The Effects of Teacher ICT Skills, Beliefs and Training on ICT Integration among Teachers in Malaysian Schools

by

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Thesis submitted in fulfillment of the requirements for the degree of

Master of Arts

February 2012

ACKNOWLEDGEMENT

Foremost, I am heartily thankful to my supervisor, Associate Professor Dr Merza Abbas whose guidance, insightful comments and ideas from the beginning of my study enabled me to develop an understanding of the subject. I am also sincerely grateful to my co-supervisor, Associate Professor Dr Irfan Naufal Umar whose continuous encouragement and invaluable time in assisting me to complete this thesis. He has made available his support in a number of ways. Without my advisors, this thesis would not have been possible.

I would like to acknowledge that this thesis is a small portion of a big project funded by a research university grant, Evaluation of ICT Initiatives in Malaysia: Success and Recommendations (1001/PMEDIA/817030). It is an honor for me to be given countless opportunities to attend seminars, conferences and workshops funded by the grant and also the Centre for Instructional Technology and Multimedia during my study. The experiences gained through working collaboratively with the centre hardworking members helped and exposed me to a dynamic education environment.

I dedicate this thesis to my lovely parents, Latifah Ahmad and Jamiat Jam Jam for their unconditional love, unceasing prayer and constant encouragement for me to complete my study. Also, to my dearest little brother, Khairil and little sister, Aisah who has always cheer me up during this journey. This thesis would not have existed without my family. Thank you and Alhamdulillah.

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LIST OF PUBLICATIONS

Jamiat, N., Abbas, M. & Umar, I. N. (2011). The direct and indirect effects of teacher ICT skills, ICT training and beliefs on ICT integration. *Proceedings of the 5th International Malaysian Educational Technology Convention (IMETC),* 66-79.

Jamiat, N., Umar, I. N. & Abbas, M. (2011). The effects of teacher characteristics, beliefs and contextual factors on technology integration among Malaysian school teachers. *Proceedings of the International Educational Technology Conference (IETC),* 1090-1095.

Umar, I. N. & Jamiat, N. (2011). Research trends of ICT application in teacher education programs: An analysis of educational technology proceedings in Malaysia. *Asia Pacific Journal of Educators and Education, 26*, 1-13.

Jamiat, N., Umar, I. N. & Masood, M. (2010). Research trends in instructional technology in Malaysian teacher education institutions: A five year content analysis. *Proceedings of the 4th International Malaysian Educational Technology (IMETC) Convention.*

Umar, I. N. & Jamiat, N. (2010). Research trends of instructional technology in Malaysian secondary education: A five year review. *Proceedings of the 3rd Asia Pacific Educational Research Association (APERA) Conference.*

KESAN KEMAHIRAN, KEPERCAYAAN DAN LATIHAN ICT TERHADAP INTEGRASI ICT DALAM KALANGAN GURU SEKOLAH DI MALAYSIA

ABSTRAK

Integrasi teknologi maklumat dan komunikasi (ICT) ke dalam pengajaran dan pembelajaran melibatkan proses-proses yang kompleks tetapi kebanyakan kajian di dalam konteks pendidikan di Malaysia hanya melibatkan analisis kesan dan akibat yang mudah dimana pelbagai pembolehubah diabai atau dianggap sebagai malar. Kajian ini menggunakan kaedah model persamaan berstruktur (*Structural Equation Modeling)* untuk mengkaji kesan langsung dan tidak langsung faktor-faktor kemahiran, kepercayaan dan latihan guru dalam ICT terhadap integrasi ICT ke dalam proses pengajaran, pembelajaran dan kerja harian. Satu model terhipotesis yang menggambarkan faktor serta hubungan di antara mereka terhadap integrasi ICT telah dibina berdasarkan teori difusi inovasi dan model penerimaan teknologi serta tinjauan literatur. Soal selidik yang digunakan adalah ubahsuaian daripada soal selidik integrasi ICT yang dibangunkaan oleh *Scottish Executive Education Department*. Sejumlah 7,320 set soal selidik telah dihantar kepada guru pelbagai sekolah dan matapelajaran di seluruh negara. Namun begitu, 1,668 soal selidik telah dikembalikan dan 1,318 maklum balas sesuai digunakan di dalam analisis data akhir selepas pemeriksaan data dilakukan.

