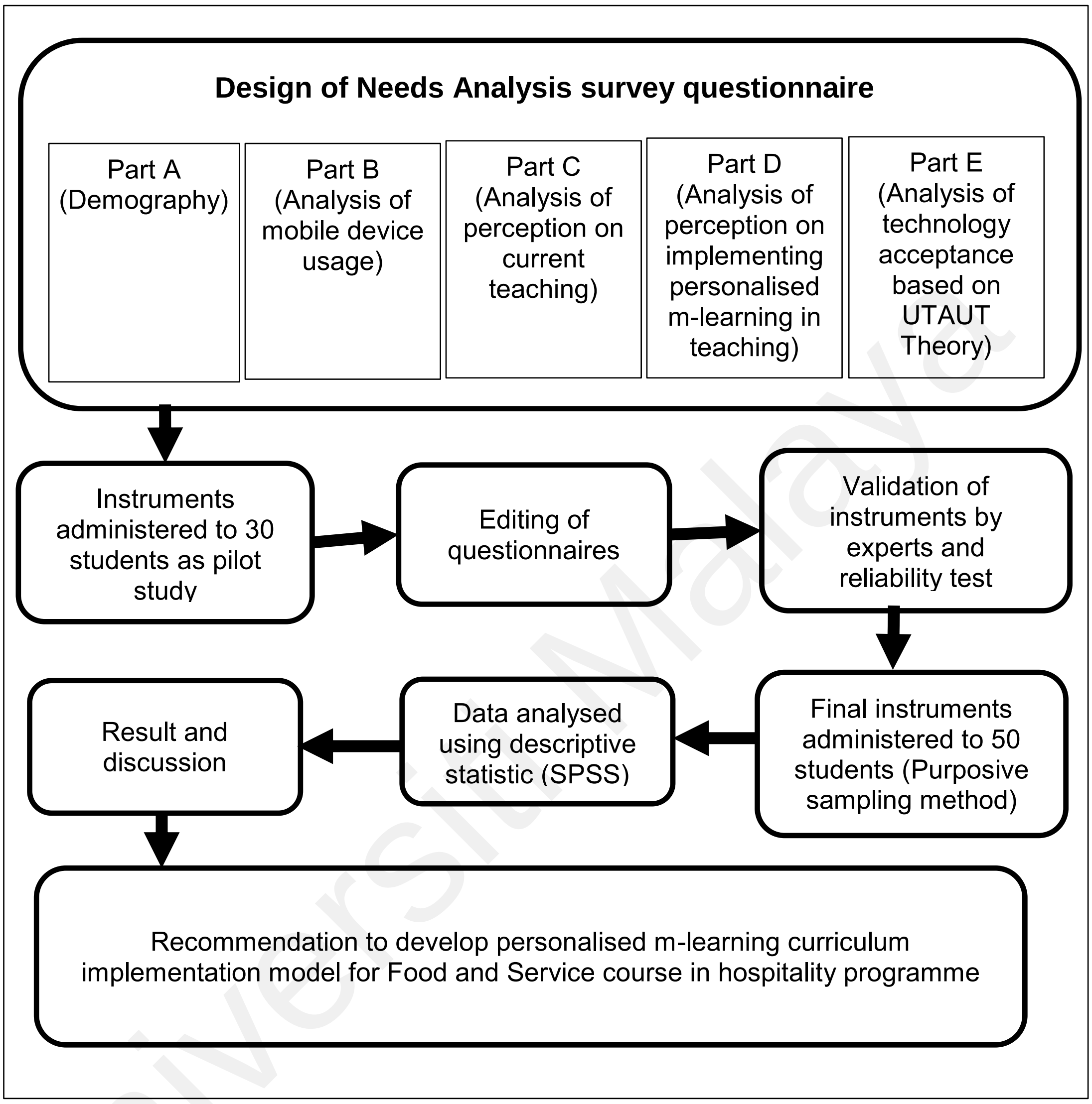

Figure 3.2 Flowchart of Needs Analysis phase

3.5 Phase 2: Development of Personalised M-learning Curriculum Implementation Model for Food and Beverage Service Course in Hospitality Programme

The second phase in DDR approach focus on the development of personalised m-learning curriculum implementation model for Food and Beverage Service course. The following sections explained in detail the process and the procedures involve in this phase.

3.5.1 Purpose

This is the second phase in DDR approach where the intended implementation model is developed. This model is developed based on the integrated views and opinions of panel of experts. The idea of this model is to support learners to achieve their learning outcomes by developing the personalised m-learning curriculum implementation model which gives anytime, anywhere and any device learning based on the learners' preferences. This personalised m-learning can happen in and/or out of formal classroom setup. This model consist of elements that support personalised m-learning to cater for different individual learning needs. The panel of experts' tasks were to identify the personalised m-learning elements and the relationship among these elements in order to fulfil the learning outcomes of the learners. However, determining the appropriate elements in personalised m-learning is a complex task and this task become even more complex as the relationships among these elements need to be investigated in order to produce not only a meaningful model but a practical one to support the implementation of personalised m-learning. This process required a great deal of time and commitment to investigate each proposed elements before it could be selected. The views and opinions from the experts are obtained by focusing on answering the following research questions:

2.1 What are the experts' collective views on personalised m-learning elements which should be included in the development of personalised m-learning curriculum implementation model?

2.2 Based on the experts' collective views, what are the relationships among the personalised m-learning elements in the development of the personalised m-learning curriculum implementation model?

2.3 Based on the experts' collective views, how should the personalised m-learning elements be classified in the interpretation of the personalised m-learning curriculum implementation model?

3.5.2 Interpretive Structural Modeling

Interpretive structural modeling (ISM) was used to facilitate the investigation into the relationships among learner's preferences, mobile device capabilities and learner's surrounding in order to extract structural model for the intended personalised m-learning implementation. ISM was first proposed by Warfield (1973, 1974, 1976) and this method was used to analyse a complex socioeconomic system. ISM referred as a management decision-making tool that interconnects ideas of individuals or groups to facilitate thorough understanding of a complex situation using a map of relationships between many elements involved in the complex decision making situation (Charan, Shankar, & Baisya, 2008). Later, when computers are available and used in many decision making process, Warfield (1982) defined ISM as a computer-assisted learning process that enables an individual or a group of user to develop a structure or map showing interrelations among previously determined elements according to a selected contextual relationship. It was specifically designed to support the human brain to manage information and ideas in a clear structure through an aerial view of the targeted problem. This techniques believed to be context free, irrespective of the content of the situation, enables individuals or groups to consolidate decisions collaboratively if the elements of the model and contextual relation are identified. Since this was a well-established methodology to represent the interrelationships among various elements related to an issue, various researchers adopted this approach in their research work (Attri, Dev, & Sharma, 2013).

The ISM is an interactive learning process which transforms unclear, poorly articulated mental models of systems into visible and well-defined models. In this ISM approach, a set of different directly and indirectly related elements are structured into a comprehensive systematic model (Sage, 1977; Warfield, 1974). And this model able to formed the structure of a complex issue or problem in a carefully designed pattern implying graphics as well as words (Raj, Shankar & Suhaib, 2007; Ravi & Shankar, 2005; Singh, Shankar, Narain & Agarwal, 2003; Raj & Attri, 2011). ISM is a powerful tool for analysing complex situations and solving complex problems. ISM can be used to process and structure ideas to make better and quicker decision with confidence. The process of building ISM are through discussion and analysis of the subject matter. ISM able to untangles complex issues by allowing experts to focus on only two ideas at a time. These ideas and their relationships among them are discussed and analysed within the framework of the issue that being investigated. By keeping track of the ideas and their relationships methodically, the ISM process able to create a visual relationship map. This map would reveal the underlying concepts and patterns to the experts to facilitate their discussion, understanding and decision-making.

In this study, ISM was used in developing a personalised m-learning model to guide in the teaching and learning of Food and Beverage course in a diploma programme. ISM uses pair-wise analysis of ideas to untangle complex issue, involving a lots of ideas by organising numbers of ideas into a structured relationship model that is easier to understand as illustrated in Figure 3.3. Experts could have a concrete view of the abstract issue at hand and able to find solutions to the problem at hand.

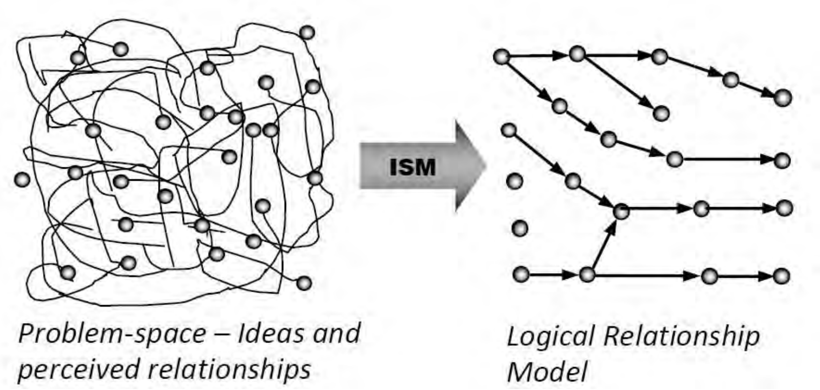

Figure 3.3 Conceptual view of ISM. Adapted from Structure Decision Making with Interpretive Structural Modeling (ISM) (p.3), 1999, Canada: Sorach Inc.

The ISM process organises many ideas or elements of the issue being investigated into comprehensible and logical view and then synthesizing a model which makes the complex issue understandable and logical. The Figure 3.4 illustrates the fundamental steps required to use ISM effectively.

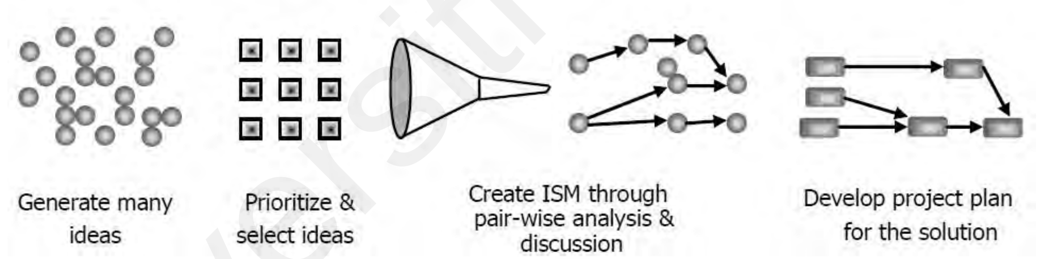

Figure 3.4 Fundamental steps to construct an effective ISM. Adapted from Structure Decision Making with Interpretive Structural Modeling (ISM) (p.3), 1999, Canada: Sorach Inc.

ISM can be categorised as an advanced Interactive Planning methodology. It allows a group of people usually experts from a particular field of problem being discussed, working as a team to find out whether there are relationships among elements and if so, how they should be connected. This method could develop a structure that defines the interrelationships among a set of elements. The overall structure and relationships among the elements could be illustrated in a graphical model. ISM is a very efficient structuring techniques and this structure can be obtained by answering a set of simple questions. If there are N elements in the set of problem that being discussed that need to be structured, the group would have to answer N x (N - 1) questions in order to fully define the relationship among the elements. The binary matrix is used to construct the reachability matrix (Warfield, 1976) which produces a mapping of relationships among the elements. An example of a reachability matrix is shown in Figure 3.5.

	e1	e2	e3	e4
e1	1	1	0	1
e2	0	1	0	0
e3	1	1	1	1
e4	1	1	0	1

e1, e2, e3, e4 denote elements
Matrix entries: 1 = 'yes'
0 = 'no'

Figure 3.5 Example of a reachability matrix. Adapted from Janes, 1988. "Interpretive structural modeling: a methodology for structuring complex issues", by F.R. Janes, 1988, Transactions of the Institute of Measurement and Control, 10(3), 145-154.

The ISM could be done manually but with ISM computer software, the pair-wise process and model generation could be done much easier. The mathematical process involved in the model generation is hidden from the experts. This allows experts from any field to use ISM in their research. ISM software called Concept Star, developed by Sorach Incorporation was used in this study.

3.5.3 The ISM Process

A systematic and logical approach needed to find interrelationships between various elements of the subject in order to understand and simplify the complexity in a subject under study. As a qualitative tool, ISM which was developed by Warfield able to do the above in understanding the complex relationships among elements related to a subject. One of the ISM's methodology is to dismantle a complex system into several subsystem using expert's knowledge and practical experience to build Hierarchical Model (Multiple Structural Model). It was also used to analyse and identify the relationship between certain variables to define a problem or issue that is complex (Janes, 1988; Sage, 1977; Warfield, 1974; Warfield & Jr, 1999). With this ISM produces a directed graph (Diagraph) to describe the relationship between elements, and the next element structuring complex issues in Hierarchical Structure Model (Porter et al., 1980). Building ISM involves a number of activities. The exact sequence of steps will vary from situation to situation. The following are the typical sequence of steps to follow when ISM is used to explore a complex issue with participant group using a computer (Janes F. R., 1988).

1. Identify issue to be studied
2. Decide on type of ISM to be constructed
3. Select participant group and facilitator
4. Generate the element set
5. Complete matrix of element interactions
6. Display the ISM
7. Discuss structure and amend if necessary

ISM methodology suggests the use of the expert opinions based on various management techniques such as brain storming, nominal group technique (Delbecq, Van de Ven, & Gustafson, 1975), Delphi technique (Dalkey, 1972), focus group interview (Krueger & Casey, 2001), and others, in developing the contextual relationship among the variables. This study employed nominal group techniques (NGT) to generate the variables to be discussed by experts during the ISM session.

3.5.4 Sample of the Study

The same participants were involved in the NGT study and ISM session in developing personalised m-learning curriculum implementation model for hospitality programme. The participants in this design and development phase are experts and the selection of these experts are carefully done because their views and opinions will be used to develop the ISM model for this study. As defined by Dalkey and Helmert (1963), experts are individuals who are knowledgeable in a certain field. Adler & Ziglio (1996) underline certain requirements in order to be called as an expert namely knowledge and experience with the issue in hand; capacity and willingness to participate in the study; have allocate sufficient time to participate in this study; and have effective communication skills. Since the success and output of this study is entirely based on experts' opinion, a correct selection of experts is vital for the success of the study (Parente et al., 2005; Skulmoski, Hartman, & Krahn, 2007). Thus, the selection of participants for this study are based on the following selection criteria:

1. Experts should possess a masters or doctorate degree in education or information technology with at least 10 years' experience in teaching in the subject matter;
2. Experts should have knowledge in curriculum design and implementation;
3. Experts should have knowledge in m-learning and/or personalised learning;
4. Experts in information technology, instructional technology or mobile communication technology who are willing to participate in the study; or
5. Experts in m-learning/personalised learning and should at least involve in conference paper presentations; researchers in m-learning/personalised learning especially those who have journal publication in m-

learning/personalised learning or related field, and m-learning/personalised learning project implementers, or involved in such projects.

Beside the experts' qualification and experience, number of experts involve in the NGT and ISM sessions is another important factor that need to be considered. According to Janes (1988), the maximum number of participants for these sessions are eight (8). (Deip, Thesen, Motiwalla & Seshardi, 1977) suggested five to nine members for NGT session for quality and diversity of opinion. The increase in the group size will have impact in the quality of the debates because every individual expert has to interact with every other expert in the panel (Janes, 1988). Besides, the larger groups tend to produce more interpersonal differences which lengthens the process without a substantial increase in the quality of output (Deip et al., 1977).

As for this study, total of eight (8) experts were selected for both NGT and ISM sessions (refer to Appendix B: Sample of Expert's Appointment Letter). They are consist of three content experts, who was the course instructor from the private institution, two instructional technologist or m-learning experts, two curriculum design experts and one policy stakeholder of the institution. The summary profile of the experts are in Table 3.4.

Table 3.4
Summary Profile of Experts

Experts	Designation	Field of Expertise	Years of Experience
E1	Director and Member-at-large (International Association of Blended Learning)	M-learning, Curriculum and Instructional Technology	18
E2	Digital Content Developer	M-learning, Learning Management System, Smart School	30
E3	Assistant Director (Malaysia Examination Syndicate)	Content development, Curriculum and Instructional Technology	16
E4	Senior Lecturer	M-learning, Curriculum and Instructional Technology	15
E5	Senior Lecturer	Personalised learning and M-learning	15
E6	Senior Lecturer	M-learning	13
E7	Senior Lecturer	M-learning	13
E8	Senior Lecturer	M-learning	12

3.5.5 Instruments

Two instruments have been identified to be used in this design and development phase. First, a draft or pre-listed personalised m-learning elements generated from literature review was used in the first step of phase 2 during the NGT session. A list of student learning preferences and mobile device capabilities drafted and this was served as a guide for the experts to identify the appropriate student preferences and mobile device capabilities for inclusion in the personalised m-learning model. These elements in the list would be agreed upon either to be included in the model, grouped together, or discarded totally. Experts also free to add new elements that they find suitable to be included in the final list for the personalised m-learning model.

The second instrument was the interpretive structural modeling software. This software was developed by Sorach Incorporation and it is called Concept Star. The software was used to facilitate discussion and decision making among experts in a closed session to determine the relationships of the personalised m-learning elements that were loaded into the software (Muhammad Ridhuan Tony Lim Abdullah, 2014).

3.5.6 Data Analysis Procedures

In ISM methodology, the judgement of group of experts decides whether and how the variables are related. An overall structure is extracted from the complex set of variables and the relationship and are portrayed in a digraph model. Building an ISM involves a number of steps and these various steps are described briefly as follows:

3.5.6.1 Step 1: Identifying the elements that are relevant to the problem or issues

It is necessary to identify fairly and clearly the particular issue which is to be explored using ISM. For that, NGT techniques was used to generate ideas or variables linking to an issue, problem, or situation. There are five (5) standard steps in classic NGT as described by Broome and Cromer (1991). These steps are:

1. A query in a form of question is presented to a group of people to initiate interest in the situation being studied;
2. Ideas are generated as individuals;
3. The ideas are then displayed to be shared with others in the group;
4. Familiarization of ideas through discussion and clarification of each item among the individuals in the group; and
5. Voting procedure where the participants select the most relevant items.

Classic NGT is an iterative and time-consuming process of elicitation of ideas from scratch. But in this study, the NGT session was modified to a shorter process with a survey of pre-listed personalised m-learning elements. This list not only used as guide by the experts with a starting point of ideas to begin with but also offer a description of the scope of the study. With the pre-listed personalised m-learning elements, the experts could agree or disagree with the list. The experts are also allow to add additional ideas on the elements that were deemed fit for the model. Each personalised m-learning elements was presented, familiarized, and clarified to allow the experts to make appropriate judgment on whether to include the elements in the final list (Broome & Cromer, 1991). In the final stage of NGT, the final list (Appendix C) was given to the experts individually for them to vote for suitable personalised m-learning elements to be included in this model by giving a ranking number for each elements. The ranking used was in the scale of one (1) to seven (7) and the interpretation of the scale is as follows:

1 = Least favorable	2 = Slightly favorable
3 = Moderately favorable	4 = Favorable
5 = Very favorable	6 = Highly Favorable
7 = Most Favorable	

The ranking numbers given by the experts were accumulated to give the priority values for the personalised m-learning elements. Based on the total ranking number, the elements were prioritized. Personalised m-learning elements with the highest number would be the most priority element in the list. The following Figure 3.6 summarized the NGT session.

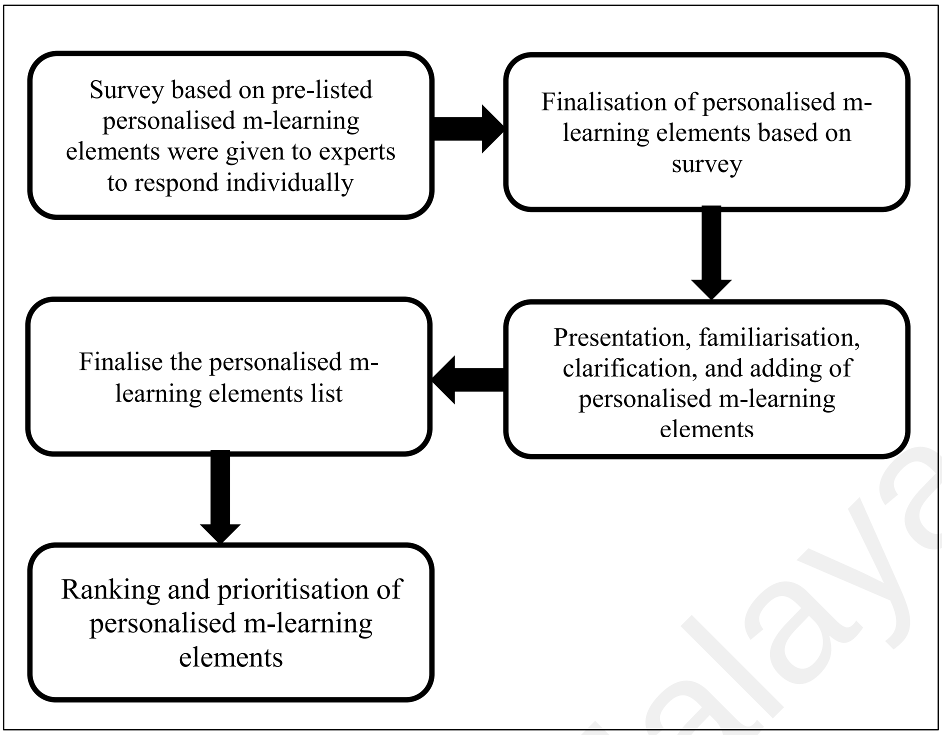

Figure 3.6 Flowchart of nominal group technique (NGT) session

3.5.6.2 Step 2: Determine the contextual relationship and relation phrase

This step is conducted to establish contextual relationship and relation phrase among elements identified in step 1 with respect to each other. When analysing the elements in the problem under consideration, a contextual relationship of 'leads to' or 'influences' type must be chosen. This means that one element influences another element. On the basis of this, contextual relationship between the identified elements is developed. The contextual relationship phrase is used to guide the discussion and decision-making process. It defines what is to be accomplished and what are the boundary conditions in the problem solving process. The context provides the focus to the experts on how the personalised m-learning elements need to be connected while constructing the ISM. The relation phrase was used to determine on how the relationships between elements are analysed during the construction of ISM. It gives the meaning of the links between elements in the completed model and finally interpreted the ISM. It is a norm for the ISM session facilitator to select the relation phrase because he understanding the ISM process better and he also familiar with the problem and the goal for solving it. However, the facilitator could ask the experts' consensus on contextual relationship and relation phrase before staring the voting process.

3.5.6.3 Step 3: Develop a Structural Self-interaction Matrix (SSIM)

SSIM is developed for elements, which indicates pair wise relationships among variables of the system under consideration. In this study, ISM software was used to develop the SSIM. The software will display pairs of elements to allow the experts to decide through voting on the relationship before the next pair of elements displayed. This process will be repeated until all the elements are paired.

3.5.6.4 Step 4: Generate the ISM model

After the pairing of elements were successfully conducted, the software generates the model. The model was generated based on the concept of pair wise comparison and transitive logic. Transitive logic states that for any 3 elements (A, B, C) with a given relation when:

- A has the relation to B, (written A → B),
- And B has the relation to C, (written B → C),
- Then, A has the relation to C, (written A → C or A → B → C).

In brief, it states that if a variable A is related to B and B is related to C, then A is necessarily related to C.

3.5.6.5 Step 5: Review the model

The ISM model developed in previous step is reviewed by the experts to check for conceptual inconsistency and necessary modifications are made if any. This model was generated through a systematic process of discussion and argument, thus it only allow minor amendments (Janes, 1988). Janes also stated that ISM is a learning process and participants' perceptions towards a situation could change during the ISM session as new information emerged. However, amendments decided by the experts should be fed back into the computer software to generate the final model.

3.5.6.6 Step 6: Presentation of final model

After the necessary changes are made in the previous step, the final model is presented. The following 2 steps after this were used to interpret the model further.

3.5.6.7 Step 7: Reachability Matrix

The reachability matrix is used to ensure all possible relationships have been determined by direct votes or Transitive Logic as mathematically specified by J. Warfield (1974) in his definition of ISM theory. In this step, personalised m-learning elements were partitioned according to levels of influence. The reachability matrix is developed from SSIM where four symbols are used to denote the direction of relationship between two elements (i and j), the associated direction of the relationship is questioned. The reachability matrix was achieved based on the SSIM developed by substituting V, A, X and O by 1 and 0 as per given case. The rules for this substitution are as follows:

1. If the (i, j) entry in the SSIM is V, then the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0;

2. If the (i, j) entry in the SSIM is A, then the (i, j) entry in the matrix becomes 0 and the (j, i) entry becomes 1;
3. If the (i, j) entry in the SSIM is X, then the (i, j) entry in the matrix becomes 1 and the (j, i) entry also becomes 1; and
4. If the (i, j) entry in the SSIM is O, then the (i, j) entry in the matrix becomes 0 and the (j, i) entry also becomes 0.

The following four symbols are used to denote the direction of relationship between two factors (i and j):

1. V for the relation from element i to element j (i.e., element i will influence element j)
2. A for the relation from element j to element i (i.e., element i will be influenced by element j)
3. X for both direction relations (i.e., element i and j will influence each other)
4. O for no relation between the element (i.e., barriers i and j are unrelated).

3.5.6.8 Step 8: Classification of clusters (MICMAC Analysis)

In this step, the personalised m-learning elements are classified according to clusters based on its' driving power and dependency using MICMAC (cross-impact matrix multiplication applied to classification) analysis. Matrice d'Impacts croises-multiplication appliqúe an classment (cross-impact matrix multiplication applied to classification) is abbreviated as MICMAC. The purpose of MICMAC analysis is to analyse the drive power and dependence power of elements. MICMAC principle is based on multiplication properties of matrices (Sharma, Gupta and Sushil, 1995). It is done to identify the key factors that drive the system in various categories.