Analisis faktor telah dijalankan bagi memperhalusi model terhipotesis ini. Tiga faktor baru untuk Kemahiran ICT Guru (Kemahiran Asas ICT, Kemahiran Lanjutan ICT, Kemahiran Internet), tiga faktor baru untuk Kepercayaan Guru

(Kepercayaan terhadap Kesan ICT kepada Pelajar, Kepercayaan terhadap Manfaat ICT dan Kepercayaan terhadap Kepentingan ICT) dan dua faktor baru untuk Integrasi ICT Guru (Integrasi ICT ke dalam Pengajaran dan Pembelajaran dan Integrasi ICT ke dalam Kerja Seharian) telah diekstrak. Analisis seterusnya menghasilkan model struktur yang menunjukkan padanan yang baik dengan data yang diperolehi (χ^2 / *df* = 2.18; CFI = 0.996; NFI = 0.992; TLI = 0.989; RMSEA is 0.03).

Model struktur ini melaporkan bahawa Integrasi ICT ke dalam pengajaran dan pembelajaran adalah dipacu secara langsung oleh Kemahiran Asas dan Kemahiran Maju ICT serta Kemahiran Internet. Intergrasi Ke Dalam Kerja Harian pula dipacu oleh Kemahiran Maju ICT serta Kemahiran Internet. Latihan ICT hanya meningkatkan kepercayaan guru terhadap manfaat dan kepentingan ICT tetapi tidak meningkatkan Integrasi ICT ke dalam pengajaran dan pembelajaran mahupun ke dalam kerja harian. Integrasi ICT ke dalam pengajaran dan pembelajaran pula melaporkan kesan yang besar dan signifikan terhadap Integrasi ke dalam kerja harian, iaitu guru yang menggunakan ICT di dalam pengajaran juga menggunakan ICT di dalam kerja harian. Model struktur juga melaporkan bahawa Faktor-faktor Kepercayaan berkait rapat dengan Kemahiran Asas ICT dan Latihan ICT dan faktor-faktor kepercayaan ini mempunyai kesan-kesan langsung dan tidak langsung yang kecil tetapi signifikan terhadap Integrasi ICT ke dalam pengajaran dan pembelajaran serta ke dalam kerja harian.

THE EFFECTS OF TEACHER ICT SKILLS, BELIEFS AND TRAINING ON ICT INTEGRATION AMONG TEACHERS IN MALAYSIAN SCHOOLS

ABSTRACT

The processes of integrating information and communication technology (ICT) into teaching and learning are complex, but most studies conducted in the Malaysian context only involved simplistic causal descriptions that applied bivariate analyses where many active variables were ignored or assumed to have been held constant. This study applied the Structural Equation Modeling method of data analysis to examine the direct and indirect effects of ICT skills, beliefs, and training factors on ICT integration into teaching, learning and everyday work among teachers. A hypothesized model representing the factors and relationships between the factors towards ICT integration was derived from the diffusion of innovation theory, technology acceptance model, and literature review. The questionnaire for this study was adapted from the ICT integration survey developed by the Scottish Executive Education Department. A total of 7,320 questionnaires were sent to teachers of all specializations nationwide. 1,668 questionnaires were returned and 1,318 responses were usable for data analysis after the screening process.

Factor analysis was conducted to refine the hypothesized model. Three new factors for *Teacher ICT Skills* (Basic ICT skills, Advanced ICT Skills and Internet Skills), three new factors for *Teacher Beliefs* (Belief towards ICT Effects on Students, Belief towards ICT Benefits and Belief towards ICT Importance) and two new factors for *ICT Integration* (ICT Integration into Teaching and Learning and

ICT Integration into Everyday Work) were extracted. Further analyses generated a structural model that indicated a good fit with the data (χ^2 / *df* = 2.18; CFI = 0.996; NFI = 0.992; TLI = 0.989; RMSEA is 0.03).

The structural model revealed that ICT Integration into Teaching and Learning was driven by Basic and Advanced ICT Skills and Internet Skills. However, Integration into Everyday Work was driven by Advanced ICT Skills and Internet Skills. ICT Training only increased teacher beliefs towards ICT Importance and Benefits, but did not increase ICT Integration into Teaching and Learning and into Everyday Work. ICT Integration into Teaching and Learning reported large and significant effects towards ICT Integration into Everyday Work which meant that teachers who were using ICT in teaching also using ICT in their everyday work. The structural model also revealed that factors of Teacher Beliefs were associated with Basic ICT Skills and ICT Training and that the factors of Teacher Beliefs had small but significant direct and indirect effects on ICT Integration into Teaching and Learning and also Everyday Work.

Chapter 1

Introduction

1.1 Introduction

Previous studies indicated that ICT integration is a complex phenomenon (Mackey & Mills, 2002; Ng, Miao & Lee, 2010) and also technology or computer use among teachers is a complicated process (Chen, 2010; van Braak, Tondeur & Valcke, 2004). Hence, the abundant of research have been done in investigating the factors affecting ICT integration. Although teachers' ICT integration research is common, this study contributed in terms of the information of the direct and also indirect effects of factors affecting teachers' ICT integration specifically in Malaysia. As most of the previous studies on this field in Malaysia only applied bivariate analyses. Also, this study involved respondents from all states in Malaysia which seems to be the first nationwide research done pertaining teachers' ICT integration.

Furthermore, most local study typically incorporated a single theoretical framework. For instance, the Technology Acceptance Model (Davis, 1989) was widely use in local studies. According to Coutinho and Neuman (2008), a better understanding of the relationship between variables can be achieved by integrating different theoretical models into a single framework. Thus, the goal of this study was to incorporate the theory of diffusion of innovations (2003) and the Technology Acceptance Model (1989). Deeper explanation pertaining these two theories and model is described in the theoretical framework section.

Einstein (n.d.) once said that "If I can't picture it, I can't understand it". In this particular study, the relationship among factors affecting teachers' ICT integration were conceptualize in order to understand the complex processes of ICT integration. Thus, structural equation modeling (SEM) was applied to present the processes in a diagram as an advantage to clarify these relationships through a path model. Another advantage provided by SEM is the ability to test simultaneously all of the relationship (Bryman & Hardy, 2009). Therefore, this study attempts to convey the process of investigation of the factors affecting teachers' ICT integration through SEM.

The research background section describes the Malaysia's growth and development in technology in education which eventually required teachers to be more competent with the new and emerging technologies to implement them in their teaching and learning environment. The following part of this chapter outlines the problem statement followed by the theoretical framework. Furthermore, the research objectives, research questions and research hypothesis for this study are also described. The last section of this chapter describes the chapter summary and the overview of the subsequent chapters.

1.2 Research Background

According to Itzkan (as cited in Willems, Stakenborg & Veugelers, 2000) technology has impacted teachers in terms of their pedagogy and roles in three phases, namely, substitution, transition, and transformation. In the substitution phase,

teachers will not change their methodologies of teaching whether they are using ICT in teaching and learning activities, whereas in the transition phase, teachers will use ICT that will stimulate changes that led to new technology.

Only in the transformation phase that will involve the application of ICT in teaching and learning that will change the teachers' and students' roles. With the immersion of technology in education, teachers are expected to change the traditional chalk and talk practices into a more student-centred learning environment that will definitely enable students to do their own research and develop their own understanding in teaching and learning activities. Therefore, in this constructivist approach, teachers are the facilitators that will guide the students to stay in the right path of using technology to enhance their critical and creative thinking.