In this step, the personalised m-learning elements are classified according to clusters based on its' driving power and dependency. This was done by clustering elements in the same level across the rows and columns of the final reachability matrix. The driving power of an element is derived by summing up the number of ones in the rows and its dependence power by summing up the number of ones in the columns (Raj, Attri and Jain, 2012; Attri, Grover, Dev and Kumar, 2012; Attri, Grover, Dev and Kumar, 2012a). And then, the driving power and dependence power ranks are calculated by giving highest ranks to the factors that have the maximum number of ones in the rows and columns, respectively. These driving power and dependencies will be used in the MICMAC analysis, where the factors will be classified into four groups of Autonomous, Linkage, Dependent, and Independent guidelines as detailed below.

Table 3.5
Description of Clusters in MICMAC Analysis

Cluster	Descriptions
Independent elements	These elements have strong driving power but weak dependence power. An element with a very strong driving power, called the 'key element' falls into the category of independent or linkage elements. These elements would have to be conducted first to have effect on other elements that depend on them.
Linkage elements	These elements have strong driving power as well as strong dependence power. These elements are unstable in the fact that any action on these elements will have an effect on others and also a feedback effect on themselves.
Dependent elements	These elements have weak driving power but strong dependence power. In order for these elements to be involved in aiding the learners achieve their learning outcomes, these elements depend on other elements connected to them.
Autonomous elements	These elements have weak driving power and weak dependence power. They are relatively disconnected from the system, with which they have few links, which may not be strong. The model can be applied with or without the elements.

3.5.6.9 Step 9: Analysis and interpretation of elements

Based on the classification of personalised m-learning elements, data could be analysed and interpreted according to the importance and hierarchy of the elements which is relevance to the implementation of personalised m-learning. The overview of the various steps involved in ISM technique which lead to the development of an ISM model in this study, are illustrated below (Figure 3.7).

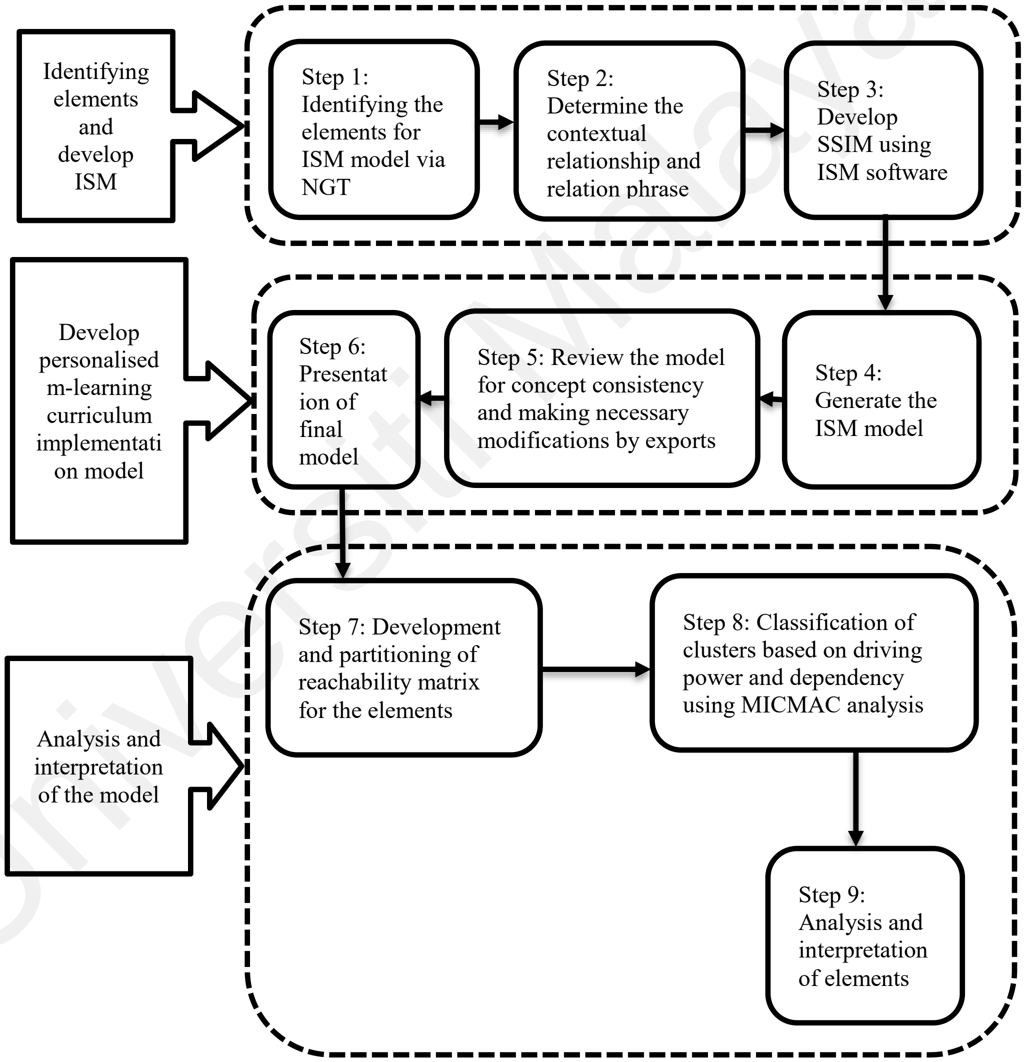

Figure 3.7 Flowchart of development of ISM for personalised m-learning Curriculum implementation model for hospitality programme

3.6 Phase 3: The evaluation of personalised m-learning curriculum implementation model for Food and Beverage Service course in hospitality programme

The final phase is the evaluation phase. In this phase, the suitability of the developed personalised m-learning curriculum implementation model for Food and Beverage Service course will be evaluated. The following sections explained in detail the process and the procedures involve in this phase.

3.6.1 Purpose

This is the third phase in DDR approach where the study model is evaluated. This is to ensure the model is suitable to guide in the implementation of personalised m-learning as learning support for student enrol in this course. A group of specifically selected experts are used to evaluate the model. Experts were asked to look into the suitability of the elements in personalised m-learning, the relationship among these elements, the classification of these elements and the suitability of the model in the teaching and learning of hospitality programme. To evaluate the model, this study adopted the fuzzy Delphi method to elicit experts' views in validation the model. The evaluation by the experts are based on the following research questions:

1. What is the experts' agreement on the suitability of the personalised m-learning elements (learning preferences) proposed in the personalised m-learning curriculum implementation model?
2. What is the experts' agreement on the classification of the personalised m-learning elements based on the three domains (Device Adaptation elements, Learner Adaptation elements, and Situated Adaptation elements) as proposed in implementing personalised m-learning curriculum implementation model?
3. What is the experts' agreement on the list of personalised m-learning elements in the respective four clusters (Independent, Linkage, Dependent,

and Autonomous) as proposed in implementing personalised m-learning curriculum implementation model?

4. What is the experts' agreement on the relationship among the personalised m-learning elements as proposed in implementing personalised m-learning curriculum implementation model?
5. What is the experts' agreement on the suitability of the personalised m-learning curriculum implementation model in the teaching and learning of Food and Beverage Service course in the hospitality programme?

3.6.2 Fuzzy Delphi Method (FDM)

In this study, a Delphi method was used to identify suitability of the elements in personalised m-learning. The Delphi panel consisted of experts from different geographic regions of the world. Kaufmann and Gupta (1988) introduced the Fuzzy Delphi method. It consist of fuzzy set theory and Delphi techniques (Murray, Pipino, & Van Gigch, 1985). This is an analytical method used in decision making process which incorporate fuzzy theory in the traditional Delphi method. The Delphi technique is "a method for the systematic solicitation and collection of judgments on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarized information and feedback of opinions derived from earlier responses" (Delbecq, Van de Ven, & Gustafson, 1975). It is a time- and cost-efficient method to obtain opinions from experts without physically bringing them together for a face-to-face meeting. One of the major advantages of the Delphi technique is anonymity which removes common biases occurring in face-to-face group settings (Listone & Turoff, 1975). This Delphi study method able to overcome implicit weaknesses in group communication, such as confrontation, argumentation, or dominance by a few individuals. The experts, who are anonymous and independent, are free to express their own ideas without direct communication with each other.

According to Linstone and Turoff (2002), the Delphi method involves several rounds of questionnaire surveys to elicit experts' opinion on an issue being investigated. This method is also known as consensus approach or inner-opinions consensus of a group of selected experts or Delphi polls of experts. RAND Corporation ("Research ANd Development") or just RAND is an American non-profit global policy think tank created in 1948 by Douglas Aircraft Company to offer research and analysis to the United States Armed Forces. According to its report in 1953, the Delphi technique was originally intended to solve the problems of the military (Dalkey & Helmer, 1963). Later it has evolved into a variety of disciplines that can be found on various articles and journals. Just to name a few, this method has been used in the field of education by Baggio (2008), in teacher training field by Frazier & Sadera (2011), in management area by Schmiedel & Brocke (2013), in sports by Eberman & Cleary (2011), in tourism by C. Lee & King (2008), and in banking sector by Bradley & Stewart (2002). The Delphi technique is an expert opinion survey method with the following features:

1. Anonymous response: Experts has no knowledge of the identity of the other experts involved in the panel. According to Armstrong (1985), the relationship among samples does not exist and their opinions are classified but their ideas are integrated in the analysis of data. The advantage of this anonymity is that the experts would not face any pressure or influence in responding their questionnaire.
2. Controlled feedback: Experts would be given the main ideas constructed from the group in the subsequent rounds of questionnaire which allow the

exports to re-evaluate their judgement and submit their responses again to the group.

3. Statistical: The experts feedbacks are analysed statistically which result in a splinesgraph. The top part of the graph indicates the experts' consensus opinion (50% of experts) which represent the overall exports' consensus opinion.
4. Convergence: The result will be determined as the result converge after multiple rounds of feedback from the experts.

Through this, the Delphi method archive its aim to make decision based on consensus on a particular study. According to Saedah Siraj (2006, 2007), the method allows integration of opinions that is gained independently from each expert through multiple cycles of questionnaires for prediction outcomes. However, there are also weaknesses in this method where the process become more costly and the repetition of the research cycle is time consuming as it needs repetitive surveys to allow forecasting values to converge (Hwang & Lin, 1987; Ishikawa et al., 1993). Beside this, since people use linguistic terms such as ‘good’ or ‘very good’ to reflect their preferences (Hsu et al., 2010), the experts’ judgments cannot be properly reflected in quantitative terms. Ambiguity might happen due to the differences in the meanings and interpretations of the expert’s opinions. This can be overcome by combining fuzzy set theory and Delphi which was proposed by Murray, Pipino and Gigch (1985) and was named the Fuzzy Delphi Method (FDM).

3.6.3 Fuzzy Theory

Fuzzy logic was first being introduced in 1965 by an expert in Mathematics, Zadeh (1965). Fuzzy theory applies fuzzy logic by using computer to make decision like human. Fuzzy logic relies on fuzzy set and fuzzy rules to model the world in making decisions. In situation that are not precise, fuzzy set is used to make measurement. On the other hand, fuzzy rules are used to model the world. A number of rules can be combined to make a decision and this process is called inference. The fuzzy rule applies human concept instead of strict measurement to make decision. The fuzzy set theory has been used widespread and it has demonstrated a high ability to improve reliability in solving real problems in the form of fuzzy (Lin & Lee, 1996). The fuzzy set theory and Delphi technique combined to provide the following (Chang, Huang & Lin, 2000):

1. It processes ambiguity on predictive items and of respondents' information.
2. The individual characteristics of the participants can be explained

Hence, the fuzzy Delphi method is used to obtain consensus of experts who act as respondents based on the use of quantitative methods.

The traditional Delphi method had limitations and it can be overcome by incorporating fuzzy theory and fuzzy Delphi. In traditional Delphi method, since its aim is to achieve a consensus of experts, various opinions can be obtained while maintaining an expert opinion. Because of this, more time is needed to gather the opinions of experts. Typically, it will be done in three rounds. It's a long process with higher cost where the questionnaire is to be administered repeatedly until a consensus is obtained. In order to achieve consensus, this repeated process might misinterpreted by the researchers. Approval of the expert opinion only applies to a certain range, while ambiguity is not taken into account. However, by using Fuzzy Delphi Method, the study time could be minimized by reducing number of Delphi rounds and guarantee consistency of group opinion. The time reduction will directly reduce the travel costs of the researchers. Beside this, the selected experts able to express their opinions fully to ensure completeness and uniformity of opinion. Data loss and leakage also can be able to eliminate by using this method. The original opinions of the experts also does not misinterpreted in this FDM and it able to provide a true reflection of their response. A modified FDM was used to conduct the evaluation of the personalised m-learning curriculum implementation model. The modifications involved are as follow:

1. In traditional Delphi technique, experts are used to determine variables prior to the development of a model. However, in this research study, the evaluation does not require generation of the variables by the experts although the session involves decision making. FDM considered the collective views of experts through consensus opinions on certain evaluation criteria of the model. It addresses the fuzziness that is always present in the survey process.
2. The second modification is in the use of defuzzification process and rankings in FDM. In conventional use of FDM, defuzzification and rankings are used to figure out the variables of a research study. However, in this evaluation procedure of this study, they are used to determine the consensual agreement among experts on elements assessed in the model according to a range of defuzzification values that was determined beforehand. The procedure in conducting the modified FDM is further elaborated in the coming sections.

3.6.4 Sample of the Study

In this phase, a panel of experts selected through purposive sampling to evaluate the model as described in the modified FMD above. In Delphi method, selection of experts is the most important step because it affects the quality of the result of the study (Jacobs, 1996; Taylor & Judd, 1989). The technique of selecting the appropriate sample in the FDM is not a non-probability sampling (Hasson, Keeney and McKenna, 2000). This is because the samples were not selected randomly since they were chosen based on their knowledge and experience in the field of the study. A lecturer who have experience of more than five years is classified as an experts since they have experience in teaching and managing an ongoing basis (Berliner, 2004). According to Akbari and Yazdanmehr (2014), the term expert in the field of education refers to an individual who has more than five years based on their specific experience. In order for the study to reach its specific objectives, Linstone and Turoff (2002) suggested the panel of experts is from 5 to 10. Okoli & Pawlowski (2004) suggested from 10 to 18 experts to validate the model. According to Gordon (2009), the usual numbers of experts selected are between 15 to 35 experts to guarantee for comprehensive and reliable research findings. Whereas, Jones and Twiss (1978) suggested the appropriate number of experts for this method should be from 10 to 50. After considering the related factors, the number of experts selected to evaluate and validate the model were set to 25.

3.6.5 Instrument

In this phase, the instrument used was a set of evaluation survey questionnaire (refer to Appendix D) which consisted of 28 questions. This questionnaire divided into three parts: 1) Experts' personal details; and 2) Experts' use of technologies; and 3) Experts' views of the model. The first part of the questionnaire was to elicit the experts' background information. The second part was to elicit the experts' use of mobile technologies. The third part was to elicit experts' view on the usability of the model using a 5-point linguistic scale as follows:

1 – Strongly Disagree 2 – Disagree

3 – Neutral 4 – Agree

5 – Strongly Disagree

3.6.6 Data Collection Procedures

In this phase, the main aim was to evaluate the model which was developed in Phase 2 of this study. As the study employed FDM to evaluate the model, the procedure for this phase are as below:

1. **Selection of experts to evaluate the model**

   Based on the experts' selection criteria explained in the previous section, a total of 25 experts was selected to evaluate the model. All the communication with the experts are done via email.

2. **Determine the linguistic scale based on triangular fuzzy**

   In order to address the issue of fuzziness among the experts' opinion, a linguistic scale was used to frame the experts' feedback. This linguistic scale is very much alike to the Likert scale with an additional of fuzzy numbers given to the scale of responses based on triangular fuzzy number as shown in Figure 3.8. For every response, there are three fuzzy values were given to consider the fuzziness of the experts' opinions. The three values as shown in Figure 3.8 consist of three levels of fuzzy value: minimum value (m_1), most plausible value (m_2), and maximum value (m_3).

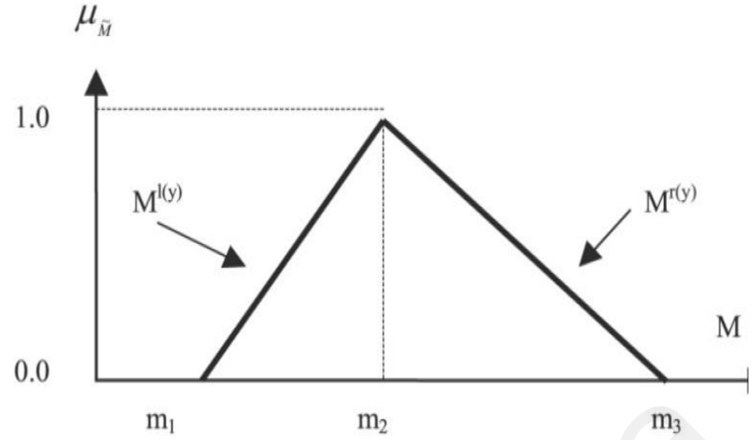

Figure 3.8 Triangular Fuzzy Number
Adapted from Muhammad Ridhuan Tony Lim Abdullah. (2014). *Development of Activity-based mLearning Implementation Model for Undergraduate English Language Learning*

The linguistic scale is used to change the linguistic variable to fuzzy numbers. The level of agreement scale should be in odd numbers, usually in 3, 5 or 7 point linguistic scale. A higher scale would indicate that the response analysis are more accurate. Table 3.6 shows an example of a 5-point linguistic scale.

Table 3.6
Sample of Linguistic Scale

5 Point Linguistic Scale	**Fuzzy Scale**		
Strongly Agree	0.60	0.80	1.00
Agree	0.40	0.60	0.80
Moderately Agree/Neutral	0.20	0.40	0.60
Disagree	0.10	0.20	0.40
Strongly Disagree	0.00	0.10	0.20

Based on the example scale above, we could observe that the fuzzy numbers are in a range of 0 to 1. In this study, this 5-point linguistic scale was used as the fuzzy numbers for the responses.

3. **Calculating average for fuzzy responses of experts**

Responses from the experts for each questionnaire item on their view of the model and their correspondent fuzzy number scales were then inserted into an excel spreadsheet. The purpose of this is to get the average for m_1, m_2 and m_3. The example shown in Table 3.7 is based on 5-Point Linguistic scale.

Table 3.7
Example of Fuzzy Delphi Experts' Responses

Respondents	**Item 2.10**		
r1	0.60	0.80	1.00
r2	0.40	0.60	0.80
r3	0.20	0.40	0.60
r4	0.40	0.60	0.80
r5	0.20	0.40	0.60
r6	0.60	0.80	1.00
r7	0.40	0.60	0.80
r8	0.60	0.80	1.00
r9	0.40	0.60	0.80
r10	0.60	0.80	1.00
Average	0.44	0.64	0.84
	m_1	m_2	m_3

This procedure is known as identifying the average responses for each fuzzy number (Benitez, Martín, & Román, 2007). They were calculated using the following formula:

$$M = \frac{\sum_{i}^{n} = 1mi}{n}$$

4. **Identify the threshold value**

In the next step, the difference between the experts' evaluation data and the average value of each item were calculated to determine the threshold value, 'd'. The following formula was used to calculate the threshold value:

$$d(\tilde{m}, \tilde{n}) = \sqrt{\frac{1}{3}\left[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2\right]}.$$

In reference to the formula above, m_1, m_2 and m_3 are the average values for all the experts' opinions while n_1, n_2 and n_3 are fuzzy values for all three values for every user. Table 3.8 shows an example of the threshold value (d) generated for 2 items surveyed by the views of 20 experts.

Table 3.8
Sample of Calculation to Identify Threshold Value, d

Respondents	Item 2.10	Item 2.11
r1	0.0764	0.0611
r2	0.0764	0.0611
r3	0.0764	0.0611
r4	0.0764	0.0611
r5	**0.2291**	0.0611
r6	0.0764	0.0611
r7	0.0764	0.0611
r8	0.0764	**0.2444**
r9	0.0764	0.0611
r10	0.0764	0.0611
r11	**0.2291**	0.0611
r12	**0.2291**	**0.2444**
r13	0.0764	0.0611
r14	0.0764	0.0611
r15	0.0764	0.0764
r16	0.0764	0.0611
r17	**0.3819**	**0.3666**
r18	0.0764	0.0611
r19	0.0764	0.0611
r20	0.0764	**0.2444**

The threshold value is essential in determining the consensus level among the experts. Cheng and Lin (2002) stated that all the experts are considered to have reached a consensus when the threshold value is less than or equal to 0.2. The threshold values which are in bold in the sample calculation in Table 3.6 indicate the individual expert's opinion that are not consensus with the other experts' view. Some experts view in the above table have a threshold value that is more than 0.2 but what is more important to be considered is the overall consensus for all items. The overall group consensus should exceed 75% and any value less than this required a second round of fuzzy Delphi.

5. Determine the percentage agreement

The overall consensus for all the items were determined based on the threshold value for each item. Chu and Hwang (2008) and J. Murry and Hammons (1995) highlighted that the percentage agreement of all experts must be equal to or greater than 75%. The following table (Table 3.7) shows the example of the percentage agreement for 2 items by the views of 20 experts based on Table 3.9.

Table 3.9
Examples of Calculation of Percentage of Experts' Agreement

	Items	
	2.10	2.11
No of items d ≤ 0.2	16	16
Percentage of each item d ≤ 0.2	80%	80%
Overall Percentage of Experts' Agreement	80%	

The Table 3.6 indicates that the overall percentage of experts' agreement has exceeded 75%. This is a clear indication that the experts have reached the required consensus in their views for all the questionnaires items.

6. Defuzzification Process

Defuzzification process is the final step in the evaluation phase. The data is analysed using the average of fuzzy numbers. The defuzzification value, also known as fuzzy scores, (A) for each questionnaire item was calculated using the following formula:

$$A = 1/3 * (m_1 + m_2 + m_3).$$

The following table (Table 3.10) shows a sample of defuzzification process to calculate fuzzy scores (A) based on FDM.

Table 3.10
Sample of Defuzzification Process

Respondents		**Item 2.10**			**Item 2.11**	
r1	0.40	0.60	0.80	0.40	0.60	0.80
r2	0.60	0.80	1.00	0.40	0.60	0.80
r3	0.40	0.60	0.80	0.40	0.60	0.80
r4	0.40	0.60	0.80	0.40	0.60	0.80
r5	0.60	0.80	1.00	0.40	0.60	0.80
r6	0.40	0.60	0.80	0.40	0.60	0.80
r7	0.60	0.80	100	0.40	0.60	0.80
r8	0.40	0.60	0.80	0.60	0.80	1.00
r9	0.40	0.60	0.80	0.40	0.60	0.80
r10	0.40	0.60	0.80	0.60	0.80	1.00
r11	0.60	0.80	1.00	0.60	0.80	1.00
r12	0.60	0.80	1.00	0.60	0.80	1.00
r13	0.60	0.80	1.00	0.60	0.80	1.00
r14	0.60	0.80	1.00	0.60	0.80	1.00
r15	0.40	0.60	0.80	0.20	0.40	0.60
r16	0.40	0.60	0.80	0.40	0.60	0.80
r17	0.20	0.40	0.60	0.20	0.40	0.60
r18	0.40	0.60	0.80	0.20	0.40	0.60
r19	0.40	0.60	0.80	0.40	0.60	0.80
r20	0.40	0.60	0.80	0.60	0.80	1.00
Average	0.45	0.65	0.85	0.44	0.64	0.84
Fuzzy Score (A)		**0.65**			**0.64**	

The calculation of defuzzification was used to identify which questionnaire items were agreed upon in evaluating the personalised m-learning curriculum implementation model. The procedure to analyse the findings of this evaluation phase is shown in Figure 3.9 below.

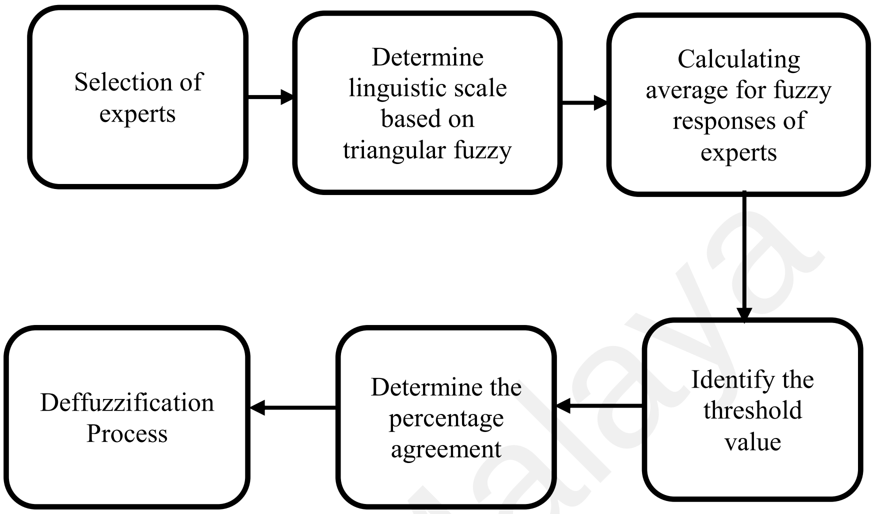

Figure 3.9 Flowchart of Fuzzy Delphi Method Procedure

3.6.7 Analysis of Data

The data collected from Part 1 of the survey questionnaire were analysed using descriptive statistics via the Statistical Package for Social Sciences (SPSS) software version 25.0. The study proposed the analysis of frequency and percentage for this phase to investigate the experts' background information of their expertise that were relevant to the study. Data collected from Part 2 of the survey questionnaire were analysed using FDM from step 2 to 6 as discussed in the data collection procedure section for Phase III. The data were later analysed using Microsoft Excel.