In addition, Tiene and Ingram (2001) listed several technologies that can help teachers and students to explore and discover the vast array of alternative information sources that are available through technologies. One of the most widely used and contains countless resources is the Internet. Through the variety of information available in the Internet, teachers will guide the students to access appropriate websites for students to explore and discover the ideas, thus constructing their own understanding by accessing different websites.

Further, Tiene and Ingram (2001) stated that interaction with others is an important part of a constructivist learning approach, in which with the online communication available, students can expand their social contacts and communicate with others about ideas and information synchronous and asynchronously.

Meanwhile, optical discs are also important as one of the educational tools that teachers can use during teaching and learning session in the classroom or laboratory which may contain pictures or even interactive videos to increase students' understanding on complex relationship or abstract information. After going through the process of learning through the various technologies available at schools, teachers should allow students to express their understanding by using technology such as developing PowerPoint presentation, a Web page or even videos. The students' effort on completing their presentation will include working with computer equipment, video cameras, and audio recording equipment in groups that will eventually increase their competencies and skill in developing a wonderful presentation of their own work.

Malaysian government also realized the importance of knowledge and education to enhance the quality of a community. For instance, in the 2011 budget, Malaysia allocates the largest sum of financial support into education (Ministry of Finance, 2011). Based on The World Fact Book published by the Central Intelligence Agency (2009), 4.9 % of Malaysia's gross domestic product (GDP) was allocated for education expenditure and ranked 99 in the country comparison on public education expenditure. In addition, a sum of RM 10.4 billion or 21.1 % of total development expenditure is allocated for education and training (Ministry of Finance, 2011).

Malaysia's support for the growth and development of technology in education started early. The Educational Technology Department (ETD) of Ministry of Education is responsible for monitoring and evaluating the use of technology in

enhancing teaching and learning in Malaysian schools. ETD was formerly known as an Audio-Visual Section when first established in 1949 (Ministry of Education, 2008). This section was renamed to ETD in 1989 and has expanded its roles in contributing to the development of technology in education. Currently, ETD together with their networks - the State Educational Technology Division and Teacher Activity Centres - are responsible for transforming all schools in the country into Smart Schools. In 2001, the government approved a stimulus package worth 4.3 billion ringgit for the purpose of building computer laboratories in 2000 schools nationwide.

The Smart School is one flagship of the Malaysia's Multimedia Super Corridor (MSC) initiative. The nation's high profile ICT ambition was conceptualized in 1996 to leapfrog Malaysia into the information age. The designated zone is a 15 km wide by 50 km long corridor that runs from Petronas Twin Towers in the heart of Kuala Lumpur to the Kuala Lumpur International Airport that includes Putrajaya and Cyberjaya cities. The MSC policy was established in 1997 with the goal of accelerating the objectives of Vision 2020 in achieving a developed nation status for Malaysia in 2020. There are seven flagship applications that have been indentified, namely, the Smart School, Smart Card, Tele-Health, E-Government, Borderless Marketing, World-Wide Web, and Research & Development Clusters.

The Smart School initiative by the government has shifted the traditional delivery systems into technology-based using electronic learning platform and

resources such as the Internet and interactive courseware. This initiative, launched in 1997 is an on-going process to enable Malaysia to produce technologically literate and creative thinking individuals which meet the National Philosophy of Education and face the information era. A pilot project was launched in 1999 with the establishment of 88 Smart Schools (Multimedia Development Corporation, 2006). By the end of the piloted project in 2002, 1494 courseware titles for Bahasa Malaysia, English, Science and Mathematics had been produced (Ministry of Education, 2006) and all the piloted schools were equipped with a computerized and integrated Smart School Management System, a Help Desk and Data Centre, and trained administrators, teachers and ICT coordinators. This project aims to ensure the piloted schools serve as a role-model and benchmark to transform 10,000 schools into Smart Schools in 2010.