3.7 Design and Development Research Matrix

This section summarizes the overall DDR approach. The research design matrix summarizes every phase, method and technique used to answer the research questions and the number of respondents involved. The development of this matrix is intended to facilitate the researcher and to give the overall picture of this research to see the details of each work being carried out. Table 3.11 shows the research design matrix in the development process of the personalised m-learning curriculum implementation model.

Table 3.11
Design and Development Research Matrix

	Needs Analysis Phase		
	Research Questions	**Method / Technique**	**Respondent**
1.1	What are the mobile devices that the students carries and capabilities of these devices?	Needs analysis survey questionnaire	50 students
1.2	What are the students' perceptions on their current ways of teaching and learning setup for Food and Beverage Service course?		
1.3	What are the students' perceptions on implementing personalised m-learning to support the teaching and learning of Food and Beverage Service course?		
1.4	What are the students' level of acceptance and intention to use personalised m-learning if incorporated into the formal Food and Beverage Service course?		

	Development Phase		
	Research Questions	**Method / Technique**	**Respondent**
2.1	What are the experts' collective views on personalised m-learning elements which should be included in the development of personalised m-learning curriculum implementation model?	Nominal Group Technique (NGT)	8 experts involved in both NGT and ISM sessions.
2.2	Based on the experts' collective views, what are the relationships among the personalised m-learning elements in the development of the personalised m-learning curriculum implementation model?	Interpretive Structural Modeling (ISM)	
2.3	Based on the experts' collective views, how should the personalised m-learning elements be classified in the interpretation of the personalised m-learning curriculum implementation model?		

Table 3.11 (Continued)

Evaluation Phase			
	Research Questions	**Method / Technique**	**Respondent**
3.1	What is the experts' agreement on the suitability of the personalised m-learning elements (learning preferences) proposed in the personalised m-learning curriculum implementation model?	Fuzzy Delphi Method (FDM)	25 experts involved
3.2	What is the experts' agreement on the classification of the personalised m-learning elements based on the three domains (Device Adaptation elements, Learner Adaptation elements, and Situated Adaptation elements) as proposed in implementing personalised m-learning curriculum implementation model?		
3.3	What is the experts' agreement on the list of personalised m-learning elements in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in implementing personalised m-learning curriculum implementation model?		
3.4	What is the experts' agreement on the relationship among the personalised m-learning elements as proposed in implementing personalised m-learning curriculum implementation model?		
3.5	What is the experts' agreement on the suitability of the personalised m-learning curriculum implementation model in the teaching and learning of Food and Beverage Service course in the hospitality programme?		

3.8 Conclusion

The design and development research approach was the main methodology used in this study to develop the personalised m-learning curriculum implementation model for hospitality programme. This approach divided the study into three phases: the needs analysis phase to seek the need to develop the personalised m-learning curriculum implementation model; the design and development of the implementation model; and the evaluation of the model. This chapter elaborates on the research methodology of each phase according to research design, population and sampling, instruments, data collection procedures, data analysis and flowchart of the procedures involved.

The need analysis phase was conducted using needs analysis survey questionnaire on diploma students. This was done to seek the needs to develop personalised m-learning as a support to their traditional classroom learning in their Food and Beverage course in hospitality programme. Besides probing into their personalised m-learning needs, their acceptance towards personalised m-learning also measured using this survey questionnaire. To do this, the survey questionnaire was guided by Unified Theory of Acceptance and Use of Technology (UTAUT) theory of technology acceptance. Analysis of data was conducted using descriptive statistics via SPSS software.

The second phase of the development of the personalised m-learning curriculum implementation model was conducted in three stages. In stage one, elements for the model was identified by experts' view using nominal group technique (NGT). This was followed by the development of the model in stage two by panel of experts using Interpretive Structural Modeling (ISM) method and Concept Star software. In the final stage, refining the model for analysis and interpretation of the model was done. Then, in the third phase, the outcome of the previous phase i.e. the personalised m-learning implementation model was evaluated by a panel of experts using the modified Fuzzy Delphi Method (FDM), a powerful decision making tool. The instrument used in this phase was an evaluation survey questionnaire, based on a five-point Linguistic scale. The data collected from this phase was analysed using descriptive statistics and Fuzzy Delphi technique.

The finding of all the phases will be presented and discussed in different chapters. In Chapter 4, finding of phase 1, which is the need analysis phase, will be discussed. This will be followed by Chapter 5, the design and development of the model in which the finding of phase 2 will be discussed. In Chapter 6, the finding of phase 3 which is the evaluation of the model will be discussed. Finally, in Chapter 7, the discussion of findings, implications and recommendations will be presented and discussed. Each chapters will elaborate according to the procedures of research involved in all stages.

CHAPTER 4

FINDINGS OF PHASE 1: NEEDS ANALYSIS

4.1 Introduction

The aim of this Phase 1 of the study was to identify the need to develop personalised m-learning curriculum implementation model for diploma students in hospitality programme enrolled for Food and Beverage Service course. This survey was based on students' view and level of acceptance and intention to use personalised m-learning to support formal classroom education. Thus, the findings in this phase are presented according to the research questions as follows:

1. What are the mobile devices that the students carries and capabilities of these devices?
2. What are the students' perceptions on their current ways of teaching and learning setup for Food and Beverage Service course?
3. What are the students' perceptions on implementing personalised m-learning to support the teaching and learning of Food and Beverage Service course?
4. What are the students' level of acceptance and intention to use personalised m-learning if incorporated into the formal Food and Beverage Service course?

4.2 Finding of the Needs Analysis

The discussion of the findings in this chapter is divided into five (5) parts. The first part (Part A) will present data analysis associated with respondents' demographics. The second part (Part B) will report the finding on the mobile device usage by the respondents. In Part C, the data analysis are performed from the finding of the students' perception on the current teaching and learning setup. The finding from Part D, the students' perceptions on implementing personalised m-learning in teaching and learning of Food and Beverage Service course will be discussed. The final part, Part E, the finding from Students' acceptance and use experience of personalised m-learning will be discussed. The findings comprised of data with descriptive statistics through the analysis of mean, standard deviation, percentage, and frequency to determine the needs to develop the personalised m-learning curriculum implementation model based on the students' view. Thus, the presentation of the findings are as the following sections.

4.2.1 Part A: Background of Participants

The main objective of the first phase of the methodology was to establish the need for a personalised m-learning among diploma students in hospitality programme. In order to collect the students' view on the need of the personalised m-learning, a need analysis survey questionnaire distributed among diploma students from hospitality programme at private higher education institution. The findings comprised of data with descriptive statistics through the analysis of mean, standard deviation, percentage, and frequency to determine the needs to develop the personalised m-learning curriculum implementation model based on the students' view. The need analysis survey questionnaire was distributed to a specific group of 50 students enrolled in Food and Beverage course. The sample consisted of 35 female and 15 male students. The findings on the background of the respondents are summarized as shown in the table 4.1.

Table 4.1
Participants' Demography

Item		Frequency	Percentage
Gender	Male	15	30
	Female	35	70
Age	From 18 – 20	50	100
	From 21 – 22	0	0
	Older the 22	0	0
CGPA	3.67 – 4.00 (1st Class)	6	12
	3.00 – 3.66 (2nd Upper)	32	64
	2.67 – 2.99 (2nd Lower)	10	20
	2.00 – 2.66 (3rd Class)	2	4
	Below 2.00 (Fail)	0	0
The mobile device capabilities	Basic (Voice call & SMS)	0	0
	Intermediate (Basic + limited Internet browsing)	42	84
	Advance (Basic + unlimited Internet Browsing)	8	16

Table 4.1 shows the demographics of survey respondents, comprising a total of 50 students with 35 (70%) of the respondents were female and the male respondents only comprises 15 respondents (30%). All the respondents were from same age group from 18 to 20 years old. In term of their result, majority of the respondents were in second class upper category (64%). There are 6 respondents (12%) from first class category while only 2 respondents (4%) are from third class category. No respondent in the fail category bracket and the remaining 10 respondents (20%) are from second class lower category. In terms with respondents' mobile device capability, there were no respondents with basic capability which permits basic voice call and SMS. Majority of the respondents, 84% were with intermediate capability where they can make basic voice call and SMS with limited Internet browsing capability. The limited Internet browsing capability was due to their data plan subscription where there are only given

certain amount of Gigabytes (GB) data to be used in a week or month (based on their plan). In terms of type of mobile device used by the respondents, there are 16 respondents (32%) having more than one device and all of the owned a smart phone. This means that all of the respondents owned a device which capable to do functions such as voice calls, SMS, sending and receiving emails, Internet browsing, camera and video recording and streaming, MMS, video calls, and preloaded software that could readily accommodate m-learning. Access to Internet became a must if you are students and besides using mobile devices for communication and collaboration, it's also important to access online content related to their studies. This survey indicates that all of the respondents' mobile device are capable to access Internet via WLAN WIFI. Thus, wherever WIFI connection is available, students are able to connect to Internet whether it's at their campus, home, hostel, and restaurant and even inside a moving bus. While there are 8 respondents (16%) who have unlimited Internet access through their data plan, the majority of them (84%) are using limited data plan due to cost concern.

4.2.2 Part B: Participants Mobile Device Usage

The following findings reported on the mobile device usage by the students. This was to investigate time spend by the students on their mobile devices, types of activities performed using their mobile devices and time spend away from campus or on the move. The findings on the respondents' mobile device usage are summarized as shown in the table 4.2.

Table 4.2
Participants' Mobile Device Usage

Items		Frequency	Percentage
Time spend on the move (weekly)	< 1 hour	0	0
	1 – 2 hours	0	0
	2 – 3 hours	9	18
	3 – 4 hours	15	30
	> 4 hours	26	52
Mode of transport	Car	5	10
	Bus	24	48
	Taxi	0	0
	Train	12	24
	Bike	6	12
	Walking	3	6
Average time spend on mobile devices in a day	< 30 minutes	0	0
	30 minutes – 1 hour	0	0
	1 – 2 hours	9	18
	2 – 3 hours	33	66
	> 3 hours	8	16
Any specific time preference to use the mobile devices	No specific time	22	44
	Mornings	3	6
	Afternoons	10	20
	Evenings	15	30
	Weekends	0	0
Place where mobile device usage is most often	At home	12	24
	On campus	20	40
	Travelling	18	36
	TV time	0	0

Table 4.2 shows students' mobile device usage pattern. Based on this table, 52% or 26 respondents spend more than 4 hours weekly for travelling. This is justifiable since 24 respondents (48%) are using bus as their mode of transport. Relaying on bus to ferry them around normally takes more time than using own vehicle such as car (10%) and bike (12%). Thirty percent of the respondents spending 3 to 4

hours weekly on the move and balance 9 respondents (18%) spend 2 to 3 hours travelling. Besides bus, train was the second highest in terms of public transport usage by the respondents. There were 12 respondents (24%) use train as their most often used mode of transport. Only 6% of the respondents used to walk to move around. In terms of average time spend in a day on mobile device, 33 respondents (66%) selected that they spend average 2 to 3 hours each day on their mobile device. This is followed by 9 respondents (18%) spend an average of one to two hours daily and 8 respondents (16%) of participant spend more than 3 hours daily. Since the students are carrying their mobile device almost all the time, they do not have a specific time as preference to use their device. There are 22 respondents (44%) who do not have any specific time preference to use their mobile device. This followed by 15 respondents (30%) prefer to use in the evening and 10 respondents (20%) prefer afternoon as their preferred time to use their mobile device. There were only 3 respondents (6%) prefer to use in the morning and no respondent selected weekend as preferred time to use their mobile device. The selected students most often use their mobile device while there are at campus, where 20 respondents (40%) selected this option. This followed by 36% of the participants use their device while travelling and remaining 12 students (24%) often use their device at home.

The following table (Table 4.3) is the continuation from participants' mobile device usage (Table 4.2). In terms of types of activities students performed on their mobile device, the respondents selected combination of most of activities listed in the questionnaire except for banking. No respondent selected banking online as one of their activity performed on their mobile device. While all of the respondent use their device to perform calls, Internet browsing, photo sharing, music listening, music download, video download, video watching and Facebook. This followed by playing games where 46 respondents (92%) would like to play games on their mobile device. As for the use of mobile device for everyday study purposes, all of the respondent involved at least in one of the activity related to studying.

Table 4.3
Participants' Mobile Device Usage (types of activities)

Items		**Frequency**	**Percentage**
Activity performed on mobile device	Call	50	100
	SMS	32	64
	Email	10	20
	Internet browsing	50	100
	Photo sharing	50	100
	Music listening	50	100
	Music download	50	100
	Music sharing	36	72
	Video download	50	100
	Video watching	50	100
	Podcast download	26	52
	Podcast watching	26	52
	Facebook	50	100
	Twitter	24	48
	Mobile education	18	36
	Study notes	14	28
	Research	5	10
	Games	46	92
	Banking	0	0
Use of mobile device for everyday study purpose	During lessons	5	10
	Between lessons	23	46
	Outside class hours	31	62
	For independent studying	18	36
	For group work	34	68
	For peer discussion	42	84
	I don't use my mobile device for studying purpose	0	0

4.2.3 Part C: Students' Perception on the current teaching and learning setup

The needs analysis investigation required to look at the current teaching and learning setup to find out whether the current setup was adequate to fulfil the students' learning needs and fulfil the learning outcome of the course. These findings justified that there is a need to make changes to the existing teaching and learning method. Thus, the following findings are discussed based on the objectives of the study. The following table (Table 4.4) is to elicit the students' perception on the current ways of teaching and learning setup.

Table 4.4
Students' perception on teaching and learning setup

Items	Descriptions	Mean	SD	Interpretation
1	Four (4) hours per week in one semester is ENOUGH for me to acquire the learning outcomes of F&B Service course	2.42	.642	Moderate
2	Two (2) hours per week in one semester is ENOUGH for me to acquire the theory part of F&B Service course	2.26	.633	Moderate
3	Two (2) hours per week in one semester is ENOUGH for me to acquire the practical part of F&B Service course	2.18	.629	Moderate
4	I am able to recall the theory and practical knowledge that I obtained in face-to-face sessions	2.48	.707	Moderate
5	The theory and practical face-to-face classroom sessions are NOT ENOUGH for me to obtain the knowledge required for this course	3.88	.558	High
6	Students who have the practical experience will perform better in this course	3.98	.553	High
7	At the end of the course, I end up emphasising more in the grade obtain rather than the practical skills that need to acquired	2.24	.591	Moderate

Note: SD = Standard Deviation

Table 4.4 discusses the students' perception on the current ways of teaching and learning. The finding shows that the respondents perceived that the current face-to-face session for theory and practical part of the course are not enough to obtain the knowledge required to master this course. This is evidenced by a mean value of 3.88 (SD = .558). The respondents also agreed that students with practical experience will perform better in this course which reflected in the mean value of 3.98 (SD = 0.553). The result in the above table also reflected that the respondents were disagree in term of duration of the course. The respondents are disagree that the four hours per week allocated for this course was enough for them to acquire the targeted learning outcomes and this is reflected by the mean value of 2.42 (SD = .642). The respondents also disagree that the two hours per week class for each theory and practical session was enough to acquire the theory and practical part of the course and this is evidenced by a mean value of 2.26 (SD = .633) and mean value of 2.18 (SD = .629) respectively. Since this course required the respondents to acquire practical skills which is useful during their internship period, the respondents disagree that they emphases more in the grade obtained rather than the practical skills. This is evidenced by the mean value of 2.24 (SD = .591).

The overall finding indicated that the majority of the respondents disagree on the amount of time spend in their face-to-face session for theory and practical part of the course. The respondents believed that lack of time spend on this course, could affect their success to meet the course outcomes. Thus, in order for the respondents to improve their knowledge acquired in this course, the need to support the learning course should be considered. Thus, the personalised m-learning intervention was proposed to aid the students to fulfil the course outcomes while assisting their learning needs.

4.2.4 Part D: Students' perceptions on implementing personalised m-learning in teaching and learning of Food and Beverage Service course

This part is to investigate the students' perceptions on implementing personalised m-learning in teaching and learning. The findings are shown in Table 4.5.

Table 4.5
Students' perception on implementing personalised m-learning in teaching and learning

Items	Descriptions	Mean	SD	Interpretation
1	I believe that my mobile device could support my learning in this course.	3.98	.515	High
2	I believe that learning with mobile device motivate me to achieve better study outcomes.	4.10	.463	High
3	I think that using my mobile device for learning would be frustrating.	2.00	.452	Moderate
4	I agree that having course materials such as slides, lecture notes and practice quizzes available on my mobile device would be beneficial to my study process.	3.96	.450	High
5	I would invest my personal time learning to use and install software that could make these resources available on my mobile device.	3.68	.551	High
6	I am willing to purchase a new mobile device if I think it would improve my performance in this course.	1.88	.328	Moderate
7	I feel that the use of some kind of m-learning software would improve overall success in my course.	3.78	.418	High
8	I would like to be able to exert control on the learning materials.	4.38	.490	High
9	I agree that if the learning materials presented in a way that I wanted, it will keep my attention focused.	4.30	.463	High
10	I agree that when a physical environment is noted but it does not hinder the lesson experience.	3.98	.428	High
11	I agree that the lessons is followed where noise and audible interference is experienced.	3.16	.866	High

Note: SD = Standard Deviation

Based on the outcomes of the needs analysis phase, personalised m-learning was proposed as a solution. In this part, the study investigate the students' use of personalised m-learning as access to technology is an important criteria in technology based education (Jones, Valdez, Nowakowski, & Rasmussen, 1995; Quinn, 2011). Table 4.5 discussed students' perceptions on implementing personalised m-learning to support the teaching and learning of Food and Beverage Service. Based on the respondents' view, they wanted to have control on the learning material presented to them. It was reflected by the highest mean value of 4.38 (SD = .490) in this part of the questionnaire. In order to keep the students' attention focused, the respondents preferred learning materials presented in a way that they wanted. This is evidenced by the mean value of 4.30 (SD = 0.463). Personalised m-learning could be a solution to the problem they faced since majority of the respondents believe that learning with mobile device could motivate them to achieve better study outcomes. This is reflected by the mean value of 4.10 (SD = 0.463). Evidenced by the mean value of 3.98 (SD = .515), the respondents believe that their mobile device could support the learning in this course. Respondents also agreed that when a physical environment is noted, it does not hinder them from learning. It was reflected by the mean value of 3.98 (SD = .428). Since the respondents spend quite a number of hours in travelling per week (Table 4.2), environmental interference such as noise, play an important role in influencing the learning process when the respondents are on the move. This is also reflected in item number 11 with mean value 3.16 (SD = .866). The respondents also agreed to have their learning materials made available on their mobile device to benefit their study process. In order to improve overall success of this course, respondents are willing to invest their personal time to learn and use some kind of m-learning software. This was reflected in item number 5 and 7 by the mean value of 3.68 (SD = .551) and 3.78 (SD = .418) respectively. Majority of respondents disagree that using mobile device for learning would be frustrating and this is evidenced by the value 2.00 (SD =

.452). Since all the respondents are students, they are not willing to spend to purchase a new mobile device just to use for learning purpose. In other word, the respondents want the learning materials suites their existing mobile device. This can be performed through adaptation and/or transformation of the learning materials.

4.2.5 Part E: Students' Acceptance and user experience of personalised m-learning

The main objective of this part of questionnaire is to access the students' acceptance and intention on the implementation of personalised m-learning into their curriculum. As discussed in Chapter 3, Items discussed in part of survey questionnaire are based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model proposed by Venkatesh et al. (2003). The major construct in this UTAUT theory are performance expectancy, effort expectance, social influence, and facilitating conditions. Based on these key constructs, the needs analysis questionnaire items were divided into eight expectancies: 1) performance expectancy; 2) effort expectance; 3) attitude towards using technology for learning; 4) social influence; 5) facilitating conditions; 6) self-efficacy; 7) behavioural intention to use personalised m-learning; and 8) anxiety. The finding revealed the students' acceptance, readiness, and intent to use this personalised m-learning as support to formal classroom learning.

4.2.5.1 Performance expectancy

Performance expectancy indicates the effectiveness of personalised m-learning to support the learning of Food and Beverage Service course. Table 4.6 shows the result of the students' expectancy on performance of personalised m-learning.

Table 4.6
Students' Acceptance and user experience of personalised m-learning (Performance expectancy)

Items	Descriptions	Mean	SD	Interpretation
1	I would find that personalised m-learning is useful for my Food and Beverage Service course.	3.94	.373	High
2	Using personalised m-learning would help me to accomplish my learning tasks more quickly.	3.98	.428	High
3	Using personalised m-learning would further improve my learning process and increase my productivity.	4.26	.443	High
4	Personalised m-learning would increase my chance to get better grades for my course.	4.04	.450	High

Note: SD = Standard Deviation

Based on the finding as in the above table shows a high rate of performance expectancy for all the items with the highest mean value of 4.26 (SD = .443) where respondents agreed or strongly agreed that personalised m-learning would further improve the participants' learning process and increase their productivity. The findings also revealed high mean value of 4.04 (SD = .450) which proved that the respondents perceived using personalised m-learning in their Food and Beverage course would increase their chances to get better grades as personalised m-learning offers more opportunity for them to access their personalised m-learning materials. The respondents also show a positive perception that using personalised m-learning would help them accomplish their tasks more quickly as showed in the evidence with the high mean value of 3.98 (SD = .428). The finding also shows that personalised m-learning would be useful for their course with the mean value of 3.94 (SD = .373).

4.2.5.2 Effort expectancy

This factor measures the degree to which a person perceives the system will be easy to use (Kijsanayotin, Pannarunothai, & Speedie, 2009). As for this study, it measures how easy the interaction to access personalised m-learning materials and how easy to be skilful in using personalised m-learning. Table 4.7 shows the result of the students' effort expectancy of personalised m-learning.

Table 4.7
Students' Acceptance and user experience of personalised m-learning (Effort expectancy)

Items	Descriptions	Mean	SD	Interpretation
1	My interaction to access learning materials through personalised m-learning would be clear and understandable.	3.82	.596	High
2	It would be an easy task for me to be skilful in using personalised m-learning.	3.96	.533	High
3	I would find personalised m-learning easy to use.	4.06	.424	High

Note: SD = Standard Deviation

Table 4.7 revealed the finding of effort expectancy as the degree of ease in using the proposed personalised m-learning. In this aspect, majority of respondents with the mean value of 4.06 (SD = .424) agreed or strongly agreed that personalised m-learning is easy to be use. This is supported by item number 2 which indicates that they are positive to become skilful at using personalised m-learning with mean value of 3.96 (SD = .533). In terms of students' interaction to access personalised m-learning materials, the findings show that the students perceived the interaction would be clear and understandable. This is evidenced with mean value of 3.82 (SD = .596). Thus, these findings revealed that it is an easy task to use, to be skilful and access the personalised m-learning materials.

4.2.5.3 Attitude towards using technology for learning

A person's attitudes are the driving force for the adoption of the technology (Straub, 2009). It is a belief that a positive attitude towards the technology make them easy to use and become useful to that person (Saadé, & Kira, 2007). Thus, this questionnaire measures how comfortable is the learner in using this personalised m-learning, whether the learning is exiting and fun, and it's a good idea to use personalised m-learning to learning this course.

Table 4.8
Students' Acceptance and user experience of personalised m-learning (Attitude towards using technology for learning)

Items	Descriptions	Mean	SD	Interpretation
1	I am not comfortable learning with personalised m-learning.	2.18	.388	Moderate
2	I find learning through personalised m-learning is exciting.	4.02	.515	High
3	It would be fun learning with personalised m-learning	4.00	.452	High
4	Using personalised m-learning would be a very good idea.	3.92	.444	High

Note: SD = Standard Deviation

Table 4.8 revealed that the respondents' attitude towards using personalised m-learning to learn the course. The results indicate that the respondents were positive in their attitude towards using personalised m-learning. This is evidenced by the mean value of 4.02 (SD = .515) for item number 2 where the respondents find learning through personalised m-learning is exciting. The respondents also positive that learning would be fun with personalised m-learning with mean value of 4.00 (SD = .452) and it is a good idea to use personalised m-learning to learn the Food and Beverage course. This is reflected by the mean value of 3.92 (SD = .444). The majority of the respondents are disagree that it not comfortable learning through personalised m-learning. It scored the mean value of 2.18 (SD = .388). The main objective of these questions were to find out whether use of personalised m-learning would be exciting, fun and very good idea to implement compare to the traditional classroom learning.

4.2.5.4 Social influence

Social influences measures the degree to which a person perceives that important others believe he or she should use the new system (Venkatesh et al., 2003).

This questionnaire measures who influence the behaviour of the learner in using the personalised m-learning (Table 4.9). In other words, the students' decision to use personalised m-learning was being influenced by the parties that are important to them.

Table 4.9
Students' Acceptance and user experience of personalised m-learning (Social Influence)

Items	Descriptions	Mean	SD	Interpretation
1	My friends and family think that I should use personalised m-learning.	3.32	.551	Moderate
2	My classmate think that I should use personalised m-learning.	3.30	.647	Moderate
3	My lecturer has convinced me to use personalised m-learning.	4.08	.444	High
4	My institute has supported the use of personalised m-learning.	4.12	.480	High

Note: SD = Standard Deviation

In this aspect, the overall results show that people who have a critical influence on students have a significant impact on their motivation in deciding whether to use the personalised m-learning. The students perceived that people have influence on their behaviour and people that are important to them thought that they should use personalised m-learning to support their formal teaching. These are evidenced by the high mean value of 4.12 (SD = .480) and 4.08 (SD = .444) where institution and lecturer respectively play an important role in convincing the respondents to use the personalised m-learning. In this case, institution with good support system to guide the respondents would be able to attract and convince them to use the personalised m-learning in their teaching and learning process. This is followed by the lecturer who could persuade the respondents to use the personalised m-learning for the subject being taught. Friends and family members, and classmates also play an important role in convincing the respondents to use the personalised m-learning. Both score mean value of 3.32 (SD = .551) and 3.30 (SD = .647) respectively.