Moreover, the English for Teaching Mathematics and Science (ETeMS) was launched in 2003 through several stages which begin with Year One in primary school and Form One and Lower Six students in secondary schools (Ministry of Education, 2006). This initiative aims to improve students' English proficiency as English is a universal language. In addition, this initiative helps to prepare the students as they progress from secondary education to tertiary level whereby English is widely used as the medium of instruction. Through this initiative, all Mathematics and Science teachers are provided with laptops to help them integrate technology in teaching these subjects. Other educational tools provided by the Ministry of Education to support this initiative are liquid crystal display (LCD) projectors, screens and printers. In addition, the ETeMS Courses is a short term professional development programs for teachers involve in this ETeMS initiative which was

conducted by the English Language Teaching Centre (ELTC) of Ministry of Education. The courses aim to improve teachers' English proficiency to enable them deliver the curriculum effectively in English.

In conjunction with the evolving technology in education, SchoolNet initiative was introduced in 2004 (Ministry for Energy, Water & Communications, 2006). One of the objectives of this initiative is to bridge the digital gap between urban and rural schools. This infrastructure project by the Ministry of Education and Ministry for Energy, Water and Communications will enable students and teachers from all part of the nation to stay connected as 10,000 schools will be provided with broadband access.

Additionally, Eduweb Television (Eduweb TV) was launched in 2008 which aims to generate the culture of using Internet in teaching and learning processes. The portal will act as one stop centre which provides teaching modules, lesson programs, educational news, documentaries, educational research, interviews and panel discussions as instructional material and information for teaching and learning activities. Selected programs can be downloaded and be used in teaching practice. In order to provide additional access for students to work with computers, the Computer Lab Initiative was introduced in 2000 (Multimedia Development Corporation, 2006) which provides server and computers proportionate to the number of students in schools and server.

Beside providing technology tools to enhance teaching and learning, the Ministry of Education also introduced various computer literacy programs for students and teachers. The first course, the Computer in Education Program was launched in 1999 in 332 schools (Ministry of Education, 2008). Then in 2002, the Computer Literacy Program was introduced to Form One and Form Two students and the ICT in Education Program was launched in 2007 for secondary school students (Ministry of Education, 2008). As for the teachers, in-service courses are provided by the Ministry of Education so that they will be able to apply it in their daily teaching activities which aim to increase their competencies in using technology as an educational tool. In addition, the Smart School Course, introduced in 1998 and In-service Courses for Smart School Teachers was introduced in 2006 for similar purposes; i.e. to provide ICT training for the teachers (Ministry of Education, 2008).

As noted above, Malaysian schools are well equipped with the facilities to create a technology-enriched curriculum. Aligned with the infrastructure development of technology in Malaysian education system, teachers were expected to be competent with the current technology and able to integrate technology in their teaching and learning practices. However, the question remains as to whether the facilities and equipment provided were adequate for teachers to quickly change their routine traditional teaching into constructivist technology-embedded activities.

1.3 Problem Statement

Many studies have been conducted to investigate the outcomes of the various ICT initiatives in the Malaysian education system. Most of the research findings reported that the teachers' levels of ICT knowledge and skills were still low (Mahmud, Ismail, Mohd Yasin, Mustapha & Din, 2006; Mahmud, Ismail, Sahid & Yazid, 2007). Further, Ismail, Zakaria and Aziz (2007), Mahmud, et al. 2007; Mohd Salleh, Mohd Nordin & Mohd Jelas (2008), Othman & Baki (2007) and Wahab & Kaur (2006) also reported that the level of technology integration was also low. The only encouraging findings were that teachers' attitudes towards ICT were positive (Sa'ari, Wong & Roslan, 2005; Sharif & Buntar, 2005). These findings are consistent with Mackey & Mills (2002) and Ng, Miao & Lee (2010) who reported that ICT integration is a complex phenomenon and with Chen (2010) and van Braak, et al (2004) who suggested that technology or computer use among teachers is a complicated process.

While the findings are enlightening, these studies have employed simple theoretical frameworks and bivariate methods of data analysis with many variables overlooked or assumed to have been held constant. This meant that measurement errors were ignored and that this might lead to serious inaccuracies of analyses when the errors were sizable (Byrne, 2010). According to Coutinho and Neuman (2008), a better understanding of the relationships between the variables can be achieved by integrating different theoretical models into a single framework and these relationships are analysed simultaneously using path analysis or structural equation modeling (SEM) to reveal the direct and indirect effects of the variables on each

other and on the dependent variables. To date the only path analysis study in the Malaysian context is an investigation the behavioral intentions to use computers by female pre-service teachers (Wong & Teo, 2009).

Therefore, in order to avoid neglecting measurement errors which frequently occur in social science research and deepen understanding, Byrne (2010) promotes the use of SEM and states that "SEM provides explicitly estimates of these error variance parameters", (p. 3) and conclusions can be made without any biases against the measurement errors. Also, a causal explanation which investigates the direct and indirect effects of factors affecting ICT integration simultaneously can be made in the actual context of the teachers' ICT integration effort. In addition, although several researchers have studied the direct effect of teacher knowledge on their technology practice (Hughes, 2005) and teachers' belief on their technology implementation (Tasouris, 2009), however, these studies were done abroad and not within the Malaysian context.

Much is still unknown with regards to ICT integration among teachers in Malaysia. Thus, it is essential for research such as this study to provide a holistic view of the complex relationships of factors affecting teachers' ICT integration in teaching and learning in the classroom. Instead of merely providing a list of significant factors and effects, the findings of this study will reveal the importance of each factor in terms of its direct, indirect and also mediating effects on ICT integration within a classroom environment.

1.4 Theoretical Framework

The theory of diffusion of innovations and the Technology Acceptance Model were reviewed and examined to justify the relationships of the factors affecting ICT integration. For instance, diffusion of innovations' theory was applied to explain the direct effects of Teacher *ICT Skills* and *ICT Training* on *ICT Integration,* whereas the Technology Acceptance Model was appropriate to describe the effects of the mediating variable in this study, *Teacher Beliefs* on *ICT Integration.*

Diffusion is a process of an individual accepting or rejecting a certain new technology or innovations which may lead to social changes (Rogers, 2003). It is a continuum of three types of innovation-decisions explained by Rogers (2003) "... from optional decisions (where the adapting individual has almost complete responsibility for the decision), through collective decisions (where the individual has a say in the decision), to authority decisions (where the adopting individual has no influence in the innovation decision)", (p. 29). Rogers further describes a model of the Innovation-Decision Process which starts with the knowledge stage, than occurs when an individual is aware of the existence and understand the function of the innovation to proceed to the next step in the of Innovation-Decision Process model to either accept or reject the new technology. In this study, knowledge in the Innovation-Decision Process refers to *Teacher ICT skills* and *ICT Training*. Because of the step by step manner of the Innovation-Decision Process, there are no mediating factors explained by Rogers and thus the need of the Technology Acceptance Model.

The Technology Acceptance Model depicts the relationship of the factors affecting a users' acceptance and use of technology. There are two fundamental determinants that influence users in technology acceptance which are perceived usefulness and perceived ease of use (Davis, 1989). According to Davis's 1989 study, perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320). In contrast, perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (p. 320). Hence, *Teacher Beliefs* in this study refers to perceived importance and benefits of ICT and perceived usefulness of ICT for learning. Figure 1.1 presents the theoretical framework of this study.