4.2.5.5 Facilitating conditions

Facilitating conditions on the other hand are used to measures the degree to which a person perceives that the technical and organisational infrastructure are available to support their use of the system (Williams, 2009). In this survey questionnaire, it measures the learners' know-how and necessary device to use the personalised m-learning and available support if they face difficulty.

Table 4.10
Students' Acceptance and user experience of personalised m-learning (Facilitating Conditions)

Items	Descriptions	Mean	SD	Interpretation
1	I have the necessary device to use personalised m-learning.	4.22	.507	High
2	I have the know-how to use the personalised m-learning.	4.10	.544	High
3	I have specific person to assist and support with my personalised m-learning difficulties.	3.78	.507	High

Note: SD = Standard Deviation

Table 4.10 shows the data analysis of the extent to which students believe that they have the know-how; and the technical and organisational infrastructure exists to support the use of personalised m-learning. In this aspect, the overall findings revealed that a positive decision on the perception of respondents on organisational and technical support on the use of personalised m-learning. For instance, Table 4.10 reflected that majority of the respondents with mean value of 4.22 (SD = .507) either agreed or strongly agreed that they have the necessary device to aid them in using personalised m-learning. They also feel that they have the know-how to use the personalised m-learning. This is evidenced by the mean value of 4.10 (SD = .544). Alternatively, the majority of the respondents with mean value of 3.78 (SD =.507) were confident that they have specific person to assist them when they face difficulties while using the personalised m-learning.

4.2.5.6 Self-efficacy

Self-efficacy deals with the students' confident and ability to use personalised m-learning and how their decision influenced by others. This is one of the most important aspects in determining their readiness to use personalised m-learning.

Table 4.11
Students' Acceptance and user experience of personalised m-learning (Self-efficacy)

I would complete learning through personalised m-learning:

Items	Descriptions	Mean	SD	Interpretation
1	If there is no one around to tell me what to do.	3.84	.370	High
2	If someone had helped me get started.	3.18	.661	Moderate
3	If I have a lot of time to complete and resources provided	2.52	.580	Moderate
4	If I have the built-in help facility for assistance	3.82	.388	High

Note: SD = Standard Deviation

The survey findings indicate that majority of the respondents perceived that they can use personalised m-learning without assistance. This is evidenced by the high mean value of 3.84 (SD = .370). However, the respondents also need help to cope with personalised m-learning as they were certain to use personalised m-learning provided they have assistance when they got stuck (mean = 3.18, SD = .661). Finding from the Table 4.11 also indicated that they would complete learning through personalised m-learning if there was a built in aid facility for assistance to complete their learning tasks. However, not many agreed that they could complete their learning task through personalised m-learning provided they had enough time and resources as indicated in the table with mean value of 2.52 (.580).

4.2.5.7 Behavioural intention to use personalised m-learning

Behavioural intention deal with students' eagerness and intention to use the personalised m-learning. In this survey questionnaire, it measures how soon the student want to use this personalised m-learning.

Table 4.12
Students' Acceptance and user experience of personalised m-learning (Behavioural intention to use personalised m-learning)

Items	Descriptions	Mean	SD	Interpretation
1	I intend to use personalised m-learning for this course immediately.	4.08	.444	High
2	I plan to use personalised m-learning for this course next month.	3.88	.328	High
3	I might use personalised m-learning for this course next month.	3.86	.351	High

Note: SD = Standard Deviation

Probing into this aspect, Table 4.12 indicated that majority of the respondents had the intention to use the personalised m-learning for this course immediately. This is evidenced by the high mean value of 4.08 (SD = .444). The results indicate that the respondents had the intention to use personalised m-learning in this course the soonest possible. It is evidenced by the mean value of 3.88 (SD = .328). In addition, the respondents also have high intention to use personalised m-learning for their course next month. This was reflected in the above table with the mean value of 3.86 (SD = .351). Thus, the overall findings for this aspect revealed that the respondents were significantly eager and intended to use personalised m-learning in the near future.

4.2.5.8 Anxiety

Anxiety refers to students' concerns about the uncertainty of what is expected of them in using personalised m-learning. It's refers to an emotional response usually resulting from a fear that using the personalised m-learning may have a negative outcome. In this study, it measures the learners' response on how the personalised m-learning can be seen as threatening and intimidating the learner.

Table 4.13
Students' Acceptance and user experience of personalised m-learning (Anxiety)

Items	Descriptions	Mean	SD	Interpretation
1	I feel uneasy using personalised m-learning for this course.	2.16	.370	Moderate
2	I am afraid I could lose lots of information by selecting my preferences.	2.64	.827	Moderate
3	Using personalised m-learning is somewhat intimidating to me.	2.18	.388	Moderate

Note: SD = Standard Deviation

The Table 4.13 indicated that the respondents are not afraid of facing the risk of using personalised m-learning such as the loss of important information when they selecting their preferences. This is evidenced by the moderate mean value of 2.64 (SD = .827). Furthermore, they were not feel intimidating of using personalised m-learning as evidenced of the mean value of 2.18 (SD = .388). The survey findings also revealed that the respondents were not apprehensive about using personalised m-learning for their courses. This is reflected in the mean value of 2.16 (SD = .370). Thus, the overall findings revealed that the respondents were slightly concerns about their uncertainty to use personalised m-learning in their courses.

4.3 Conclusion

This chapter has reported the findings of the needs analysis phase, which is the first phase of a three-phase methodology adopted for the development of the personalised m-learning curriculum implementation model. This chapter has discussed the mobile device usage by the students which indicates that the students spend quite number of hours on mobile device on daily basis. The survey also reported that majority of the students spend more than 4 hours weekly on travelling (on the move). It also presented types of activities that the students performed on their mobile devices including educational related activities. Based on the research questions of the study, the findings have revealed that the students' perception on their current ways of teaching and learning setup for Food and Beverage course. The students are interested to explore new way of learning since the current setup of teaching and learning not able to fulfil their learning needs. This can be seen in the result of Part C of the questionnaire (Table 4.4). Hence, the study presented the findings of the proposed personalised m-learning to support the teaching and learning of the course.

This chapter also reported on the students' mobile device capabilities especially access to Internet since there are many learning materials are available online. This was done to investigate the students' learning needs in terms of access to mobile technology infrastructure to facilitate the personalised m-learning environment. The final part of the findings revealed the students' acceptance and expectation of the personalised m-learning incorporated into their course to support the traditional classroom teaching. Based on the findings, the students highly accepted personalised m-learning as intervention in facilitation their learning needs and they intended to use it for the betterment of the study. Hence, the overall findings of this Phase 1 revealed that personalised m-learning is feasible to be incorporated in the formal learning as the mobile devices and technology are readily accessible by students. Furthermore, the positive response from the students on the acceptance and intention to use personalised m-learning in their formal course justify the need to develop the interpretive structural modeling for this course. The following chapter discusses the findings for the development of the model.

CHAPTER 5

FINDINGS OF PHASE 2: DESIGN AND DEVELOPMENT OF THE MODEL

5.1 Introduction

This chapter reports on the results of the second phase of the study which is the design and development of the model. This phase is the most crucial part of the three phase methodology where the personalised m-learning curriculum implementation model was developed. The model was developed according to the findings of the needs analysis survey conducted on selected students. This model was developed since there was a need to support the students learning their Food and Beverage course. The findings revealed that the students highly anticipate proposed personalised m-learning to be incorporated in the formal classroom learning of this course. The study focuses on developing a personalised m-learning implementation model for learning support based on the list of elements that support personalised m-learning. This model was developed based on the integrated views and opinions of panel of experts. The idea of this model is to support students to achieve their learning outcomes by developing the personalised m-learning curriculum implementation model which gives anytime, anywhere and any device learning based on the learners' preferences. The panel of experts' tasks were to identify the personalised m-learning elements and the relationship among these elements in order to fulfil the learning outcomes of the learners.

Thus, the findings in this phase are presented to achieve the following research objectives:

1. What are the experts' collective views on learning preferences which should be included in the development of personalised m-learning curriculum implementation model?
2. What are the experts' collective views on categorising mobile devices based on its capabilities?
3. Based on the experts' collective views, how should the learning content to be delivered (based on students' preferences and mobile device capabilities) in the implementation of personalised m-learning curriculum implementation model?

5.2 Findings of the Development Phase

The second phase in DDR approach focus on the development of personalised m-learning curriculum implementation model for Food and Beverage Service course. The following sections explained in detail the process and the procedures involve in this phase.

5.2.1 Findings from Step 1: Identifying the elements that are relevant to the problem or issues

The findings of this phase are discussed according to the research objectives which constitutes of experts' collective views on learning preferences which should be included in the development of personalised m-learning curriculum implementation model. In this design and development phase, two instruments have been used to determined elements for learning preferences. First, a draft or pre-listed personalised m-learning elements generated from literature review and then used in the NGT session. The result of the findings from this NGT session determined the personalised m-learning elements that should be included in the model. At the end of NGT session, the experts proposed the final list of personalised m-learning elements that they have agreed upon. The final list contain 31 personalised m-learning elements which experts consensually agreed. The ranking and prioritization of the elements is one of the important procedures that must conducted before the ISM session. Table 5.1 shows the ranking and prioritization of the personalised m-learning elements based on the experts' individual voting decision. The voting session was not to eliminate any elements at the final stage of NGT since all the experts had already decided on this final list. The purpose was to rank the degree of the experts' individual preference on the scale of 1 to 7 as the following:

1 = Least favourable 2 = Slightly favourable

3 = Moderately favourable 4 = Favourable

5 = Very favourable 6 = Highly favourable

7 = Most favourable

Table 5.1

Finding of NGT: Ranking and prioritization of personalised m-learning elements

	Personalised m-learning elements	**E1**	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**	**E8**	**Total**	**Priority**
1	Listening to mobile audio at own space	6	6	6	6	5	6	6	6	47	5
2	Listening to mobile audio in noisy environment with headset	5	5	6	6	5	5	5	5	42	9
3	Listening to mobile audio in unlimited connectivity	4	4	4	4	3	4	4	4	31	17
4	Listening to mobile audio just before examination	5	5	4	5	5	4	4	4	36	13
5	Listening to mobile audio via limited connectivity	3	4	3	3	3	3	3	3	25	21
6	Listening to mobile audio while on the move	7	7	7	7	7	6	6	7	54	1
7	Watching mobile video at own space	6	6	5	6	6	5	6	6	46	6
8	Watching mobile video in noisy environment with headset	5	5	5	5	6	5	5	4	40	10
9	Watching mobile video in unlimited connectivity	3	4	3	4	3	4	4	4	29	18
10	Watching mobile video just before examination	4	5	4	5	4	4	5	4	35	14
11	Watching mobile video via limited connectivity	3	3	3	3	3	3	3	3	24	22
12	Watching mobile video while on the move	7	6	7	6	7	7	6	6	52	2
13	Accessing mobile document in unlimited connectivity	4	3	4	3	4	3	4	3	28	19
14	Accessing mobile document via limited connectivity	3	2	3	3	3	3	3	3	23	23
15	Accessing mobile notes in unlimited connectivity	4	3	3	3	3	3	4	3	26	20
16	Accessing mobile notes via limited connectivity	3	3	3	2	3	2	3	3	22	24
17	Accessing mobile document in noisy environment	5	5	5	6	5	4	4	5	39	11
18	Accessing mobile notes in noisy environment	5	5	4	5	4	5	5	4	37	12

Table 5.1 (Continued)

	Personalised m-learning elements	E1	E2	E3	E4	E5	E6	E7	E8	Total	Priority
19	Accessing mobile document while on the move	7	6	7	6	6	6	6	6	50	3
20	Accessing mobile notes while on the move	6	6	7	6	6	6	6	6	49	4
21	Accessing mobile notes at own space	6	6	5	6	5	6	5	5	44	8
22	Accessing mobile document at own space	6	6	5	6	5	6	5	6	45	7
23	Accessing mobile document just before examination	5	4	4	4	4	5	4	4	34	15
24	Accessing mobile notes just before examination	4	4	4	5	4	3	4	4	32	16
25	Tracking learning progress to personalise the content accordingly	3	2	2	3	4	2	2	3	21	25
26	Automisation of content personalisation according to student's learning styles	3	2	2	3	2	2	3	2	19	26
27	Automization of content personalisation according to device's battery life	2	2	1	1	2	1	2	2	13	31
28	Automization of content personalisation according to device's display capacity	2	2	2	2	2	2	2	2	16	29
29	Automization of content personalisation according to device's storage capacity	2	2	2	2	2	1	2	1	14	30
30	Automization of content personalisation according to individual student's learning outcome	2	2	2	2	3	2	2	3	18	27
31	Automization of content personalisation according to student's emotional status/mood	2	2	2	3	2	2	2	2	17	28

Note: E = Expert

Table 5.1 listed the result of NGT activity based on 31 personalised m-learning elements that were agreed upon by the experts for the construction of the personalised m-learning curriculum implementation model. The table also shows the ranking numbers for each element given by the experts. The ranking numbers determined the priority value for the personalised m-learning elements. Based on the priority value calculated as shown in Table 5.1, the personalised m-learning elements were arranged as shown in Table 5.2.

Table 5.2
List of personalised m-learning elements based on ranking

Ranking	Personalised m-learning elements
1	Listening to mobile audio while on the move
2	Watching mobile video while on the move
3	Accessing mobile document while on the move
4	Accessing mobile notes while on the move
5	Listening to mobile audio at own space
6	Watching mobile video at own space
7	Accessing mobile document at own space
8	Accessing mobile notes at own space
9	Listening to mobile audio in noisy environment with headset
10	Watching mobile video in noisy environment with headset
11	Accessing mobile document in noisy environment
12	Accessing mobile notes in noisy environment
13	Listening to mobile audio just before examination
14	Watching mobile video just before examination
15	Accessing mobile document just before examination
16	Accessing mobile notes just before examination
17	Listening to mobile audio in unlimited connectivity
18	Watching mobile video in unlimited connectivity

Table 5.2 (Continued)

Ranking	Personalised m-learning elements
19	Accessing mobile document in unlimited connectivity
20	Accessing mobile notes in unlimited connectivity
21	Listening to mobile audio via limited connectivity
22	Watching mobile video via limited connectivity
23	Accessing mobile document via limited connectivity
24	Accessing mobile notes via limited connectivity
25	Tracking learning progress to personalise the content accordingly
26	Automisation of content personalisation according to student's learning styles
27	Automisation of content personalisation according to individual student's learning outcome
28	Automisation of content personalisation according to student's emotional status/mood
29	Automisation of content personalisation according to device's display capacity
30	Automisation of content personalisation according to device's storage capacity
31	Automisation of content personalisation according to device's battery life

Next is the ISM session where the above personalised m-learning elements inserted in the ISM computer software (Concept Star) according to the above priority list. As per the list, 'Listening to mobile audio while on the move' was in the top of the list whereas 'Automisation of content personalisation according to device's battery life' were found to be at the bottom of the list. According to Janes (1988), the most important element should lead the pairing with other elements during the ISM session. Thus, the priority list was generated during the NGT session.

The list of personalised m-learning elements and the elaborations of each elements suggested by experts are as follows:

1. Listening to mobile audio while on the move

   Mobile audio is identified as the most commonly currently utilized medium for delivery of m-learning. Audio is also the most pervasive of all of the media, and can be readily deployed to personal digital media devices (Mohamed Ally, Steve Schafer, Billy Cheung, Rory McGreal & Tony Tin., 2006). Based on the needs analysis survey, student spend quite number of hours on the move. When they are in the bus, taxi, car, train or while waiting for it, they are able to listen to mobile audios such as audio podcast related to their studies. They can listen to mobile audio with or without headset.

2. Watching mobile video while on the move

   Digital video generally consists of two major components: a digital video track and digital audio track. These components of the video are known as data streams. Data streams are multiplexed together to present all of the content in a single video file. Some video files contained text narration in order to give better understanding of the content. However, when students' are on the move, it is lot more easier to watch video compare to reading mobile documents.

3. Accessing mobile document while on the move

   Mobile document can be in any form from power point slides, work documents, and PDF document. While on the move, students are able to access their mobile document online or access the downloaded content. Whenever they are free and wanted to engage in the learning activities, they can do it through their mobile device, even when they are on the move.

4. Accessing mobile notes while on the move

Mobile notes are a shorter version of mobile documents since not all students are willing to read the entire content. Also they might be in certain constraint such as shorter duration to access and read the content, low battery life of their mobile device, wanted to reinforce what have been studied before and at such they prefer to access short notes (mobile notes) while they are on the move.

5. Listening to mobile audio at own space

   Own space defined as whenever the students' are on their own space such as at their home or at their own hostel room. When the students are at own space, they can listen to mobile audio such as audio podcast with or without headset.

6. Watching mobile video at own space

   Lots of lecture series are available online in the form of video podcast and the students are able to watch these mobile videos at their own space whenever they have urge to study. And they can do this with or without the headset.

7. Accessing mobile document at own space

   When the students are free at their own space, they can access their course content in the format of mobile document. Based on their learning style, some students prefer to learn when they are alone and at their own space.

8. Accessing mobile notes at own space

   Some students are prefer to access mobile notes just to get the gist of the content. And accessing it at their own space give them the freedom to learn.

9. Listening to mobile audio in noisy environment with headset

   Noisy environment is when the students are at bus/train/taxi station, cafeteria or other crowded place where noise and audible interference is experienced. Such environmental interference can play an important role in influencing the learning process. With headset, the students able to reduce the noise interference and they could be able to concentrate in listening the mobile audio.

10. Watching mobile video in noisy environment with headset

    Based on the students' learning preferences and style, they are able to watch mobile video in noisy environment with their headset for better understanding.

11. Accessing mobile document in noisy environment

    This is when the students knew they are in noisy environment but still want to access their mobile document online or from their mobile device to engage in their learning activities.

12. Accessing mobile notes in noisy environment

    The students also can access mobile notes in noisy environment if they wanted to engage in the learning activities.

13. Listening to mobile audio just before examination

    This is when the students want to listen to the mobile audio just before examination. The situation is not only cover the examination but it include just before any important session such as tutorials, practical, internship and so on. This is performed by the students in order to get some quick updates before the important session.

14. Watching mobile video just before examination

Based on the students' learning preference, they might watch mobile video of lecture session or practical activities before an important session.

15. Accessing mobile document just before examination

Sometime students' need to go through their details learning materials just before an important session in order to understand well and excel in whatever they do after that such as examination, practical test or internship.

16. Accessing mobile notes just before examination

This is to get some quick updates on the learning content of a course before an important session.

17. Listening to mobile audio in unlimited connectivity

When the students decided to learn and want to listen to mobile audio, it can be from two main source, online or from their device itself. When the students have unlimited connectivity, accessing this type of content whether from device or from online did not make much different.

18. Watching mobile video in unlimited connectivity

Video files are generally large in size and good quality video files are even larger. Accessing these files in unlimited connectivity did not make much different. The students can learn from this type of learning material continuously without any interruption.

19. Accessing mobile document in unlimited connectivity

Accessing mobile document in unlimited connectivity is not a problem for students when they decided to learn via their mobile device.

20. Accessing mobile notes in unlimited connectivity

Continuous access to the learning materials outside WIFI connectivity would be easy if the students subscribe for unlimited connectivity.

21. Listening to mobile audio via limited connectivity

When students are out of WIFI connectivity, they are solely depend on their Internet connection to access the learning materials from online depository. In a limited connectivity, students must be very careful in selecting types of materials that they want to access or download.

22. Watching mobile video via limited connectivity

Watching mobile video in limited connectivity not a good experience if the students are not careful in selecting the learning content. They can still access their mobile video but must make sure the material is in permissible size.

23. Accessing mobile document via limited connectivity

If the students decided to learn, they still able to access mobile document via their limited connectivity but must always ensure it is within their limit.

24. Accessing mobile notes via limited connectivity

Mobile notes files are among the smallest size and the students able to access it in limited connectivity.

25. Tracking learning progress to personalise the content accordingly

The students want to keep track their learning progress such as keep track of navigation history or management of learning processes, so that they can start from where they left before. Sometime tracking is done to order to personalise the content for their following visit.

26. Automisation of content personalisation according to student’s learning styles

Students have preferences in terms of the way they receive and process information. The content personalisation is based on the four dimension Felder-Silverman model namely Active and Reflective Learners; Sensing and Intuitive Learners; Visual and Verbal Learners; and Sequential and Global Learners (Pritchard, 2013). The learning management system will be able to personalise the learning content according to student’s learning styles. This is an automated process where students’ learning style profile is used to do the personalisation.

27. Automisation of content personalisation according to individual student’s learning outcome

Students want to achieve certain learning goals or outcomes when they engage in the learning activity. For example, they wanted to learn about certain concept in a topic or chapter. Hence, the system should automate content personalisation process in order to deliver the learning material accordingly.

28. Automisation of content personalisation according to student's emotional status/mood

Students’ emotional status or their mood influence their learning capability. Thus, the students’ emotional status need to capture in order to personalise the learning materials. For example, if the student specify his/her personal status as tired and then the system should automate the content so that the student receives only version of the content which do not require high concentration.

29. Automisation of content personalisation according to device's display capacity

    Students' mobile devices' screen sizes and resolutions are vary. System should automise the content personalisation according to the device's display capacity so that the students are able to receive their learning content that fit their device resolution or screen size.

30. Automisation of content personalisation according to device's storage capacity

    Students are able to download learning content when WIFI connection is available so that it can be used when they are out of WIFI connection. In order to do that, their mobile device's storage must permits the content size. Personalisation of the content based on the available storage capacity can be performed by the system.

31. Automisation of content personalisation according to device's battery life

    Automisation of content personalisation must be performed if the students' mobile device battery life is low. This is important so that the students receive content that not require high battery usage or higher processing power such as video and animation.

5.2.2 Findings from Step 2: Determine the contextual relationship and relation phrase

This section reported the findings on the Step 2 of the procedure in this phase where the contextual relationship phrase and the relation phrase among the personalised m-learning elements were determined with respect to each other. The context provides the focus to the experts on how the personalised m-learning elements need to be connected while constructing the ISM. Referring to the personalised m-learning elements agreed during the NGT session, 'Priority Structural' were applied to build the pair wise contextual relationship among these elements to guide through the SSIM process. Therefore, the phrase 'In determining the MOST prevalent element in the design of personalised m-learning curriculum implementation model,…' was agreed as a contextual relationship phrase. Whereas, the experts agreed to the personalised m-learning elements 'i' contributes significantly compare to personalised m-learning elements 'j' to be the relation phrase to relate the elements in the model.

5.2.3 Findings from Step 3 and 4: Development of the model

These steps were the process of developing the personalised m-learning curriculum implementation model based on experts' decisions on the relationships of the elements using pair wise technique which was aided by the ISM computer software called 'Concept Star' as mentioned in the methodology section earlier. The model aimed to serve as a guide to the course instructor to implement personalised m-learning in their teaching and learning. However, as discussed in the earlier section, although the personalised m-learning could be used to deliver full course, this model was designed to support and complement the formal classroom learning.

The model was developed interpretively by selected experts constructed through a network of relationship of the personalised m-learning elements. The development of the model solely based on the views of these selected experts in order to produce an appropriate personalised m-learning. The relationship among the personalised m-learning elements which were identified from their collective decisions during the NGT session in step 1 and the 'relation phase' and 'contextual relationship phase' from step 2, the ISM model for personalised m-learning curriculum implementation model for Food and Beverage course was developed as shown in Figure 5.1. However, the model may not be considered final as it was to be reviewed and modified if necessary by the experts. This process was conducted in Steps 5 and 6 of this phase.

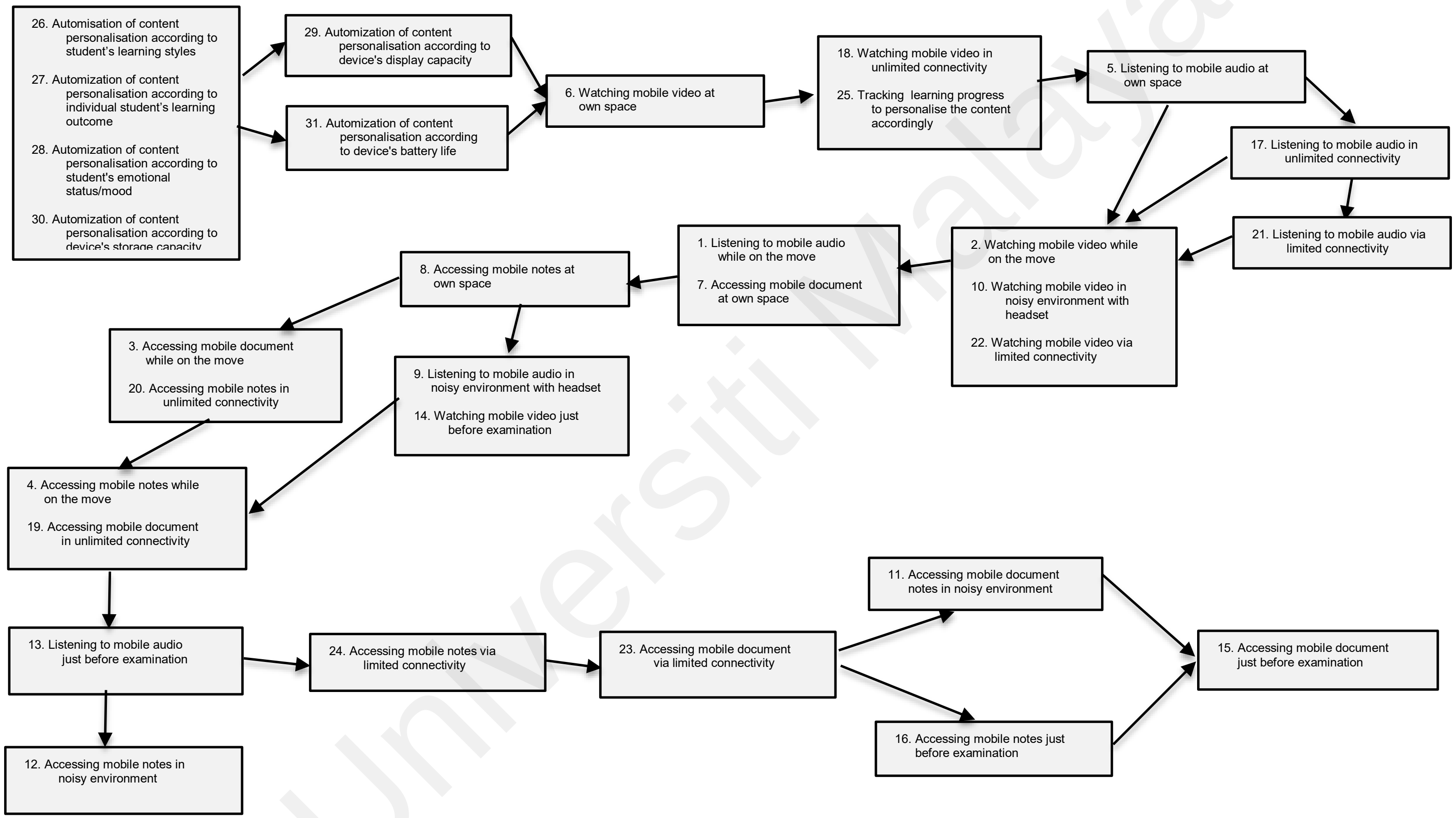

Figure 5.1 Interpretive structural modeling (ISM) for personalised m-learning curriculum implementation model for Food and Beverage course in hospitality programme.