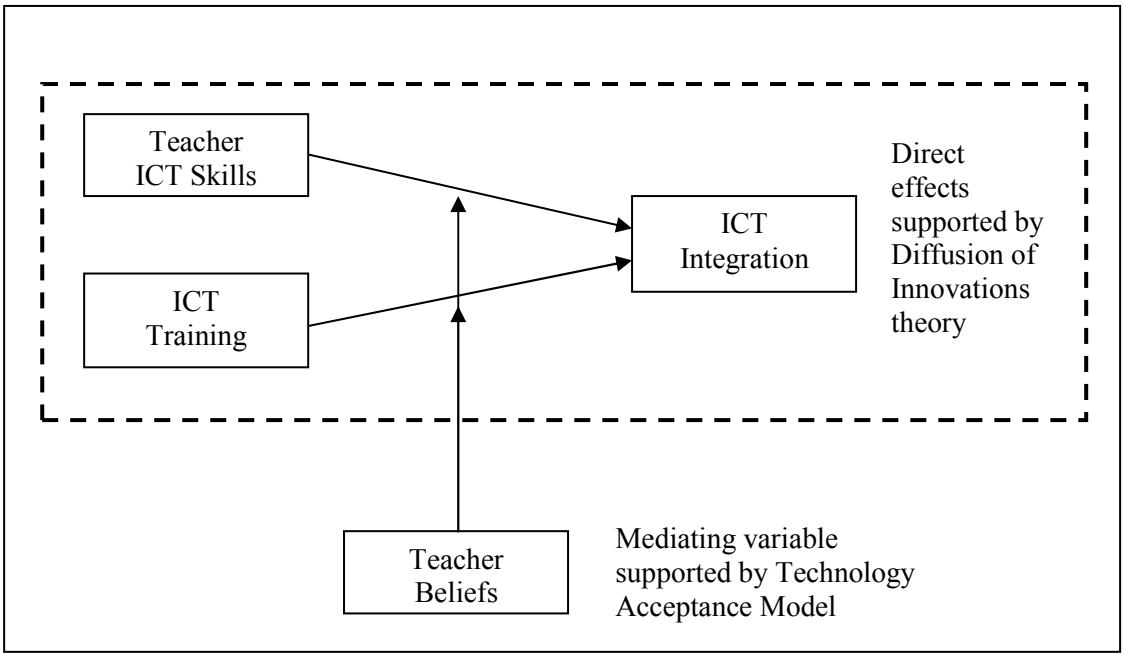

Figure 1.1: Theoretical framework underpinning this study

Figure 1.2 represent the mediator model where **a** and **b** are the direct effects of *Teacher ICT Skills* and *ICT Training* on *ICT Integration* respectively whereas **c** is the indirect effects of *Teacher ICT Skills* and *ICT Training* on *ICT Integration* through *Teacher Beliefs.* The total effects of *Teacher ICT Skills* on *ICT Integration* through *Teacher Beliefs* is represented by **x** and **c**, whereas the combination of **y** and **c** is the total effects of *ICT Training* on *ICT Integration* through *Teacher Beliefs.* Hence, this study will describe and discuss whether the exogenous variables (*Teacher ICT Skills* and *ICT Training)* directly influence the endogenous variable (*ICT Integration*) or *Teacher Beliefs* is a mediating variable in this relationship.