5.2.4 Findings from Steps 5 and 6: Review and Presentation of the Model

In these steps, first the model was presented to the experts and followed by the review process of the model. Here, the experts were allowed to give their feedbacks and proposed amendments if necessary to the model.

Referring to Figure 5.1, a few experts proposed that personalised m-learning element 25 (Tracking learning progress to personalise the content accordingly) should be in the initial stage of the model together with the rest of the automisation elements (elements 26, 27, 28 and 30) because the tracking process involved system and it could be automated. However, majority of the experts viewed that personalised m-learning element 25 (Tracking learning progress to personalise the content accordingly) can be conducted separately as tracking learning progress is not important as the other automated elements (elements 26, 27, 28 and 30). Besides, the students can select their new preferences during each content access so the tracking process seems not as important as the other automated elements. Thus, the personalised m-learning element 18 remained its position as it is.

The experts also suggested that the personalised m-learning element 10 (Watching mobile video in noisy environment with headset) to be connected to personalised m-learning element 6 (Watching mobile video at own space) since the student wearing the headset and it would not make any different than watching mobile video at their own space. However, after revisit these two elements and discussions, majority of the experts still viewed that the environmental interference such as noise still can play an important role in influencing the learning process even with the headset on. Thus, the personalised m-learning element 18's position is unchanged.

After reviewing the relationships of each personalised m-learning elements in the model, the panel of experts agreed to maintain the model developed by the ISM software. Since there was no amendment needed, the process of regenerating the model using the ISM software was not conducted.

Finally, the experts proposed that the final ISM model for personalised m-learning to be divided into three domains which are Device Adaptation domain, Learner Adaptation domain and Situated Adaptation domain. The Device Adaptation domain consist of personalised m-learning element 26, 27, 28, 29, 30 and 31. This domain consists of elements that needs the personalisation according to the students' preferences and mobile device capabilities which need to be performed at device level. The content personalisation performed by the system and it is an automated adaptation according to the students' learning preferences. The Learner Adaptation domain are perhaps the most important personalised m-learning elements since it interact directly with the students and their learning preferences. This domain consist of personalised m-learning element 1, 2, 3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 22, 23, 24 and 25. The adaptation of personalised m-learning elements in this domain involved the students' learning preferences and the students' mobile device connectivity at the point of content request and/or delivery. And the last domain, the Situated Adaptation domain consist of personalised m-learning element 9, 10, 11, 12, 13, 14, 15 and 16. The adaptation of personalised m-learning elements in this domain involved the students' learning preferences and the students' learning environment or surrounding at the point of content request and/or delivery. Therefore, the final personalised m-learning curriculum implementation model for Food and Beverage service course is shown in Figure 5.2.

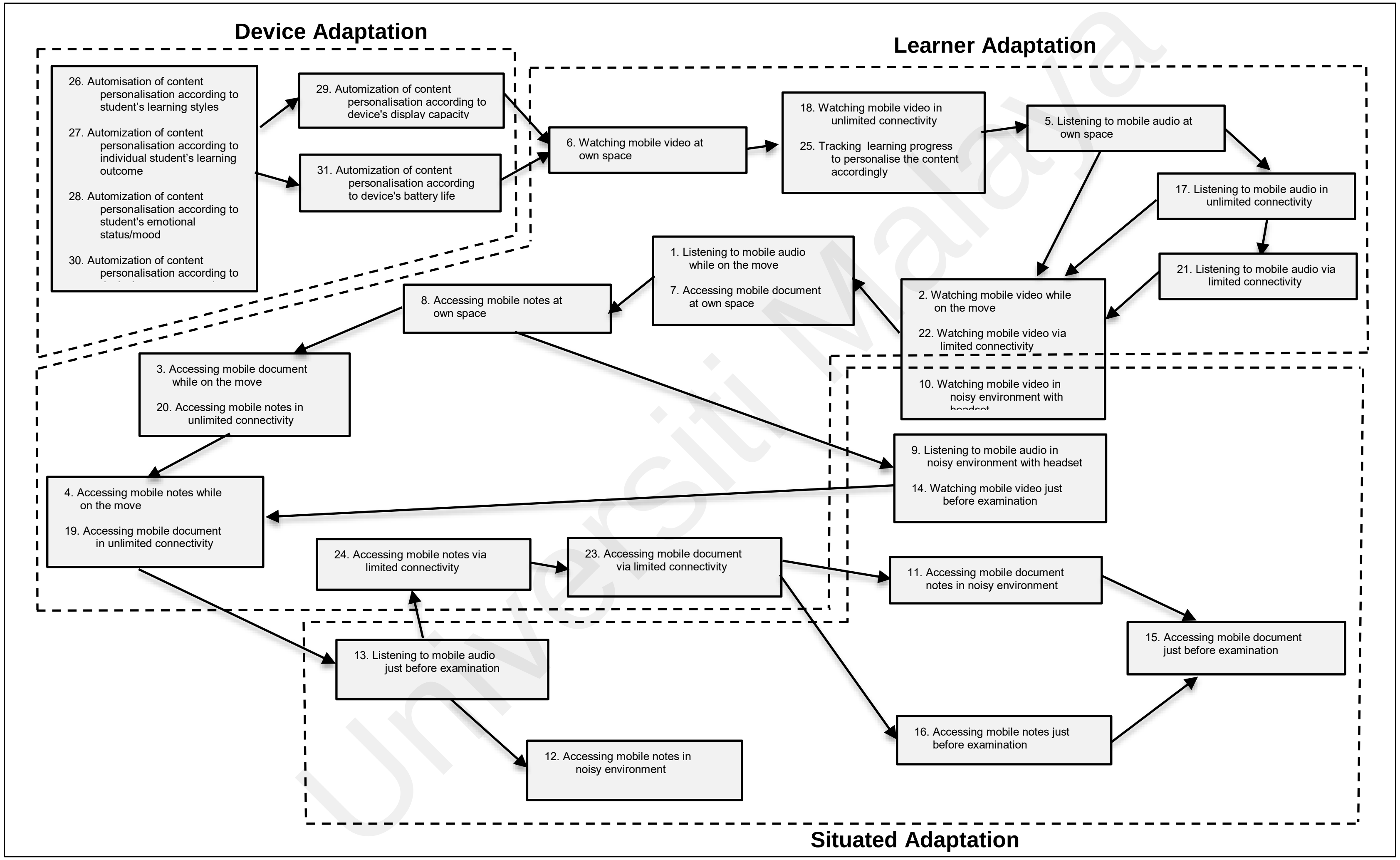

Figure 5.2 Reviewed Interpretive structural modeling (ISM) for personalised m-learning curriculum implementation model for Food and Beverage course in hospitality programme.

5.2.5 Findings from Step 7: Classifying of the personalised m-learning elements into different levels

The personalised m-learning implementation model could be further interpreted and discussed based on the finding in this step. This section reports the findings for step 7, 8, and 9 of the procedures and to answer the fourth research objective which is to interpret the model by defining the driving power and dependence power of each element in the model. Based on the model in Figure 5.2, the personalised m-learning elements were classified into different levels by defining the driving power and the dependence power of each elements. Driving power is the power driving the elements in achieving the goals and objectives by itself (Mohd Ridhuan Tony, Saedah Siraj, & Zaharah Hussin, 2014). The dependence power is the power that depends on other powers to achieve certain goals and objectives. Thus, the reachability matrix for the personalised m-learning elements was developed in order to explain the driving power and the dependence power of each element in the model. This is shown in Table 5.3.

Table 5.3
Reachability Matrix

E	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	DP
1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	17
2	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	18
3	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	14
4	0	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
5	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	0	0	0	21
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	26
7	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	17
8	1	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	16
9	1	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	13
10	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	18
11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3
12	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	6
13	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	10
14	0	0	0	0	0	0	1	1	1	0	1	0	1	1	1	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	0	13
15	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
16	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4
17	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	20
18	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	23
19	1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	11
20	1	0	1	1	0	0	1	1	0	0	1	1	1	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	14
21	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	19
22	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	18
23	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	5
24	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	9
25	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	23
26	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	30
27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	30
28	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	30
29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	29
30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	30
31	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	28
DEP	19	16	20	21	13	10	17	18	22	18	28	24	23	20	30	28	16	11	24	23	17	17	27	25	12	4	4	3	6	6	6	

Note: E – Personalised m-learning elements; DP – Driving Power; DEP – Dependent Power

The reachability matrix in Table 5.3 defines the driving power and the dependence power of each personalised m-learning element. The total number shown at the end of the horizontal axis represents the driving power for each element. It is the total number of all personalised m-learning elements that may help to achieve including itself. Whereas, in the vertical axis, the total number shown represents the dependence power of each element. It is the total number of personalised m-learning elements (including itself), which may help achieve it. For example, the driving power for personalised m-learning element 26, 27, 28 and 30 are the highest which is '30'. This means that these personalised m-learning elements are the most prevalent element which contributes significantly in the design of personalised m-learning curriculum implementation model compare to other elements. Among these elements, the lowest dependence power recorded by element 28, which is '3'. This means that element 28 does not depends on other elements to achieve its goal and objective. In contrary, the driving power for personalised m-learning element 15 is only ‘2’. This indicate that this element with lowest driving power is the least prevalent element in the design of personalised m-learning curriculum implementation model and it should be considered last after other elements.

Based on the reachability matrix in Table 5.3, the personalised m-learning elements are further divided according to levels of influence. The partitioning is performed based on the reachability and antecedent set for each personalised m-learning element as shown in Table 5.4. The reachability set consists the element itself and the other elements which it may help achieve, whereas the antecedent set consists of the element itself and the other elements that may help in achieving it. The partitioning of reachability matrix is essential when ISM is conducted manually without the software. The development of the model can be done by grouping the elements based on its levels. Even though the model in this study was developed with the help of the ISM software, this partition levels of personalised m-learning elements was still being used to guide in the mapping of the elements in the model.

Table 5.4
Partitioning of Reachability Matrix

Element	Reachability Set	Antecedent Set	Intersection	Level
1	1, 2, 3, 4, 11, 12, 13, 14, 15, 16, 19, 20, 21, 22, 23, 24, 25	1, 5, 6, 7, 8, 9, 10, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 30, 31	1, 19, 20, 21, 25	12
2	2, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	1, 2, 3, 4, 5, 6, 7, 8, 17, 18, 26, 27, 28, 29, 30, 31	2, 17, 18	13
3	2, 3, 9, 10, 11, 12, 13, 14, 15, 16, 22, 23, 24, 25	1, 3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29, 30, 31	3, 24, 25	10
4	2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16	1, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	4	8
5	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 25, 26	5, 6, 7, 8, 18, 21, 22, 26, 27, 28, 29, 30, 31	5, 21, 26	16
6	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26	6, 18, 22, 25, 26, 27, 28, 29, 30, 31	6, 18, 22, 25, 26	18
7	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13, 15, 16, 19, 20, 23, 24	6, 7, 10, 14, 17, 18, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31	7, 10, 19, 20,	12
8	1, 2, 3, 4, 5, 8, 9, 11, 12, 13, 14, 15, 16, 20, 23, 24	6, 7, 8, 10, 14, 17, 18, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31	8, 14, 20	11
9	1, 9, 10, 11, 12, 15, 16, 17, 19, 20, 21, 23, 24	2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 17, 18, 21, 22, 25, 26, 27, 28, 29, 30, 31	9, 10, 17, 21	9
10	1, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24	2, 3, 4, 5, 6, 7, 9, 10, 17, 18, 22, 25, 26, 27, 28, 29, 30, 31	7, 9, 10, 17, 22	13
11	11, 16, 22	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29, 30, 31	11	2
12	11, 12, 14, 15, 23, 24	1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 16, 17, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31	12	5
13	9, 11, 12, 13, 15, 16, 19, 20, 23, 24	1, 2, 3, 4, 5, 6, 7, 8, 10, 13, 14, 17, 18, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31	13, 20	7
14	7, 8, 9, 11, 13, 14, 15, 16, 19, 20, 21, 23, 24	1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 17, 18, 22, 25, 26, 27, 28, 29, 30, 31	8, 14	9
15	11, 15	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	15	1

Table 5.4 (Continued)

Element	Reachability Set	Antecedent Set	Intersection	Level
16	12, 15, 16, 22	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31	16	3
17	1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24	2, 5, 6, 9, 10, 17, 18, 21, 22, 25, 26, 27, 28, 29, 30, 31	2, 10, 21	15
18	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24	2, 6, 18, 22, 25, 26, 27, 28, 29, 30, 31	2, 6, 18, 22	17
19	1, 3, 4, 7, 8, 11, 12, 15, 16, 19, 23	1, 2, 5, 6, 7, 9, 10, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	1, 7, 19, 23	8
20	1, 3, 4, 7, 8, 11, 12, 13, 15, 16, 19, 20, 23, 24	1, 2, 5, 6, 7, 8, 9, 10, 13, 14, 17, 18, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31	1, 7, 8, 20, 24	10
21	1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16, 17, 19, 20, 21, 22, 23, 24	1, 2, 5, 6, 9, 10, 14, 17, 18, 21, 25, 26, 27, 28, 29, 30, 31	1, 5, 9, 17, 21	14
22	4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 19, 20, 22, 23, 24	1, 2, 3, 6, 10, 11, 16, 18, 21, 22, 25, 26, 27, 28, 29, 30, 31	6, 10, 18, 22	13
23	4, 15, 16, 19, 23	1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	19, 23	4
24	3, 4, 11, 15, 16, 19, 20, 23, 24	1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 17, 18, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31	3, 20, 24	6
25	1, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	1, 2, 3, 5, 6, 25, 26, 27, 28, 29, 30, 31	1, 3, 6, 25	17
26	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 31	5, 6, 26, 28	5, 6, 26	21
27	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31	26, 27, 29, 30	27, 29, 30	21
28	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31	27, 28, 30	28, 30	21
29	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 29, 30, 31	26, 27, 28, 29, 30, 31	27, 29, 30, 31	20
30	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31	26, 27, 28, 29, 30, 31	27, 28, 29, 30, 31	21
31	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 29, 30, 31	26, 27, 28, 29, 30, 31	29, 30, 31	19

The influence level of each personalised m-learning element is determined based on its reachability set and antecedent set. This has been indicated in Table 5.4.There are 21 levels of personalised m-learning elements with element 15 is at level 1 and at the other end its element 26, 27, 28, 30 at level 21. Level 1 is the lowest level and level 21 is the highest level. The elements are rearranged in order to indicate clearly the hierarchy of the personalised m-learning elements based on the level of partitions. This is shown in the following table (Table 5.5).

Table 5.5
Level Partition of Reachability Matrix

Ranking	Personalised m-learning elements	Level
15	Accessing mobile document just before examination	1
11	Accessing mobile document in noisy environment	2
16	Accessing mobile notes just before examination	3
23	Accessing mobile document via limited connectivity	4
12	Accessing mobile notes in noisy environment	5
24	Accessing mobile notes via limited connectivity	6
13	Listening to mobile audio just before examination	7
4	Accessing mobile notes while on the move	8
19	Accessing mobile document in unlimited connectivity	8
9	Listening to mobile audio in noisy environment with headset	9
14	Watching mobile video just before examination	9
3	Accessing mobile document while on the move	10
20	Accessing mobile notes in unlimited connectivity	10
8	Accessing mobile notes at own space	11
1	Listening to mobile audio while on the move	12
7	Accessing mobile document at own space	12
2	Watching mobile video while on the move	13
10	Watching mobile video in noisy environment with headset	13
22	Watching mobile video via limited connectivity	13
21	Listening to mobile audio via limited connectivity	14
17	Listening to mobile audio in unlimited connectivity	15
5	Listening to mobile audio at own space	16
18	Watching mobile video in unlimited connectivity	17
25	Tracking learning progress to personalise the content accordingly	17
6	Watching mobile video at own space	18
31	Automisation of content personalisation according to device's battery life	19
29	Automisation of content personalisation according to device's display capacity	20

Table 5.5 (Continued)

Ranking	Personalised m-learning elements	Level
26	Automisation of content personalisation according to student’s learning styles	21
27	Automisation of content personalisation according to individual student’s learning outcome	21
28	Automisation of content personalisation according to student's emotional status/mood	21
30	Automisation of content personalisation according to device's storage capacity	21

5.2.6 Findings from Step 8 and 9: Classification of elements, and analysis and interpretation of the model

Finally, based on elements' driving power and dependence power, the personalised m-learning elements are further classified according to clusters using MICMAC (Cross-impact multiplication applied to classification) analysis. This was performed in reference to Table 5.2, reachability matrix, Table 5.3 partitioning of reachability matrix and Table 5.4 level partition of reachability matrix. The aim of this classification is to analyse the driving power and dependence power of each element. The classification is divided into four clusters (Mandal & Deshmukh, 1994); a) Autonomous elements; b) Dependent elements; c) Linkage elements; and d) Independent elements.

The personalised m-learning elements which are categorised according to the clusters in MICMAC analysis are shown in Figure 5.3.

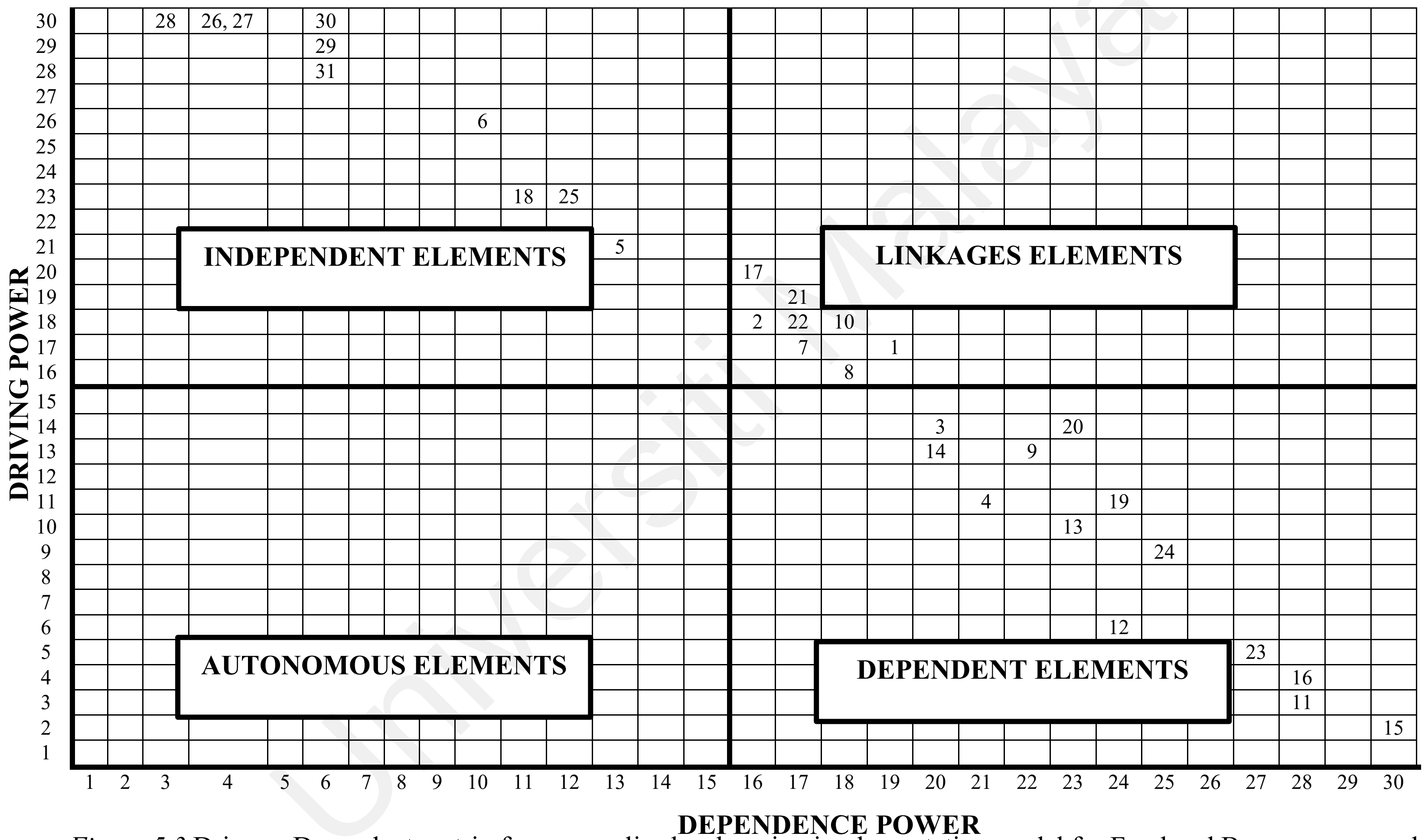

Figure 5.3 Driver – Dependent matrix for personalised m-learning implementation model for Food and Beverage course based on MICMAC analysis

Based on Figure 5.3, it is observed that personalised m-learning element 28 has driving power of 30 and dependence power of 3 and thus, it was positioned in the coordinate that corresponds to the driving power of 30 (Y-axis) and dependence power of 3 (X-axis). Based on the above figure (Figure 5.3), the Autonomous elements cluster, which is the first cluster, classifies elements that have both weak driving power and dependence power. This indicates that, any personalised m-learning elements classified under this cluster are weak and relatively can be disconnected from the personalised m-learning implementation. However, referring to Figure 5.3, there is no element under this cluster for this study. The second cluster is the Dependent elements cluster. This cluster have weak driving power and strong dependence power. In this study, 13 personalised m-learning elements (3, 4, 9, 11, 12, 13, 14, 15, 16, 19, 20, 23 and 24) are classified in this cluster.

The third cluster is the Linkage elements cluster. This cluster consist of personalised m-learning elements that have strong dependence and strong driving power. Thus, these elements are being labelled as important links between the dependent elements and independent elements. The personalised m-learning elements 1, 2, 7, 8, 10, 17, 21 and 22 fall into this cluster. The fourth and final cluster consist of independent elements which has strong driving power and weak dependence power. This makes the elements that are categorised under this cluster have most prevalent elements which contributes significantly in the design of personalised m-learning compare to elements in other cluster. As observed, the personalised m-learning elements 5, 6, 18, 25, 26, 27, 28, 29, 30 are classified under this cluster. The following Table 5.6, details the personalised m-learning elements according to clusters as discussed above.

Table 5.6
Personalised m-learning elements according to clusters

Cluster		**Personalised m-learning elements**
Autonomous Elements	-	-
Dependent Elements	3	Accessing mobile document while on the move
	4	Accessing mobile notes while on the move
	9	Listening to mobile audio in noisy environment with headset
	11	Accessing mobile document in noisy environment
	12	Accessing mobile notes in noisy environment
	13	Listening to mobile audio just before examination
	14	Watching mobile video just before examination
	15	Accessing mobile document just before examination
	16	Accessing mobile notes just before examination
	19	Accessing mobile document in unlimited connectivity
	20	Accessing mobile notes in unlimited connectivity
	23	Accessing mobile document via limited connectivity
	24	Accessing mobile notes via limited connectivity
Linkage Elements	1	Listening to mobile audio while on the move
	2	Watching mobile video while on the move
	7	Accessing mobile document at own space
	8	Accessing mobile notes at own space
	10	Watching mobile video in noisy environment with headset
	17	Listening to mobile audio in unlimited connectivity
	21	Listening to mobile audio via limited connectivity
	22	Watching mobile video via limited connectivity
Independent Elements	5	Listening to mobile audio at own space
	6	Watching mobile video at own space
	18	Watching mobile video in unlimited connectivity
	25	Tracking learning progress to personalise the content accordingly
	26	Automisation of content personalisation according to student's learning styles
	27	Automisation of content personalisation according to individual student's learning outcome
	28	Automisation of content personalisation according to student's emotional status/mood
	29	Automisation of content personalisation according to device's display capacity
	30	Automisation of content personalisation according to device's storage capacity
	31	Automisation of content personalisation according to device's battery life

5.3 Conclusion

The main outcome of this phase is the interpretive structural personalised m-learning curriculum implementation model for Food and Beverage Service in hospitality programme. This model is shown in Figure 5.1. This model was developed based on the experts' opinions using the Interpretive Structural Modeling (ISM) technique, where it is an effective tool in making decisions especially in the economic and business sector (Warfield, 1974). Development of this model was aided by the ISM computer software called 'Concept Star'. The model aimed to serve as a guide to the course instructor to implement personalised m-learning in their teaching and learning. To streamline the focus of the study, the model was developed for Food and Beverage course at diploma level in hospitality programme. This course is a compulsory subject which contain face-top-face lecture, tutorial, and practical sessions. This is an important course because the students need to use theory and practical part of this course during their internship stint.

This model consists of 31 personalised m-learning elements that was determined by the panel of experts during the Nominal Group Technique (NGT) session. These elements were matched to each other using a hierarchical manner based on the pairing techniques. Next, the model is divided into three domains: Device Adaptation domain, Learner Adaptation domain, and Situated Adaptation domain. The personalised m-learning elements were further analysed and interpreted to form a driver-dependence matrix based on driving power and dependence power of each elements in the model. The reachability matrix for the personalised m-learning elements was developed as an output from this activity. With this reachability matrix, the personalised m-learning elements were partitioned according to levels of influence.

There are 21 levels of elements that helps in the mapping of the personalised m-learning elements in the implementation model.

Finally, the model was interpreted using the MICMAC analysis where the elements were categorised into four clusters: Autonomous cluster, Linkage cluster, Dependent cluster, and Independent cluster (Figure 5.3). These clusters could determine which cluster have elements that are the most prevalent which contributes significantly in the design of personalised m-learning compare to elements in other cluster. The outcomes of this phase is a proposed personalised m-learning curriculum implementation model which developed through a series of personalised m-learning elements to support the students to achieve their learning needs as well as to achieve the learning outcomes of this course.

CHAPTER 6

FINDINGS OF PHASE 3: EVALUATION OF THE MODEL

6.1 Introduction

The main aim of this phase was to evaluate the personalised m-learning curriculum implementation model for Food and Beverage Service course in hospitality programme which was developed in Phase 2. This is the third phase in DDR approach where the study model is evaluated. This is an important phase to conduct to ensure the model is suitable to guide in the implementation of personalised m-learning as learning support for student enrol in this course. To evaluate the model, this study adopted the modified Fuzzy Delphi Method (FDM) to elicit experts' views and opinions of the feasibility of the model. A group of specifically selected experts are used to evaluate the model.

The findings in this evaluation phase by the experts are based on the following research questions:

1. What is the experts' agreement on the suitability of the personalised m-learning elements (learning preferences) proposed in the personalised m-learning curriculum implementation model?
2. What is the experts' agreement on the classification of the personalised m-learning elements based on the three domains (Device Adaptation elements, Learner Adaptation elements, and Situated Adaptation elements) as proposed in implementing personalised m-learning curriculum implementation model?
3. What is the experts' agreement on the list of personalised m-learning elements in the respective four clusters (Independent, Linkage, Dependent,

and Autonomous) as proposed in implementing personalised m-learning curriculum implementation model?

4. What is the experts' agreement on the relationship among the personalised m-learning elements as proposed in implementing personalised m-learning curriculum implementation model?
5. What is the experts' agreement on the suitability of the personalised m-learning curriculum implementation model in the teaching and learning of Food and Beverage Service course in the hospitality programme?

6.2 Findings of the Evaluation Phase

The evaluation questionnaire divided into three parts. Thus, the findings of this evaluation phase will be presented in three part. The first part of the survey questionnaire is about the experts' background information. The experts' background information is used to validate their expertise in evaluating the model. The second part presents the experts' use of mobile technologies in their daily life. This part will reveal how good they are with the mobile technologies and how they use these technologies. The third part presents the experts' views on the suitability of the personalised m-learning curriculum implementation model. Their views and opinions will be used as a guideline for the instructor in implementing personalised m-learning to support the formal classroom learning.

6.2.1 Part A: Background information of the experts

A total of 25 experts were selected for this evaluation phase to evaluate the model which was developed in phase 2 of the study. Table 6.1 shows the findings of the experts' background information.

Table 6.1
Experts' Background Information

Item		**Frequency**	**Percentage**
Gender	Male	14	56.0
	Female	11	44.0
Teaching/Working Experiences	Below 5 years	0	0.0
	5 - 10 years	12	48.0
	11 - 20 years	10	40.0
	Above 20 years	3	12.0
Highest Qualification	PhD	8	32.0
	Master	11	44.0
	Degree	6	24
	Diploma/Certificate	0	0.0
Field of work/expertise	Education (m-learning/online learning)	13	52.0
	Education (Science and Engineering)	6	24.0
	Mobile Technologies and Interface Design	4	16.0
	Information System/Technology	2	8

The Table 6.1 revealed the background information of the 25 experts involved in this survey questionnaire. Based on the table, total number of male and female experts who participate in this study are represent 56% and 44% respectively. The findings show that majority of the experts have teaching and/or working experience between 5 to 10 years (48%, n = 12). Very close to this number are experts from 11 to 20 years of experience (40%, n = 10). There are also experts with more than 20 years of experience (12%, n = 3). In terms of their academic qualification, majority of the experts (44%, n = 11) possessed masters as their highest qualification, 32% (n = 8) with PhD, and balance 24% (n = 6) with basic degree (Table 6.1). In terms of field of expertise, out of four major categories given, majority of the experts were from the field of education with specialised area in m-learning and/or online learning (52%, n = 13) and 24% (n = 6) are specialised in science and engineering. Whereas, 16% (n = 4) experts were expertise in mobile technologies and interface design. The rest of the experts were from information system and/or technology field.

6.2.2 Part B: Use of mobile technologies

This part will reveal how good the experts are with the mobile technologies and their technical skills with the mobile devices. Table 6.2 shows the findings in the aspect of experts' mobile device related skills. The findings reveals that 64% (n = 16) of the experts claimed that they were moderate in terms of their mobile device related skills and 36% (n = 9) of them claimed that they were skilful.

Table 6.2
Experts' mobile device related skills

Items	Frequency	Percentage
Skilful *(Develop and managing website or/and blogs, content creation for online system)*	9	36.0
Moderate *(Able to communicate through social networks like Facebook, Twitter, Instagram, etc.)*	16	64.0
Low skilled *(Browse and search for information on the Internet; use of office tools such as spreadsheets, words, power point; receive and sending emails)*	0	0.0
None	0	0.0
Total	**25**	**100.0**

Table 6.3 shows the findings in terms of experts' mobile device technical skill level. The findings indicates that majority of the experts (60%, n = 15) claimed that

they were highly skilled, whereas the remaining 40% (n = 10) of the experts indicates that they have average technical skill with mobile devices.

Table 6.3
Experts' mobile device technical skill level

Items	Frequency	Percentage
High	15	60.0
Average	10	40.0
Low	0	0.0
Total	**25**	**100.0**

Based on the analysis results from all the three tables above (Table 6.1, Table 6.2 and Table 6.3), the selected survey questionnaire participants fit the description as experts in evaluating the model in this phase. According to Pawlowski, Suzanne & Okoli (2004), experts selected for a specific Delphi study should have some background or experience in the related field of study, to be able to contribute their opinions to the needs of the study, and willing to revise their initial judgement to reach consensus among other experts in the team. In terms of experts' background experience and academic qualification in the related study field, the findings showed that majority of the participants specialise either from m-learning or online learning in the field of education. This indicates that, these selected experts were suitable to evaluate the personalised m-learning curriculum implementation model of the study. Besides this, the experts also have some mobile device related skills and majority of them claimed that they have high technical skill with mobile devices. These criteria is an added advantage in evaluating the model. Thus, based on the findings in this part, the selected respondents were qualify as experts in this phase.

6.2.3 Part C: Experts' views on the suitability of the personalised m-learning curriculum implementation model

The responses of the participants (experts) to the evaluation survey questionnaire (refer to Appendix D) were based on the five-point linguistic scale. Based on the responses collected from participants, the threshold value 'd' was calculated for all the questionnaire items. This is to determine the level of consensus among experts for each item in the questionnaire and illustrated in Table 6.4. The process of calculating the threshold value 'd' was based on the following formula:

$$d\left(\tilde{m},\tilde{n}\right)=\sqrt{\frac{1}{3}\left[(m_1-n_1)^2+(m_2-n_2)^2+(m_3-n_3)^2\right]}.$$

Table 6.4:
Threshold Value 'd', for Evaluation Survey Questionnaire Items

E	Items																		
	1.1	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**3.4**	**4.1**	**4.2**	**4.3**	**4.4**	**5.1**	**5.2**	**5.3**	**5.4**	**5.5**	**5.6**
1	0.083	0.103	0.117	0.091	**0.439**	0.181	0.043	0.127	**0.447**	0.192	0.152	0.122	0.122	0.136	0.115	0.132	0.164	0.169	0.194
2	0.083	0.103	0.090	0.091	0.141	0.125	0.043	0.127	0.137	0.114	**0.428**	0.183	0.171	0.155	0.190	0.160	0.128	0.123	0.198
3	0.083	0.103	0.117	0.091	0.141	0.181	0.043	0.127	**0.447**	0.192	0.152	0.122	0.122	0.136	0.115	0.132	0.164	0.169	0.194
4	0.083	0.103	0.117	0.091	0.155	0.181	0.043	**0.424**	**0.447**	**0.359**	0.127	0.122	0.122	**0.430**	0.115	0.132	0.164	0.093	0.066
5	0.083	0.103	0.117	0.091	**0.439**	0.181	0.043	**0.424**	**0.447**	0.192	0.127	0.122	0.122	0.155	**0.362**	0.132	0.094	0.123	0.066
6	0.083	0.103	**0.468**	0.091	0.141	0.125	0.043	**0.424**	0.106	**0.359**	**0.428**	0.122	0.140	0.136	0.115	0.125	0.164	0.123	0.194
7	0.083	0.103	0.090	0.063	0.155	0.125	0.110	0.127	0.155	0.192	0.252	0.122	0.140	0.155	**0.362**	0.125	0.128	0.123	0.066
8	**0.383**	0.103	0.090	0.063	0.141	0.125	0.110	0.179	0.155	0.114	0.143	0.122	**0.412**	0.136	0.190	**0.427**	0.128	0.169	0.194
9	0.169	0.103	0.117	0.063	0.155	0.125	0.043	0.127	0.106	0.192	0.152	0.183	0.171	**0.430**	0.190	**0.427**	0.164	**0.461**	0.066
10	0.169	0.103	0.090	0.091	0.120	0.181	0.110	0.179	0.137	0.192	0.127	0.183	0.171	0.155	0.190	0.125	0.094	0.169	0.194
11	0.169	0.103	**0.335**	0.063	**0.439**	0.125	0.043	0.127	0.137	0.192	0.127	0.183	0.171	0.136	0.190	0.125	0.094	**0.461**	0.198
12	0.169	0.103	0.090	0.091	0.141	**0.372**	0.110	0.179	0.137	0.192	0.152	0.122	**0.412**	0.123	0.190	0.132	**0.459**	0.123	**0.488**
13	**0.383**	0.103	0.090	0.063	0.141	0.125	0.043	0.127	0.137	0.114	0.152	0.122	**0.412**	0.136	0.115	0.132	0.164	0.093	0.198
14	0.083	**0.350**	**0.335**	0.091	0.141	0.181	0.043	0.179	0.106	**0.491**	**0.428**	0.122	**0.412**	0.123	0.190	0.132	0.128	0.169	0.198
15	**0.309**	0.103	0.117	0.063	**0.439**	0.181	0.043	0.127	0.106	0.114	**0.428**	0.183	0.171	0.123	0.115	0.132	0.128	0.123	0.194
16	0.083	0.103	0.090	**0.303**	0.155	0.181	0.043	0.127	0.155	0.114	0.143	0.122	0.171	**0.430**	0.190	0.160	0.094	0.093	0.198
17	0.083	0.203	0.117	0.063	0.120	0.181	0.110	0.127	0.106	0.192	0.143	0.183	0.122	0.155	0.115	0.160	0.164	0.169	0.066
18	0.169	0.103	0.117	0.091	**0.439**	0.125	0.043	0.127	0.155	0.114	0.152	0.122	0.122	0.155	0.190	0.160	0.164	0.093	0.066
19	0.083	0.103	0.090	0.063	**0.439**	0.125	0.043	0.127	0.137	0.192	0.152	0.183	0.122	0.136	0.115	0.132	0.164	0.169	0.198
20	0.169	**0.350**	0.117	0.063	0.141	0.125	0.043	0.127	0.106	0.192	**0.428**	0.122	0.140	0.123	0.190	0.125	0.128	0.169	0.066
21	0.083	0.103	0.117	0.091	0.141	0.125	0.110	0.127	0.155	0.114	**0.428**	0.183	0.140	0.155	0.115	0.160	0.128	0.169	0.198
22	0.169	0.103	0.090	**0.303**	0.120	0.181	0.043	0.179	0.106	0.114	0.127	0.122	0.171	0.123	0.115	0.132	0.128	0.093	0.066
23	0.169	0.103	0.090	0.063	0.141	0.125	0.043	0.127	0.106	0.114	0.143	0.183	0.122	0.136	0.115	0.132	0.094	0.123	0.194
24	0.083	0.103	0.090	0.091	0.141	0.181	0.043	0.127	0.106	0.114	0.152	0.122	0.122	0.123	0.115	0.125	0.164	0.123	0.194
25	0.169	0.103	0.090	0.091	0.141	0.125	0.110	0.127	0.137	0.192	0.152	0.183	0.171	0.136	0.190	0.160	0.164	0.123	0.198

Note: E = Expert

Table 6.4 shows the threshold value 'd', for the evaluation survey questionnaire items for this study. The threshold value determines the level of consensus among the experts for each item in the survey questionnaire for the model being studied. The above table (Table 6.1) shows the threshold values in bold (black). Any items that exceeded the threshold value of 0.2 were marked in bold. This value shows the opinion of an expert that differs or not in consensus with other experts for a particular item in the survey questionnaire (Chang, Hsu and Chang, 2011; Cheng and Lin, 2002). For example, for questionnaire item 1.1, experts' number 8, 13, and 15 were not in consensus with the other experts in their agreement on the list of elements proposed in the model which required personalisation when designing the personalised m-learning curriculum implementation model. However, as discussed in the methodology chapter, the calculation of the threshold value is to find the threshold values for the overall questionnaire items. What is more important is that the overall group consensus have exceeded 75%. Table 6.5 indicates that the percentage of experts' consensus is 88% which is greater than 75%, the minimum percentage required for consensus. The overall group consensus should exceed 75% and any value less than this required a second round of fuzzy Delphi. Thus, based on Table 6.4, the overall threshold value 'd', was calculated as shown in Table 6.5.

Table 6.5

The Overall Threshold value 'd' for questionnaire items

	Items																		
	1.1	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**3.4**	**4.1**	**4.2**	**4.3**	**4.4**	**5.1**	**5.2**	**5.3**	**5.4**	**5.5**	**5.6**
No of Items d ≤ 0.2	22	23	22	23	19	24	25	22	21	22	19	25	21	22	23	23	24	23	24
Percentage (%) of each items d ≤ 0.2	**88**	**92**	**88**	**92**	**76**	**96**	**100**	**88**	**84**	**88**	**76**	**100**	**84**	**88**	**92**	**92**	**96**	**92**	**96**
Percentage of overall items d ≤ 0.2	89.89																		

Based on Table 6.5, the overall threshold value 'd' for questionnaire items is 89.89%. This overall threshold value 'd', was calculated as:

[475 (total experts' responses) – 48 (total responses more than 0.2) ÷ 960] x 100% = 89.89%

This indicates that the threshold value 'd', has exceeded 75%. This means that the experts have reached the required consensus in their views for all questionnaire items of the evaluation survey questionnaire in evaluating the personalised m-learning curriculum implementation model for Food and Beverage course in hospitality programme. For a threshold value, 'd', less than 75% would require a second round of Fuzzy Delphi where the participants need to respond to the evaluation survey questionnaire again to re-evaluate their views. More subsequent rounds of FDM may be needed until the group consensus is achieved. For this study, since group consensus has already been acquired, the following step was is to seek the findings for the participants' collective opinions on the evaluation of the model in terms of their consensus on the following aspects:

1. The suitability of the elements (personalised m-learning elements);
2. The domain classification of the personalised m-learning elements;
3. The cluster classification of the personalised m-learning elements;
4. The relationships among the personalised m-learning elements; and
5. The overall suitability of the model in supporting the formal classroom teaching and learning for this course.

The aspects listed above are consistent with the research questions for this phase. Thus, the findings of this part were presented according to the research questions as follows:

1. What is the experts' agreement on the suitability of the personalised m-learning elements (learning preferences) proposed in the personalised m-learning curriculum implementation model?
2. What is the experts' agreement on the classification of the personalised m-learning elements based on the three domains (Device Adaptation elements, Learner Adaptation elements, and Situated Adaptation elements) as proposed in implementing personalised m-learning curriculum implementation model?
3. What is the experts' agreement on the list of personalised m-learning elements in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in implementing personalised m-learning curriculum implementation model?
4. What is the experts' agreement on the relationship among the personalised m-learning elements as proposed in implementing personalised m-learning curriculum implementation model?
5. What is the experts' agreement on the suitability of the personalised m-learning curriculum implementation model in the teaching and learning of Food and Beverage Service course in the hospitality programme?

The analysis of the evaluation survey questionnaire data for FDM is based on the requirements contained in the triangular fuzzy number and deffuzification process. According to Cheng & Lin (2002), the terms of triangular fuzzy number is engaging the threshold value 'd' and the percentage of the experts' consensus where the threshold value 'd' for each item (components and elements) as measured must be less than or equal to 0.2. Whereas, the percentage of consensus of the experts must be more than or equal to 75.0% (H. C. Chu & Hwang, 2008; J. W. Murry & Hammons, 1995).

The threshold value ‘d’ will be analysed using Microsoft Excel based on the following formula:

$$d(\tilde{m},\tilde{n}) = \sqrt{\frac{1}{3}\left[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2\right]}.$$

As discussed in Chapter 3, for the deffuzification process, there is only one condition which is the Fuzzy Score (A) must be greater than or equal to the value of α-cut of 0.5 (Bodjanova, 2006; Tang & Wu, 2010). The Fuzzy score (A) was analysed using Microsoft Excel by using the following formula:

$$A_{max} = 1/3 * (m1 + m2 + m3)$$

Thus, the following findings are presented based on these two requirements contained in the triangular fuzzy number and deffuzification process.

1. Experts’ view on the suitability of the elements proposed in the personalised m-learning curriculum implementation model

   In this part, the experts had to respond to the following question to confirm whether they agreed on the list of element proposed:

   1.1 Do you agree with the list of elements proposed in the model which required personalisation when designing the personalised m-learning curriculum implementation model?"

   Findings from the above question was analysed using FDM and the threshold value ‘d’ for the item was calculated. This is shown in Table 6.6.

Table 6.6
Fuzzy Delphi Analysis on experts' views on the suitability of the personalised m-learning elements

Experts	**Items**
	1.1
1	0.083
2	0.083
3	0.083
4	0.083
5	0.083
6	0.083
7	0.083
8	0.383
9	0.169
10	0.169
11	0.169
12	0.169
13	0.383
14	0.083
15	0.309
16	0.083
17	0.083
18	0.169
19	0.083
20	0.169
21	0.083
22	0.169
23	0.169
24	0.083
25	0.169
Threshold value (d)	0.147
% of experts' consensus	88
Fuzzy Score (A)	0.755

The above table indicates that opinions of experts 8, 13 and 15 were not consensus with the other experts' view based on the threshold values which was more than 0.2. However, what is more important is that the overall group consensus have exceeded 75% (88% for this item).

Table 6.7

Experts' view on the suitability of the elements proposed in the model

Item	Triangular Fuzzy Numbers		Defuzzification Process			
	Threshold value each items	**Percentage of experts' consensus**	**m1**	**m2**	**m3**	**Fuzzy Score (A)**
1.1 Do you agree with the list of elements proposed in the model which required personalisation when designing the personalised m-learning curriculum implementation model?	0.147	88	0.572	0.768	0.924	0.755

Whereas, Table 6.7 indicates that the percentage of experts' consensus is 88% which is greater than 75%, the minimum percentage required for consensus. The value of Fuzzy Score (A) is 0.755 which is greater than 0.5. Based on these values, it can be concluded that this item has met the requirements contained in the triangular fuzzy number and deffuzification process where all experts consensually agreed with the proposed personalised m-learning elements.

2. Experts' view on the domain classification of the elements in the proposed personalised m-learning curriculum implementation model

   Personalised m-learning elements were classified into three domain (Figure 5.2). In order to elicit the experts' view on the classification of these personalised m-learning elements, the experts' were given the following questionnaire items to respond accordingly:

2.1 Do you agree with the grouping of personalised m-learning elements into three (3) domains as shown in the model: Device Adaptation, Learner Adaptation and Situated Adaptation?

2.2 Do you agree with the list of elements grouped under Device Adaptation?

2.3 Do you agree with the list of elements grouped under Learner Adaptation?

2.4 Do you agree with the list of elements grouped under Situated Adaptation?

Findings from the above questions were analysed using FDM and the threshold value 'd' for each item were calculated. This is shown in Table 6.8. This is followed by Table 6.9 which shows the details of the findings of the experts' consensus on the classification of the personalised m-learning elements to its respective domains.

Table 6.8
Fuzzy Delphi Analysis on experts' views on the domain classification of personalised m-learning elements

Experts	**Items**			
	2.1	**2.2**	**2.3**	**2.4**
1	0.103	0.117	0.091	0.439
2	0.103	0.090	0.091	0.141
3	0.103	0.117	0.091	0.141
4	0.103	0.117	0.091	0.155
5	0.103	0.117	0.091	0.439
6	0.103	0.468	0.091	0.141
7	0.103	0.090	0.063	0.155
8	0.103	0.090	0.063	0.141
9	0.103	0.117	0.063	0.155
10	0.103	0.090	0.091	0.120
11	0.103	0.335	0.063	0.439
12	0.103	0.090	0.091	0.141
13	0.103	0.090	0.063	0.141
14	0.350	0.335	0.091	0.141
15	0.103	0.117	0.063	0.439

Table 6.8 (Continued)

Experts	Items 2.1	Experts 2.2	Items 2.3	Experts 2.4
16	0.103	0.090	0.303	0.155
17	0.103	0.117	0.063	0.120
18	0.103	0.117	0.091	0.439
19	0.103	0.090	0.063	0.439
20	0.350	0.117	0.063	0.141
21	0.103	0.117	0.091	0.141
22	0.103	0.090	0.303	0.120
23	0.103	0.090	0.063	0.141
24	0.103	0.090	0.091	0.141
25	0.103	0.090	0.091	0.141
Threshold value (d)	0.123	0.136	0.097	0.212
% of experts' consensus	92	88	92	76
Fuzzy Score (A)	0.633	0.644	0.905	0.800

Table 6.9

Details analysis of experts' views on the domain classification of personalised m-learning elements

Item	**Triangular Fuzzy Numbers**		**Defuzzification Process**			
	Threshold value each items	**Percentage of experts' consensus**	**m1**	**m2**	**m3**	**Fuzzy Score (A)**
2.1 Do you agree with the grouping of personalised m-learning elements into three (3) domains as shown in the model: Device Adaptation, Learner Adaptation and Situated Adaptation?	0.123	92	0.436	0.636	0.828	0.633

Table 6.9 (Continued)

Item	Triangular Fuzzy Numbers		Defuzzification Process			
	Threshold value each items	**Percentage of experts' consensus**	**m1**	**m2**	**m3**	**Fuzzy Score (A)**
2.2 Do you agree with the list of elements grouped under Device Adaptation?	0.136	88	0.452	0.648	0.832	0.644
2.3 Do you agree with the list of elements grouped under Learner Adaptation?	0.097	92	0.788	0.936	0.992	0.905
2.4 Do you agree with the list of elements grouped under Situated Adaptation?	0.212	76	0.668	0.820	0.912	0.800

Requirements: a) Triangular Fuzzy Numbers b) Defuzzification Process
i) Threshold value (d) ≤ 0.2 i) Fuzzy score (A) ≥ value α – cut = 0.5
ii) Percentage of experts' consensus ≥ 75.0%

Based on Table 6.9, the percentage of experts' consensus for item 2.1 (Agreement on the grouping of personalised m-learning elements into three (3) domains as shown in the model: Device Adaptation, Learner Adaptation and Situated Adaptation) and item 2.3 (Agreement on the list of elements grouped under Learner Adaptation) both show the highest percentage of consensus from the experts which is 92%. Meanwhile, item 2.2 (Agreement on the list of elements grouped under Device Adaptation) received 88% of experts' consensus for this item which indicated that the item was in the range of requirement for triangular fuzzy number. However, item 2.4

(Agreement on the list of elements grouped under Situated Adaptation) received the lowest percentage of consensus (76%), it is still met the requirement of triangular fuzzy number which is greater than 75%. Beside this, the item shows the value of Fuzzy Score (A) is 0.800 which is greater than Alpha a – cut value of 0.5. The above table also showed that, all the items in this questionnaires had the Fuzzy Score (A) more than 0.5. This shows that all the items in this above table have met the requirements contained in the triangular fuzzy number and deffuzification process. Thus, all the experts consensually agreed with the proposed classification of personalised m-learning elements into three domains: Device Adaptation, Learner Adaptation and Situated Adaptation, as well as consensually agreed to the list of elements in each domain.

3. Experts' view on cluster classification of the elements in the proposed personalised m-learning curriculum implementation model

   The list of personalised m-learning elements were classified into four cluster, namely: Independent elements, Linkage elements, Dependent elements and Autonomous elements. In order to gather experts' collective view on cluster classification, the following questions were asked in the questionnaire items:

   3.1 Do you agree with the classification of personalised m-learning elements in the Independent cluster?

   3.2 Do you agree with the classification of personalised m-learning elements in the Linkage cluster?

   3.3 Do you agree with the classification of personalised m-learning elements in the Dependent cluster?

3.4 Do you agree with the classification of personalised m-learning elements in the Autonomous cluster?

The following table (Table 6.10) shows the findings of Fuzzy Delphi analysis indicated threshold value 'd' for each item. This is followed by Table 6.11 which indicates the detailed findings of the experts' consensus agreement on the list of personalised m-learning elements in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the personalised m-learning curriculum implementation model.

Table 6.10
Fuzzy Delphi Analysis of experts' views on the cluster classification of personalised m-learning elements

Experts	**Items**			
	3.1	**3.2**	**3.3**	**3.4**
1	0.181	0.043	0.127	0.447
2	0.125	0.043	0.127	0.137
3	0.181	0.043	0.127	0.447
4	0.181	0.043	0.424	0.447
5	0.181	0.043	0.424	0.447
6	0.125	0.043	0.424	0.106
7	0.125	0.110	0.127	0.155
8	0.125	0.110	0.179	0.155
9	0.125	0.043	0.127	0.106
10	0.181	0.110	0.179	0.137
11	0.125	0.043	0.127	0.137
12	0.372	0.110	0.179	0.137
13	0.125	0.043	0.127	0.137
14	0.181	0.043	0.179	0.106
15	0.181	0.043	0.127	0.106
16	0.181	0.043	0.127	0.155
17	0.181	0.110	0.127	0.106
18	0.125	0.043	0.127	0.155
19	0.125	0.043	0.127	0.137
20	0.125	0.043	0.127	0.106
21	0.125	0.110	0.127	0.155
22	0.181	0.043	0.179	0.106
23	0.125	0.043	0.127	0.106
24	0.181	0.043	0.127	0.106
25	0.125	0.110	0.127	0.137
Threshold value (d)	0.159	0.062	0.173	0.179
% of experts' consensus	96	100	88	84
Fuzzy Score (A)	0.619	0.939	0.584	0.803

Table 6.11
Details analysis of experts' views on the cluster classification of personalised m-learning elements

Item	Triangular Fuzzy Numbers		Defuzzification Process			
	Threshold value each items	**Percentage of experts' consensus**	**m1**	**m2**	**m3**	**Fuzzy Score (A)**
3.1 Do you agree with the classification of personalised m-learning elements in the Independent cluster?	0.159	96	0.420	0.620	0.816	0.619
3.2 Do you agree with the classification of personalised m-learning elements in the Linkage cluster?	0.062	100	0.844	0.972	1.000	0.939
3.3 Do you agree with the classification of personalised m-learning elements in the Dependent cluster?	0.173	88	0.388	0.588	0.776	0.584
3.4 Do you agree with the classification of personalised m-learning elements in the Autonomous cluster?	0.179	84	0.652	0.824	0.932	0.803

Requirements: a) Triangular Fuzzy Numbers b) Defuzzification Process
i) Threshold value (d) ≤ 0.2 i) Fuzzy score (A) ≥ value α – cut = 0.5
ii) Percentage of experts' consensus ≥ 75.0%

Table 6.10 and Table 6.11 shows that the percentage of experts' consensus for item 3.2 (Agreement on the classification of the personalised m-learning elements in the Linkage cluster) show the highest percentage of consensus which is 100%. This is followed by the percentage of experts' consensus for item 3.1 (Agreement on the classification of the personalised m-learning elements in the Independent cluster) which shows 96%. The experts also consensually agreed on the classification of the elements in the dependent cluster (3.3 Agreement on the classification of the personalised m-learning elements in the Dependent cluster) and autonomous cluster (Agreement on the classification of the personalised m-learning elements in the Autonomous cluster) which scores 88% and 84% respectively. Table 6.11 indicates that all the items were in the range of requirement for triangular fuzzy number which is greater than 75%. Even though item 3.3 shows the value of Fuzzy Score (A) is 0.584, which is relatively low, but it still met the requirement of the deffuzification process which is equal or greater than Alpha α - cut value of 0.5. In fact, all the items in this questionnaires showed the Fuzzy Score (A) more than 0.5. Hence, the deffuzification values for all the items indicate that the experts consensually agreed on the cluster classification and the list of the personalised m-learning elements under each cluster as proposed in the personalised m-learning curriculum implementation model.

4. Experts' view on the relationships among the elements in the proposed personalised m-learning curriculum implementation model

   The three important features in the development of ISM for personalised m-learning curriculum implementation model are the personalised m-learning elements, the positioning of the elements, and the relationship among these elements in the development of the model. The findings of the first two features have been discussed before and the findings from the last feature, the relationship among the elements, will be discussed based on the following questionnaire items:

4.1 Do you agree with the relationships among the personalised m-learning elements in the Device Adaptation domain as shown in the model?

4.2 Do you agree with the relationships among the personalised m-learning elements in the Learner Adaptation domain as shown in the model?

4.3 Do you agree with the relationships among the personalised m-learning elements in the Situated Adaptation domain as shown in the model?

4.4 Do you agree with the OVERALL relationships among the personalised m-learning elements as shown in the model?

Table 6.12 shows the findings of experts' view on the questionnaire items in terms of relationship among personalised m-learning elements. This table shows the findings of Fuzzy Delphi analysis indicating threshold value ‘d’ for each item. This is followed by Table 6.13 which shows the details of the findings indicates the experts’ consensus agreement on the relationships among the personalised m-learning elements in three main domains: device adaptation domain, learner adaptation domain, and situated adaptation domain as proposed in the personalised m-learning curriculum implementation model.

Table 6.12

Fuzzy Delphi Analysis of experts' views on the relationship among personalised m-learning elements

Experts	**Items**			
	4.1	**4.2**	**4.3**	**4.4**
1	0.192	0.152	0.122	0.122
2	0.114	0.428	0.183	0.171
3	0.192	0.152	0.122	0.122
4	0.359	0.127	0.122	0.122
5	0.192	0.127	0.122	0.122
6	0.359	0.428	0.122	0.140
7	0.192	0.152	0.122	0.140
8	0.114	0.143	0.122	0.412
9	0.192	0.152	0.183	0.171
10	0.192	0.127	0.183	0.171
11	0.192	0.127	0.183	0.171
12	0.192	0.152	0.122	0.412
13	0.114	0.152	0.122	0.412
14	0.491	0.428	0.122	0.412
15	0.114	0.428	0.183	0.171
16	0.114	0.143	0.122	0.171
17	0.192	0.143	0.183	0.122
18	0.114	0.152	0.122	0.122
19	0.192	0.152	0.183	0.122
20	0.192	0.428	0.122	0.140
21	0.114	0.428	0.183	0.140
22	0.114	0.127	0.122	0.171
23	0.114	0.143	0.183	0.122
24	0.114	0.152	0.122	0.122
25	0.192	0.152	0.183	0.171
Threshold value (d)	0.186	0.212	0.147	0.187
% of experts' consensus	88	76	100	84
Fuzzy Score (A)	0.628	0.792	0.580	0.780

Table 6.13

Details analysis of experts' views on the relationship among personalised m-learning elements

Item	**Triangular Fuzzy Numbers**		**Defuzzification Process**			
	Thres hold value each items	**Percentage of experts' consensus**	**m1**	**m2**	**m3**	**Fuzzy Score (A)**
4.1 Do you agree with the relationships among the personalised m-learning elements in the Device Adaptation domain as shown in the model?	0.186	88	0.436	0.632	0.816	0.628
4.2 Do you agree with the relationships among the personalised m-learning elements in the Learner Adaptation domain as shown in the model?	0.212	76	0.652	0.812	0.912	0.792
4.3 Do you agree with the relationships among the personalised m-learning elements in the Situated Adaptation domain as shown in the model?	0.147	100	0.380	0.580	0.780	0.580
4.4 Do you agree with the OVERALL relationships among the personalised m-learning elements as shown in the model?	0.187	84	0.628	0.796	0.916	0.780

Requirements: a) Triangular Fuzzy Numbers *b) Defuzzification Process*
i) Threshold value (d) ≤ 0.2 *i) Fuzzy score (A) ≥ value α – cut = 0.5*
ii) Percentage of experts' consensus ≥ 75.0%

Based on Table 6.13, item 4.3 (Agreement on the relationships among the personalised m-learning elements in the Situated Adaptation domain in the model) received 100% consensus among the experts. The experts also show strong agreement on both items 4.1 (Agreement on the relationships among the personalised m-learning elements in the Device Adaptation domain as shown in the model), and 4.4 (Agreement on the overall relationships among the personalised m-learning elements as shown in the model) where the percentage of experts' consensus is 88% and 84% respectively. However, item 4.2 (Agreement on the relationship among the personalised m-learning elements in the Learner Adaptation domain in the model) received a slightly low percentage of experts' consensus compared to other questionnaire items which is 76%. All the items in this questionnaires showed the Fuzzy Score (A) more than 0.5 and met the requirement of the deffuzification process which is equal or greater than Alpha α - cut value of 0.5. This also indicates that all the items were in the range of requirement for triangular fuzzy number which is the percentage of experts' consensus is greater than 75%. Thus, all the experts consensually agreed with these questionnaire items on the relationships among the personalised m-learning elements in these three domains (Device Adaptation domain, Learner Adaptation domain, and Situated Adaptation domain) as proposed in the personalised m-learning curriculum implementation model.

5. Experts' view on the overall usability of the personalised m-learning curriculum implementation model in the teaching and learning

The final part of questionnaire items were on the experts' view on the usability of the model in aiding the teaching and learning process in order for the students to fulfil their learning goal. The experts' view were extracted from their responds to these following questionnaire items:

5.1 The model shows a clear guide on how personalised m-learning could be conducted in complementing the traditional classroom learning.

5.2 The model shows clearly on the elements to be considered before designing a curriculum to implement a personalised learning for mobile devices in order to provide personalised learning experience.

5.3 The model shows clearly on how elements in different domain in personalised m-learning could merge to offer personalised learning experience to the learners.

5.4 The model shows clearly how personalised m-learning elements are connect to each other in aiding the learners in achieving the learning objectives.

5.5 The model could be used to assist planning of course unit lessons by the lecturer in facilitating students' in personalised m-learning.

5.6 The model could be used as an example to develop other curriculum implementation models for other courses.

The findings of Fuzzy Delphi analysis which indicates threshold value 'd' for each item for these questionnaire shown in Table 6.14. This followed by Table 6.15 which shows the details of the findings of the experts' consensus agreement on the overall usability of the model in the context of teaching and learning.

Table 6.14
Fuzzy Delphi Analysis of experts' views on the usability of the model in teaching and learning

Experts	Items					
	5.1	**5.2**	**5.3**	**5.4**	**5.5**	**5.6**
1	0.136	0.115	0.132	0.164	0.169	0.194
2	0.155	0.190	0.160	0.128	0.123	0.198
3	0.136	0.115	0.132	0.164	0.169	0.194
4	0.430	0.115	0.132	0.164	0.093	0.066
5	0.155	0.362	0.132	0.094	0.123	0.066
6	0.136	0.115	0.125	0.164	0.123	0.194
7	0.155	0.362	0.125	0.128	0.123	0.066
8	0.136	0.190	0.427	0.128	0.169	0.194
9	0.430	0.190	0.427	0.164	0.461	0.066
10	0.155	0.190	0.125	0.094	0.169	0.194
11	0.136	0.190	0.125	0.094	0.461	0.198
12	0.123	0.190	0.132	0.459	0.123	0.488
13	0.136	0.115	0.132	0.164	0.093	0.198
14	0.123	0.190	0.132	0.128	0.169	0.198
15	0.123	0.115	0.132	0.128	0.123	0.194
16	0.430	0.190	0.160	0.094	0.093	0.198
17	0.155	0.115	0.160	0.164	0.169	0.066
18	0.155	0.190	0.160	0.164	0.093	0.066
19	0.136	0.115	0.132	0.164	0.169	0.198
20	0.123	0.190	0.125	0.128	0.169	0.066
21	0.155	0.115	0.160	0.128	0.169	0.198
22	0.123	0.115	0.132	0.128	0.093	0.066
23	0.136	0.115	0.132	0.094	0.123	0.194
24	0.123	0.115	0.125	0.164	0.123	0.194
25	0.136	0.190	0.160	0.164	0.123	0.198
Threshold value (d)	**0.173**	**0.168**	**0.161**	**0.150**	**0.161**	**0.166**
% of experts' consensus	**88**	**92**	**92**	**96**	**92**	**96**
Fuzzy Score (A)	0.791	0.625	0.788	0.811	0.813	0.831

Table 6.15

Details analysis of experts' views on the usability of the model in teaching and learning

Item	Triangular Fuzzy Numbers		Defuzzification Process			
	Threshold value each items	**Percentage of experts' consensus**	**m1**	**m2**	**m3**	**Fuzzy Score (A)**
5.1 The model shows a clear guide on how personalised m-learning could be conducted in complementing the traditional classroom learning.	0.173	88	0.636	0.808	0.928	0.791
5.2 The model shows clearly on the elements to be considered before designing a curriculum to implement a personalised learning for mobile devices in order to provide personalised learning experience.	0.168	92	0.428	0.628	0.820	0.625
5.3 The model shows clearly on how elements in different domain in personalised m-learning could merge to offer personalised learning experience to the learners.	0.161	92	0.628	0.804	0.932	0.788

Table 6.15 (Continued)

Item	Triangular Fuzzy Numbers		Defuzzification Process			
	Threshold value each items	Percentage of experts' consensus	m1	m2	m3	Fuzzy Score (A)
5.4 The model shows clearly how personalised m-learning elements are connect to each other in aiding the learners in achieving the learning objectives.	0.150	96	0.660	0.828	0.944	0.811
5.5 The model could be used to assist planning of course unit lessons by the lecturer in facilitating students' in personalised m-learning.	0.161	92	0.668	0.832	0.940	0.813
5.6 The model could be used as an example to develop other curriculum implementation models for other courses.	0.166	96	0.684	0.852	0.956	0.831

Requirements: a) Triangular Fuzzy Numbers *b) Defuzzification Process*
i) Threshold value (d) ≤ 0.2 *i) Fuzzy score (A) ≥ value α – cut = 0.5*
ii) Percentage of experts' consensus ≥ 75.0%

Based on Table 6.15, the experts were consensually agreed (96%) that the model shows clearly on how personalised m-learning elements are connect to each other in aiding the learners in achieving the learning objectives (item 5.4). The same percentage of experts also consensually agreed that the model could be used as an example to develop other curriculum implementation models for other courses (item 5.6). The experts also show consensually agreement on item 5.2 (The model shows clearly on the elements to be considered before designing a curriculum to implement a personalised learning for mobile devices in order to provide personalised learning experience), 5.3 (The model shows clearly on how elements in different domain in personalised m-learning could merge to offer personalised learning experience to the learners), and 5.5 (The model could be used to assist planning of course unit lessons by the lecturer in facilitating students' in personalised m-learning) where the items share the same percentage of consensus of 92% respectively. However, the percentage of experts' consensus is slightly low (88%) compared to other items in item 5.1 (The model shows a clear guide on how personalised m-learning could be conducted in complementing the traditional classroom learning) but still greater than the minimum consensus required (75%). In fact, all the items were in the range of requirement for triangular fuzzy number which is the percentage of experts' consensus is greater than 75%. It also shows that all the items recorded the value of Fuzzy Score (A) more than the Alpha α - cut value of 0.5. Hence, all the items have met the requirements needed in the triangular fuzzy number and deffuzification process which revealed that all experts consensually agreed with these questionnaire items. Overall, the experts were on high agreement note that the personalised m-learning curriculum implementation model is suitable to be implemented as a guidance to employ personalised m-learning in complementing the traditional face-to-face classroom learning.

6.3 Conclusion

The following table (Table 6.16) shows the overall mapping result for all five aspects discussed above in evaluating the model. This table indicates the defuzzification values and ranking of the questionnaire items. The ranking of the items indicates how an item compares with other items in the degree of agreement among the experts. The highest ranking consistent with the highest defuzzification value registered to the particular item.

Table 6.16
Defuzzification Value and Ranking of the Items

Items	Threshold value, d	Fuzzy Score (A)	Ranking
1.1	0.147	0.755	12
2.1	0.123	0.633	14
2.2	0.136	0.644	13
2.3	0.097	0.905	2
2.4	0.212	0.800	7
3.1	0.160	0.619	17
3.2	0.062	0.939	1
3.3	0.173	0.584	18
3.4	0.179	0.803	6
4.1	0.186	0.628	15
4.2	0.212	0.792	8
4.3	0.146	0.580	19
4.4	0.187	0.780	11
5.1	0.173	0.791	9
5.2	0.168	0.625	16
5.3	0.161	0.788	10
5.4	0.150	0.811	5
5.5	0.161	0.813	4
5.6	0.166	0.831	3

In conventional Fuzzy Delphi, as explained in Chapter 3, the ranking of the items is to determine the element for the scope of a case being studied. Items with higher rank could be considered as an element chosen as the result of the study. However, in this study, the ranks were used to compare the level of consensus among the experts for the questionnaire items. From the table 6.16, item 3.2 (Agreement on the classification of the personalised m-learning elements in the Linkage cluster) is ranked among the experts with Fuzzy Score (A) value 0.939 while item 4.3 (Agreement on the relationships among the personalised m-learning elements in the Situated Adaptation domain in the model) received the lowest rank in the level of experts' agreement.

In this evaluation phase, the model which has been developed was evaluated using the Fuzzy Delphi Method (FDM). This is to determine the usability of the model as a guideline for the instructor in implementing personalised m-learning to support in the formal classroom learning. Experts from education field who have knowledge in the field of this study, were selected to evaluate the model. The evaluation was made in terms of experts' agreement on: 1) the suitability of the elements proposed in the personalised m-learning model; 2) the domain classification of the elements in the proposed personalised m-learning model; 3) cluster classification of the elements in the proposed personalised m-learning model; 4) the relationships among the elements in the proposed personalised m-learning model; and 5) the overall usability of the personalised m-learning curriculum implementation model in the teaching and learning.

The analysis of questionnaire findings for FDM is based on the requirements contained in the triangular fuzzy number and deffuzification process. The triangular fuzzy number take into consideration of the threshold value 'd' and the percentage of the experts' consensus for each item. The threshold value 'd' for each item measured must be less than or equal to 0.2 to indicate the expert's consensus with other experts for a particular item in the survey questionnaire. Whereas, the percentage of agreement of the experts must be more than or equal to 75%. As for the deffuzification process, there is only one condition which is the Fuzzy Score (A) must be greater than or equal to the α-cut value of 0.5.

Based on the overall findings, all the items have met the requirements needed in the triangular fuzzy number (less or equal to 0.2 for threshold value, d, and more than 75% for the percentage of experts' consensus) and deffuzification process (more than the Alpha α - cut value of 0.5). This revealed that all the experts consensually agreed with all questionnaire items. Hence, according to the experts, the proposed personalised m-learning curriculum implementation model is suitable to serve as a guideline for the instructor in implementing personalised m-learning to support the formal classroom learning.

CHAPTER 7

SUMMARY AND DISCUSSION

7.1 Introduction

This final chapter recap and discuss the presentation of the findings, implications and recommendations of the study carried out in three phases: The Need Analysis phase (Phase 1), The Design and Development phase (Phase 2) and The Evaluation phase (Phase 3). The needs analysis phase concluded the need for the development of the personalised m-learning curriculum implementation model for Food and Beverage Service course in diploma in hospitality programme. This was based on students' view. In phase 2, the focus is to develop the personalised m-learning curriculum implementation model using Nominal Group Technique (NGT) and Interpretive Structural Modeling (ISM) approaches. This was done based experts' opinion and decision. And the last phase, evaluation phase, employed Fuzzy Delphi Method (FDM) to evaluate the personalised m-learning curriculum implementation model by selected experts to determine the usability of the model to support the formal classroom teaching and learning.

7.2 Summary of Findings

The following sections elaborate the findings of each phase. This is followed by the discussion on the implications and recommendations of the study. This section also contain the practical implications, theoretical implications and the methodology implications. Finally, the chapter ends with the future possible directions of the study.

7.2.1 Summary of Findings for Phase 1: The Need Analysis Phase

The personalised m-learning curriculum implementation model has been proposed in aiding the instructor for the teaching and learning process for students enrolled in Food and Beverage Service course in diploma in hospitality programme. This proposed model intended to provide guidance to instructors in implementing personalised m-learning in their teaching process. However, before the proposed model can be developed, it is important to investigate learner's readiness, acceptance, and satisfaction in using personalised m-learning in their learning needs. The outcome from this phase is used as a basis for the development of personalised m-learning curriculum implementation model for a greater learning experience for students in hospitality programme. The needs analysis was conducted using the needs analysis survey questionnaire which consist a total of 60 questions divided into five parts:

1. Students' demographic details and mobile device profile
2. Students' use of mobile device
3. Students' perception on the current teaching and learning setup
4. Students' perception on personalised m-learning and Food and Beverage Service course
5. Students' acceptance and intention to use personalised m-learning to learn this course

The main aim of this questionnaire is to access the students' opinion on the current state of the learning, the need to have personalised m-learning as their learning support as well as their level of acceptance on the implementation of personalised m-learning into their curriculum and most importantly the delivery of the learning content based on their learning preferences, their mobile devices and the environment (surrounding). The fifth part of survey questionnaire items were guided by Unified Theory of

Acceptance and Use of Technology (UTAUT), a theory of technology acceptance proposed by Venkatesh et al. (2003). This needs analysis survey questionnaire was distributed to a specific group of 50 students enrolled in Food and Beverage course. Purposive sampling method was used to select the students for this study which attempted to develop the personalised m-learning curriculum implementation model for this course. Analysis of data was conducted using descriptive statistics via Statistical Package for Social Science (SPSS) software. The findings comprised of data with descriptive statistics through the analysis of mean, standard deviation, percentage, and frequency to determine the needs to develop the personalised m-learning curriculum implementation model based on the students' view. The following section discuss the findings of needs analysis stage based on the research questions:

1.1 Students' mobile devices and capabilities of these devices

In the process of implementing personalised m-learning, the mobile device itself considered as a learning tool and the ownership of this device is important since it give students feeling of true ownership and opportunities to take control of their own learning. The finding also revealed that (Table 4.1) majority of the respondents were with intermediate capability where they can make basic voice call and SMS with limited Internet browsing capability. In fact, all the students surveyed own a smart phone where this device have at least a minimum capacity to carry out mobile learning with 32% having more than one mobile device. This findings are important as the use of mobile technology is an essential criteria in technology based education (Quinn, 2011). According to Garrison and Anderson (2000), technology equipment can be used as a medium of instruction as it has a privilege not shared by other learning media. This shows that the personalised m-learning can be implemented since the students have readily access to mobile technology (mobile device and Internet accessibility).

1.2 Students' perceptions on their current ways of teaching and learning setup for Food and Beverage Service course

The findings from this stage justified that there is a need to make changes to the existing teaching and learning method (Table 4.4). The surveyed students perceived that the current face-to-face session for theory and practical part of the course are not enough to obtain the knowledge required to master this course. The overall finding indicated that in order for the surveyed students improve their knowledge acquired in this course, the need to support the learning course should be considered. Thus, the personalised m-learning intervention was proposed to aid the students to fulfil the course outcomes while assisting their learning needs.

1.3 Students' perceptions on implementing personalised m-learning to support the teaching and learning of Food and Beverage Service course

Table 4.5 discussed students' perceptions on implementing personalised m-learning to support the teaching and learning of Food and Beverage Service. This is to investigate he students' use of personalised m-learning as access to technology is an important criteria in technology based education (Jones, Valdez, Nowakowski, & Rasmussen, 1995; Quinn, 2011). The surveyed students wanted to have control on the learning material presented to them. It was reflected by the highest mean value of 4.38 (item 8) in this part of the questionnaire. Personalised m-learning could be a solution to the problem they faced since majority of them believed that learning with mobile device could motivate them to achieve better study outcomes which has reflected by the mean value of 4.10 (item 9).

1.4 Students' level of acceptance and intention to use personalised m-learning if incorporated into the formal Food and Beverage Service course

The main aim of this part of questionnaire is to access the students' acceptance and intention on the implementation of personalised m-learning into their curriculum. The findings are discussed based on all the main constructs in the UTAUT model which are performance expectancy, effort expectance, attitude towards using technology, social influence, facilitating conditions, self-efficacy, behavioral intention to use personalised m-learning, and anxiety. In terms of performance expectancy, the surveyed students agreed that personalised m-learning would further improve the participants' learning process and increase their productivity (Table 4.6). Based on Kijsanayotin, Pannarunothai, & Speedie (2009) explanation, students believed that proposed personalised m-learning is easy to use. A person's attitudes are the driving force for the adoption of the technology (Straub, 2009). The surveyed results indicate that the students were positive in their attitude towards using personalised m-learning. In terms of social influences, the findings revealed that the institution and lecturer play an important role in convincing the students to use the personalised m-learning. They also strongly believed that they have the necessary device to aid them in using personalised m-learning without assistance (Table 4.10 and Table 4.11). The findings also revealed that the surveyed students had the intention to use the personalised m-learning for this course immediately and they are not afraid of facing the risk of using personalised m-learning such as the loss of important information when they selecting their preferences. Overall, the findings revealed the students' acceptance, readiness, and intent to use this personalised m-learning as support to formal classroom learning.

The findings from the research questions of the needs analysis stage justified that there is a need to develop personalised m-learning implementation model for Food and Beverage Service course. Overall findings suggested that the students are eager and ready to use this personalised m-learning to support their formal classroom teaching and learning.

7.2.2 Summary of Findings for Phase 2: Design and Development Phase

This section elaborates the discussion of the findings for the design and development of the model. The design and development for personalised m-learning curriculum implementation model sought to answer the following research questions and the findings of this design and development stage are discussed here:

2.1 Experts' collective views on personalised m-learning elements which should be included in the development of personalised m-learning curriculum implementation model

The proposed personalised m-learning elements generated from literature review (pre-listed personalised m-learning elements). This draft list of elements consist of student's learning preferences, mobile device capabilities, and student's environment. This list was served as a guide for the experts to identify the appropriate elements for inclusion in the personalised m-learning model. The process of identifying and determining of the element through experts' opinion called nominal group technique (NGT). During the NGT session, these elements in the list would be agreed upon either to be included in the model, grouped together, or discarded totally. Experts also free to add new elements that they find suitable to be included in the final list for the personalised m-learning model. At the end of NGT session, the experts proposed the final list of personalised m-learning elements that they have agreed upon. The final list contain 31 personalised m-learning elements which experts consensually agreed upon.

2.2 Experts' collective views on the relationships among the personalised m-learning elements in the development of the personalised m-learning curriculum implementation model

In response to this research question, the contextual relationship among personalised m-learning elements was developed with respect to each other. The development of this relationship were based on experts' opinion with the aid of Interpretive Structural Modeling (ISM) technique. ISM technique is an effective tool in making decisions especially in the economic and business sector (Warfield, 1974). Based on the findings, 31 personalised m-learning elements were finalised and relationship among these elements are determined by the experts based on pair wise technique with the aid from the Concept Star software.

2.3 Experts' collective views on the classification of personalised m-learning elements in the interpretation of the personalised m-learning curriculum implementation model

Based on the findings for this phase, the research question 2.3 resulted in the classification of the personalised m-learning elements into three domain to facilitate interpretation of the model. These domains are

Device Adaptation domain, Learner Adaptation domain and Situated Adaptation domain. The Device Adaptation domain consist of personalised m-learning element that needs the personalisation according to the students' preferences and mobile device capabilities which need to be performed at device level. The Learner Adaptation domain are perhaps the most important personalised m-learning elements since it interact directly with the students and their learning preferences. The adaptation of personalised m-learning elements in this domain involved the students' learning preferences and the students' mobile device connectivity at the point of content request and/or delivery. And the Situated Adaptation domain consist of personalised m-learning element involved the students' learning preferences and the students' learning environment or surrounding at the point of content request and/or delivery. The reviewed ISM model with these domains for the personalised m-learning curriculum implementation model for Food and Beverage service course is shown in Figure 5.2.

The personalised m-learning elements were then analysed to form a driver-dependence matrix. Based on the elements' driving power and dependence power, the personalised m-learning elements are further classified according to clusters using MICMAC analysis. The classification is divided these elements into four clusters (Mandal & Deshmukh, 1994); a) Autonomous elements; b) Dependent elements; c) Linkage elements; and d) Independent elements. The clusters indicated how the personalised m-learning elements were related among each other in terms of the flow and priority of elements in order to achieve the learning course objectives.

7.2.3 Summary of Findings for Phase 3: Evaluation of the Model

The final phase of this study was the evaluation of the personalised m-learning curriculum implementation model for Food and Beverage Service course, which was developed in Phase 2. The findings from this evaluation phase indicates the consensus agreement among the panel of experts on the usability of the personalised m-learning curriculum implementation model which has been developed in phase two using the Interpretive Structural Modeling (ISM) approach. Based on the research questions, the model was evaluated based on the following five aspects:

1) The suitability of the elements (personalised m-learning elements);
2) The domain classification of the personalised m-learning elements;
3) The cluster classification of the personalised m-learning elements;
4) The relationships among the personalised m-learning elements; and
5) The overall suitability of the model in supporting the formal classroom teaching and learning for this course.

A total of 25 experts were selected for this evaluation phase to evaluate the model which was developed in phase 2 of the study. The evaluation of the personalised m-learning curriculum implementation model adopted the modified Fuzzy Delphi method (FDM) which was elaborated in the methodology. The experts have responded to the evaluation questionnaires consisting of 28 questions which was divided into 3 parts. The first part of the survey questionnaire is about the experts' background information. The second part presents the experts’ use of mobile technologies in their daily life. The third part presents the experts’ views on the suitability of the personalised m-learning curriculum implementation model. This part of the questionnaires comprises of five aspects that need to be evaluated.

Based on the overall threshold value 'd' (Table 6.4), the percentage of experts' agreement which is 89.89% (Table 6.5) has exceeded the required consensual agreement of 75% ($d \leq 0.2$). In the defuzzification process, all the items showed the fuzzy scores (A) more than the value of Alpha α-cut of 0.5 which showed consensual agreement among the experts of the proposed personalised m-learning model.

As for the experts' views on the suitability of the personalised m-learning curriculum implementation model, first, the suitability of personalised m-learning elements were evaluated. The findings showed that these elements are suitable for personalised m-learning curriculum implementation model based on the threshold value 'd', the percentage of experts' agreement and the Fuzzy Score (A) (Table 6.7). The next items being evaluated are related to the classification of personalised m-learning elements into domains. The findings revealed that the experts consensually agreed with all the items based on the threshold value 'd' ≤ 0.2, the percentage of experts' consensus ≥ 75% and the Fuzzy Score (A) $\geq \alpha - \text{cut} = 0.5$ (Table 6.9). The experts also consensually agreed on the classification of personalised m-learning elements into clusters. The findings showed that it fulfilled all the requirements of the threshold value 'd', the percentage of experts' agreement and the Fuzzy Score (A) (Table 6.11). The next evaluation is on the relationships among the personalised m-learning elements which considering the positioning of these elements into the three domains. Findings from the Table 6.13 revealed that all the items were in the range of the requirements for the threshold value 'd', the percentage of experts' agreement and the Fuzzy Score (A). This indicates that all the experts consensually agreed with the relationships among the personalised m-learning elements into the three domains.

The final part of questionnaire items were on the experts' view on the usability of the model in aiding the teaching and learning process in order for the students to fulfil their learning goal. Finding from Table 6.15 revealed that the experts were consensually agreed that the model shows a clear guide on how personalised m-learning could be conducted in complementing the conventional face-to-face classroom learning. The experts also consensually agreed to the model that shows clearly on the elements that need to be considered before designing a curriculum to implement a personalised learning for mobile devices in order to provide personalised learning experience. The model also shows clearly on how elements from different domain could merge to offer a holistic learning experience for the students. The experts also consensually agreed to the model which clearly on personalised m-learning elements are connected to each other in aiding the learners in achieving the course's learning objectives. Finding from Table 6.15 also revealed that the model could be used to assist planning of course unit lessons by the lecturer in facilitating students' in personalised m-learning, and the model could be used as an example to develop other curriculum implementation models for other courses. Based on the threshold value 'd' and the defuzzification values, the findings conclusively suggest that the experts have consensually agreed to all the items in the evaluation aspects of the model. This concluded that the experts consensually agreed that the proposed personalised m-learning model is suitable to be used as a guide for the lecturers to implement personalised m-learning as learning support in teaching and learning process.

7.3 Discussion of the Study

The personalised m-learning is not about learner who need to conforms to the requirement of the system but it is about the system that need to conform to the needs and preferences of the learner. In personalised m-learning, the learner will be able to create learning experience in diverse locations and the learner's preference and needs changes in each location. Personalised m-learning cannot be viewed as new ways to distribute learning resources but it's more than that where it understand the learner and distribute learning resources based on needs and preferences of a learner. As suggested in the conceptual framework in Chapter 2 (figure 2.6), this study adopted the PALLAS, IMLIS and Methodic model to be used as a guidance in the design and development of personalised m-learning curriculum implementation model. This section starts with the discussion on the similarities and differences between these application/model compare to the suggested personalised m-learning curriculum imeplementation model.

PALLAS (Sobah & Jan-Kristian, 2008) was developed to provide personalised and contextualised access to learning resources. This system provides personalised learning resources according to the learner's needs and interests and presenting it to the learner rather than the learner having to look for it. Similarly, the personalised m-learning curriculum implementation model also focuses on the learner's needs and preferences to customise the learning resources. The personalisation of the learning content in this study suggested through the identification of personalised m-learning elements based on learner's need, preferences, surrounding environment and mobile device used to engage in learning activities. Furthermore, the PALLAS system uses dynamic and static parameters in order to do personalisation where the dynamic parameters are updated automatically by the system and the static parameters are provided by the learner. Information on dynamic parameters such as environmental parameters include location, time and day and the mobile device that is used by the learner collected automatically by the system for personalisation. Based on learner's context, learning resources in PALLAS will be selected and/or suggested for personalisation before it deliver the context specific content or tasks to the learner. In contrast to this, the development of personalised m-learning curriculum implementation model did not suggest the collection of dynamic parameter but it allow the learner to decide on the personalisation. For example, eventhough the learner is on the move and in a noisy environment, if the learner still wanted to listen to an audio in noisy environment, the personalisation need to perform based on the learner's requirement. The suggested model did not decide type of personalisation or content that need to be distributed to the learner. But the personalisation of learning resources will consider information of dynamic and static parameter when the learner make a learning request.

Another adopted project, IMLIS (Saeed Zare, 2010), is a project to develop personalised m-learning system for people with mental/learning disabilities based on their specific abilities. This system was built to support m-learning activities for people with cognitive disabilities within different contexts. This system uses decision engine to enhance personalisation by analysing user's abilities, learning history and reactions to processes. It's works on adaptation, adjustment and personalisation of content, learning activities, and the user interface on different levels in a context where learners and teachers are targeting autonomous learning by personalised lessons and feedback. The similarities between IMLIS and this study is that both suggested adaptation to be performed based on needs for an individual learner. There is no one size fit all concept where learning materials adapted the same way for all or a group of leaners. Besides this, IMLIS and this study also look at learning styles of the learner in order to perform content personalisation. However, since IMLIS system is for student with special needs, teachers are responsible to create personalised learning resources after analysing specific steps and influencing factors for content adaptation. IMLIS allows teachers to control learner's activities and plant their learning process. Wherelse, in personalised m-learning curriculum implementation model, the learner has full control of his learning activities and this is done by controling the content personalisation process. Unlike IMLIS where the system develop different digital learning resources for each learner, this study's proposed model suggested that each learner will create one learning resources based on his needs, preferences, surrounding environment and device he owns.

The Methodic model (Iva, Lidija, and Mario, 2011) developed content personalisation to support the teaching of mathematics. The personalisation of learning contents are encompossed and adjusted to the m-learning. This model aimed to provide learning content to every student, at any location, the moment he decide to learn mathematics. The similarities between this Methodic model and personalised m-learning curriculum implementation model is that, both allow the learner to interact with the learning content and decide on the content adaptation. The learner can perform this according to his individual needs for an optimal way of learning. Similarly, both model also offer many posibility of choices and different combinations of learning styles. However, Methodic model divide the educational materials into theory, video clips of the teacher, mathematical problems, video solutions of the problem, and interactive play. Eventhough this model provide many possible ways to learn mathematics according to the learner, but each mathematic lesson is divided according to the same methodic model. In contrast, the personalised m-learning implementation curriculum implementation model suggest to offer the same content in different format (video, audio, image, text and etc.) based on learner's requirement. The learner has freedom to select available learning resources based on their needs, preferences and learning styles. The personalisation of thsi learning resources also influence by the environment and capabilities of the mobile device used when the students engage in the learning activities.

The aim of this study was to develop personalised m-learning curriculum implementation model to support formal learning of diploma students who enrolled for Food and Beverage Service course in hospitality management programme. The outcome of this study suggested that the potential use of personalised m-learning in formal education is encouraging and will have an impact in teaching and learning process in this course. However, the concept of personalised m-learning and the implementation model of this personalised m-learning is still new. Proper planning in the implementation of this personalised m-learning in formal learning believed will bring benefits for students. This model was developed to aid the students in this course to have access to their learning materials according to their learning preferences and learning environment. The finding also indicated that the developed model can be used to assist planning of course unit lessons by the lecturer in facilitating students in personalised m-learning.

This study also discussed relevant concepts and past studies of personalised m-learning and how it can be used in supporting the formal classroom teaching and learning in order to provide personalised learning experience to the students. This study highlights important elements in personalised m-learning in regards to the students learning preferences and learning environment. These personalised m-learning elements can be used to perform adaptations to provide learning materials according to the students' preferences. The developed personalised m-learning curriculum implementation model for this Food and Beverage Service course is expected to improve the teaching and learning experiences for the students and could be used as guideline to develop other model for other courses. This study employed Design and Development Research (DDR) approach in order to develop this model. This DDR approach was introduced by Richey and Klein (2007). This approach consist of three phases, Needs Analysis phase, Design and Development phase, and Evaluation phase.

The needs analysis study which is the first phase in DDR approach, aimed to identify the need to develop personalised m-learning curriculum implementation model for Food and Beverage Service course. In order to do that, four research questions were formulated. Need analysis survey questions were used to measure the students' perceptions and intention to use personalised m-learning, their perceptions on their current ways of teaching and learning setup for Food and Beverage course, and the capabilities of their mobile devices. The findings indicated that the students own mobile device that have minimum capacity to perform m-learning and this case personalised m-learning. The survey also revealed that the current teaching and learning setup for this course were not enough to obtain the knowledge required for this course. Students also believed that personalised m-learning could be a solution to fulfil the course outcomes and their learning needs for this course. The findings also revealed that the students' acceptance and intention to use personalised m-learning to support their formal classroom learning. This needs analysis phase concluded that there is a need to develop the personalised m-learning curriculum implementation model.

The design and development stage which is the second phase in DDR approach, aimed to develop the proposed model for personalised m-learning curriculum implementation model for Food and Beverage Service course. In this stage, Nominal Group Technique (NGT) and Interpretive Structural Modeling (ISM) techniques were adopted to develop the proposed model. The development of this model was based on panel of experts' integrated views and opinions. The experts' views and opinions were facilitated through Interpretive Structural Modeling (ISM) technique session with the aid of Concept Star software. The findings revealed the experts' collective views on the personalised m-learning elements and the relationships among these elements. There were 31 personalised m-learning elements which the experts consensually agreed upon. Then, the relationship among these elements were determined by experts using Concept Star software. With this, the personalised m-learning curriculum implementation model was created. The experts suggested that the personalised m-learning elements in this model could be divided into three domains. These domains are Device Adaptation Domain, Learner Adaptation Domain and Situated Adaptation Domain. A reviewed model for personalised m-learning implementation model was created with these domains.

The final phase of the DDR approach is the evaluation phase. The study at this phase aimed to evaluate the personalised m-learning curriculum implementation model which was created at the previous phase. A total of five research questions were formulated to evaluate the model in order to determine the suitability of the personalised m-learning elements used in this model and the relationship among these elements. The questions also evaluate the suitability of the model in supporting the formal classroom teaching and learning for Food and Beverage Service course. This phase adopted the modified Fuzzy Delphi Method (FDM) to determine the consensus views of 25 selected experts in validating the proposed model. The experts responded to a total of 28 questions in the evaluation questionnaire in a five-point linguistic scale. The experts' consensus for all the questionnaire items are determine by the threshold value 'd'. The experts' agreement for the items on the other hand are determine by the defuzzification values of the items. Based on the threshold value 'd' and the defuzzification values, the findings conclusively suggest that the experts have consensually agreed to all the items in the evaluation aspects of the model. Hence, this concluded that, the experts consensually agreed the suitability of the proposed personalised m-learning curriculum implementation model to be used as a guide in teaching and learning process.

7.4 Implications of the Study

The findings of the study discussed in previous sections do have implications and the main three main implications are; the practical implications, the theoretical implications, and the methodology implications. Detail of these implications are discussed in the following sections.

7.4.1 Practical Implications of the Study

Personalised m-learning is gaining acceptance as new way of learning since the learner determine the learning experience they want to create around their mobile devices. This is evidenced by the result of this study where students wanted their learning materials tailored according to their demand (Table 4.5). This also reflected in the development of personalised m-learning curriculum implementation model where the students' learning materials adapted according to their preferences, mobile device capabilities and their environment. The result from the data analysis justified the need for the development of personalised m-learning curriculum implementation model and the level of acceptance of the students if the personalised m-learning were used in teaching and learning. Based on the findings, the students also believed that in order to keep their attention focused, the students preferred learning materials presented in a way that they wanted. This personalised m-learning can happen in and/or out of formal classroom setup. This model consist of elements that support personalised m-learning to cater for different individual learning needs. Through this model, students decide learning materials that they want to receive based on their preferences, while looking into their current environment (surrounding) and their mobile device capabilities. With these adaptations, the students only receive content that suits their learning requirement at that point of time. Hence, this model support the students to achieve their learning outcomes by tailored their learning materials based on the students' preferences and gives anytime, anywhere and any device learning.

In facilitating the development of the model, the study was focused to design personalised m-learning curriculum implementation model to a specific course, Food and Beverage Service, for diploma students in a private higher education institution in Malaysia. But the study through the development of the model and the result of this study will also be able to contribute to the implementation of personalised m-learning for other courses as well. This pedagogical model can also be used to support a formal classroom teaching and learning. Through this learning method of personalised m-learning, the students can explore the new way of learning which gives them control over the learning materials that they want to receive. This will bring excitement to the students and they will be able to keep their attention focused on their own adopted materials.

The Ministry of Higher Education and the management of private higher education institutions may refer to the outcomes of this study in adding value to the available infrastructure at these institutions in terms of technology setup and suitable mobile devices for personalised m-learning in supporting a formal classroom teaching and learning. The ministry also may need to collaborate with mobile technology providers especially the telecommunication provider to make Internet access (data plan) affordable for the students. The findings of the study also will help in identifying new teaching and learning skills needed by both course instructors and students in managing this personalised m-learning via their mobile devices. The outcome of this study will not neglect the traditional classroom teaching and learning practices but this study focuses on aspects of teaching and learning of personalised m-learning approach to enhance and support in face-to-face traditional classroom teaching.

7.4.2 Theoretical Implications of the Study

Theory is the fundamental in any study. For every educational effort, there are always a theory or idea that will describe how the learner's mind works and how the learner should be taught (Hakkarainen, Lonka & Lipponen 1999). The way to use the mobile devices to support learning strongly linked pedagogical theories and its' strategies. In this study, the theoretical framework that guides the development of the model divided into two. The first part elaborates the theories involved in achieving the intended learning outcomes from personalised m-learning. And the second part focuses on the models adopted into the development of curriculum implementation model for diploma student in hospitality programme. The basic principle of personalised learning belief that each student is unique and learns in different ways. Personalised learning is originated from Howard Gardner's theory of multiple intelligence (G. H., 2004; Johnson 2004) and focused on individual student's interests, their needs and abilities, and the identification of the best learning style for each student (Good & Brophy, 1990).

Personalised learning strategies are in line with constructivist learning theories (Savery & Duffy, 1995; Pritchard 2013), which underline that learning is active and knowledge is built on top of own experiences. Constructivist learning theory demonstrate how a traditional learning theory can impact a new innovative technology (Thomas Craig & Michelle Van Lom, 2010). Constructivism learning theory places learners in an open-ended learning environment in which they build their own meaning from knowledge and content. In order to do that, the correct content need to be make available to the students and this can be achieved through personalised m-learning. It is also important for learning to take place in realistic settings and for the learning tasks to be relevant to the learner (Ertmer, & Newby, 1993). In personalised m-learning, the students knew what content are relevant to them at that point of time and accessing them will help them achieve their learning goal. Therefore, constructivist learning environment should provide rich experiences that encourage students to learn.

Connectivism learning theory was introduced by Siemens (2005) for learning in digital age. This theory explains how technologies have created new opportunities for people to learn and share information across. In connectivist learning, a teacher will guide students to information and answer key questions as needed, in order to support students learning and sharing on their own and with their own tools/devices. In this study, mobile devices are the tools to be used in the learning process. It has the ability to connect with information and resources when the student need them most. This theory also described that the learning connections can happen at various location whenever needed such as in classroom, at home or on the go (Stoerger, 2013) and this can happen in personalised m-learning where students are able to access what they want, when they want and how they want.

The personalised m-learning curriculum implementation model implicates the connectivism learning theory where both places emphasis on importance of wanting students to search for, filter, analyse and synthesize information in order to obtain knowledge. Giving importance to what students need and their preferences are the key elements in personalised m-learning and this was reflected in Siemens's (2004) research where for the knowledge continues to grow and evolve, access to what is needed is more important than what the learner currently possesses. Connectivism also assumes that the learner's role is not to memorize or even understand everything, but to have the capacity to find and apply knowledge when and where it is needed. According to (Hughes, 2009; McLoughlin & Lee, 2011), in a networked society, learners require access to ideas, resources and communities driven by personal needs and choice (personalisation), and engage primarily in the social processes of knowledge creation rather than consumption (productivity).

The development of the personalised m-learning curriculum implementation model was driven by appropriate technology-based models. The adopted models are PALLAS (Personalised Language Learning on Mobile Devices), IMLIS (Intelligent Mobile Learning Interaction System), and Methodic model (personalised m-learning for mathematic class). The employment of these models aim to identify appropriate personalised m-learning elements involved in the development of these model and adaptation of learning resources. PALLAS was developed to support to a mobile language learner by providing personalised and contextualised access to learning resources. The adaptability of static and dynamic parameters implemented in this model was used as guidance in identifying the personalised m-learning elements. The IMLIS system's works on adaptation, adjustment and personalisation of content, learning activities, and the user interface was used as guidance in developing the personalised m-learning model. The Methodic model demonstrate on how to provide the learning content to every student regardless of their whereabouts, or moment in time they decide to learn or study mathematics. The student's interaction with the learning content and the content adaptation was the reason this model was adopted in the development of personalised m-learning curriculum implementation model.

Based on the discussion in this above section, the personalised m-learning curriculum implementation model implicates the theories by demonstrating how multiple learning theories, framework and model could be combined to develop an effective educational strategy. The study also showed that the past learning theories could still be relevant to describe the present learning application especially in this digital age.

7.4.3 Methodology Implications of the Study

The development of personalised m-learning curriculum implementation model was completed with the help of few methodological approaches. This section will discuss briefly on the methodological approaches. The first approach that was used in this study was Design and Development Research (DDR) approach. This approach consist of three phases, beginning with the Needs Analysis phase where it investigate problems and justifications for developing a model. In this study, it investigate the need for personalised m-learning for students in hospitality programme and the mean score of the findings was used to interpret the views of respondents. Phase 2 describes the design and development of the implementation model involving a panel of experts in the related fields to review the suitability of the developed model. A modified Nominal Group Technique (NGT) was employed to list, evaluate and validate identified elements based on experts' views. This was followed by the development of the model which employed the Interpretive Structural Modeling (ISM) approach which involving a panel of experts to facilitate the investigation into the relationships among learner's preferences, mobile device capabilities and learner's surrounding in order to extract structural model for the intended personalised m-learning implementation. The last phase is the evaluation phase where a modified Fuzzy Delphi method (FDM) was applied in evaluating the elements and the overall suitability of the model in personalised m-learning teaching and learning process.

The research methodologies used in this study are not new. ISM which was used in the development of the personalised m-learning curriculum implementation model, is a powerful decision making tools which transforms unclear, poorly articulated mental models of systems into visible and well-defined models. It is a very popular decision making tool but not many have used it in education field. However, the integration of ISM with NGT has successfully generate desired elements for ISM as presented in this study. The Fuzzy Delphi technique also have same fate as ISM where not many have used it in the field of education. The Fuzzy Delphi technique is a proven strategy in evaluating the structured model and for this study it was used to elicit experts' views in validation the personalised m-learning curriculum implementation model. These three methods are starting to gain popularity in the field of education with many researchers are showing interest in using them. These three methods are also compatible with each other due to the fact that all of these three techniques utilises the experts' decision as the outcome of the methods.

Therefore, the integration of ISM with NGT and FDM in the development of personalised m-learning curriculum implementation model could be seen as an example in using these methods for education strategies. The methodology used in this study to develop the model could be replicated or adapted to develop other pedagogical models.

7.5 Recommendations for Further Research of the Study

The outcome of the study is the personalised m-learning curriculum implementation model for Food and Beverage course for diploma in hospitality programme. The model was developed based on personalised m-learning elements. This section will discuss a few recommendations for further research in this subject. The first recommendation is that this model need to be further studied to make it available for the students. This further developed model need to be evaluated for its effectiveness in supporting the personalised m-learning based on the students' view. The model could be further refined based on the new findings from this evaluation in order to improve the effectiveness of the model and to give better results. This model also can be used in further study to develop and implement personalised m-learning system by taking consideration from all the stakeholders involved in teaching and learning process such as students, lecturers, content developers, content designers, parents and institution administrators. Besides, the graduates, industry experts and future employers can be consulted as well to make sure the personalised m-learning system prepare the students to have knowledge and the skills needed to excel in job market.

The next recommendation is to use this model as basis for the development of another pedagogical model for another course or programme. This is because the development process focuses on a specific course for specific group of students. The personalised m-learning elements identified in this model could be used in the development of more general personalised m-learning model for another course and for another programme. The new personalised m-learning elements could be determined, if any, based on the opinions from selected panel of experts. This will enable the development of personalised m-learning model that could be implemented for any course or programme.

Another recommendation is to include collaboration in personalised m-learning curriculum implementation model. The current version of personalised m-learning model does not support collaboration and interaction among different learners. The personalised m-learning elements that have been implemented provides support to an individual learner. However, personalisation and contextualisation elements to support the social context of the learner and to model the communities that the learner interacts with need to be considered. This could enhance the personalised m-learning system to support collaborative learning.

Finally, the personalised m-learning curriculum implementation model could also be developed for learners with cognitive disabilities within different contexts (specific needs learners). The personalised m-learning could provide a personalised learning process for learners with mental/learning disabilities based on their specific abilities. This is to ensure that the learners with physical impairments also to be able to use this personalised m-learning system. This exclude the learners who cannot move their hands and blind.

7.6 Conclusion

The rapid development of wireless infrastructure and wide use of mobile devices in our daily life has a major impact on our way of learning using mobile technology. Furthermore, personalised services is an important research topic in the field of web-based and m-learning systems as there are no fixed learning path which are appropriate for all learners. However, most studies in this field have only focus on learning style and habits of learners. Far too little attention has been paid on learners' preferences. Therefore, this study proposed a new personalised m-learning curriculum implementation model for diploma student enrolled in Food and Beverage course. The development of this model is to support the formal face-to-face classroom teaching and learning process. This could be possible by incorporating personalised m-learning into formal education to assist students to fulfil both learning needs and target learning outcomes. Through this personalised m-learning implementation model, the students could be able to access their learning material based on their own preferences. This model also take into consideration of the students' mobile device capabilities and the environment or surrounding from which the students request for the content. The suggested curriculum implementation model will be used as a support to the students in formal classroom learning and this will not in any way used to replace the formal learning. In short, the study explored the use of mobile technology as a solution for a specific learning issue, which is the personalised learning.

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