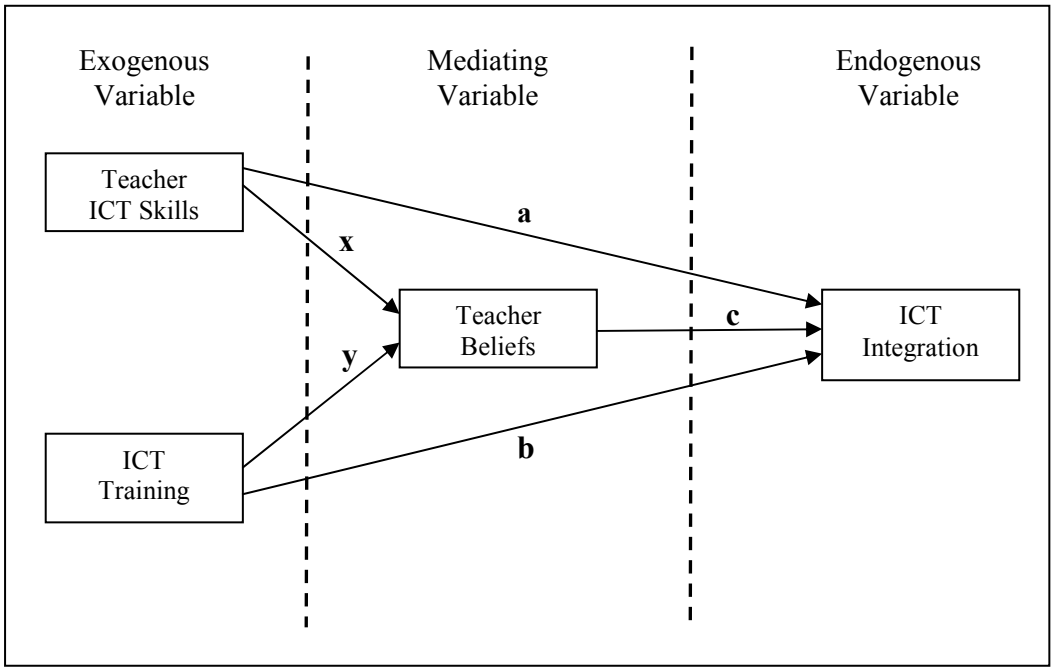

Figure 1.2: A mediator model depicting the direct and indirect effects of exogenous variables on endogenous variable through a mediating variable in this study

The path model in this study was conceptualised from the previous studies that indicate the factors affecting teachers' ICT integration. The literature that supports the developed general model was presented in Figure 1.3. The recursive model was developed to explain the causal relationship among the factors that affect teachers' ICT integration in general. The final analysis by using Analysis of Moment Structure (AMOS) version 16 was conducted which provide empirical evidence that exhibit the relationships among the factors and also the model fit indices.

According to Raykov and Marcoulides (2000), independent (exogenous) variables are variables that emanate paths (one-way arrows), but never receive a path and will appear in the left-hand side of an equation, in that system of model equations which represent the *Teacher ICT Skills* and *ICT Training* in this general model. Other factors - *Teacher Beliefs* as well as *ICT Integration* are the dependent variables in this model. This indicates that a dependent variable which is *Teacher Beliefs* in this study was also a mediating variable in the model as a whole. Hence, from the general model, it is indicated that there are direct and indirect effects from the exogenous variables (*Teacher ICT Skills* and *ICT Training*) on the endogenous variable (*ICT integration)* through a mediating variable (*Teacher Beliefs)*.

Teacher ICT Skills (Drent & Meelissen, 2008; Hakkarainen et al. 2001; Trimmer, 2006), *ICT Training* (Angers & Machtmers, 2005; Kin, 2004; Park, 2004; Sharma, 2004; Tondeur, van Keer, van Braak & Valcke, 2008) and *Teacher Beliefs* (Angers & Machtmers, 2005; Figg, 2000; Gobbo & Girardi, 2001; Hermans, Tondeur, van Braak & Valcke, 2008; Ottenbreit-Leftwich, Glazewski, Newby &

Ertmer, 2010; Prestidge, 2010; Tasouris, 2009; Windschilt & Sahl, 2002) are hypothesized to have direct effects towards *ICT Integration*. In addition, *Teacher ICT Skills* (Albirini, 2006) and *ICT Training* (Brinkerhoff, 2006; Galanouli, Murphy & Gardner, 2004; Gallagher, 2007; Goos & Bennison, 2006) are hypothesized to have direct effects on *Teacher Beliefs*.

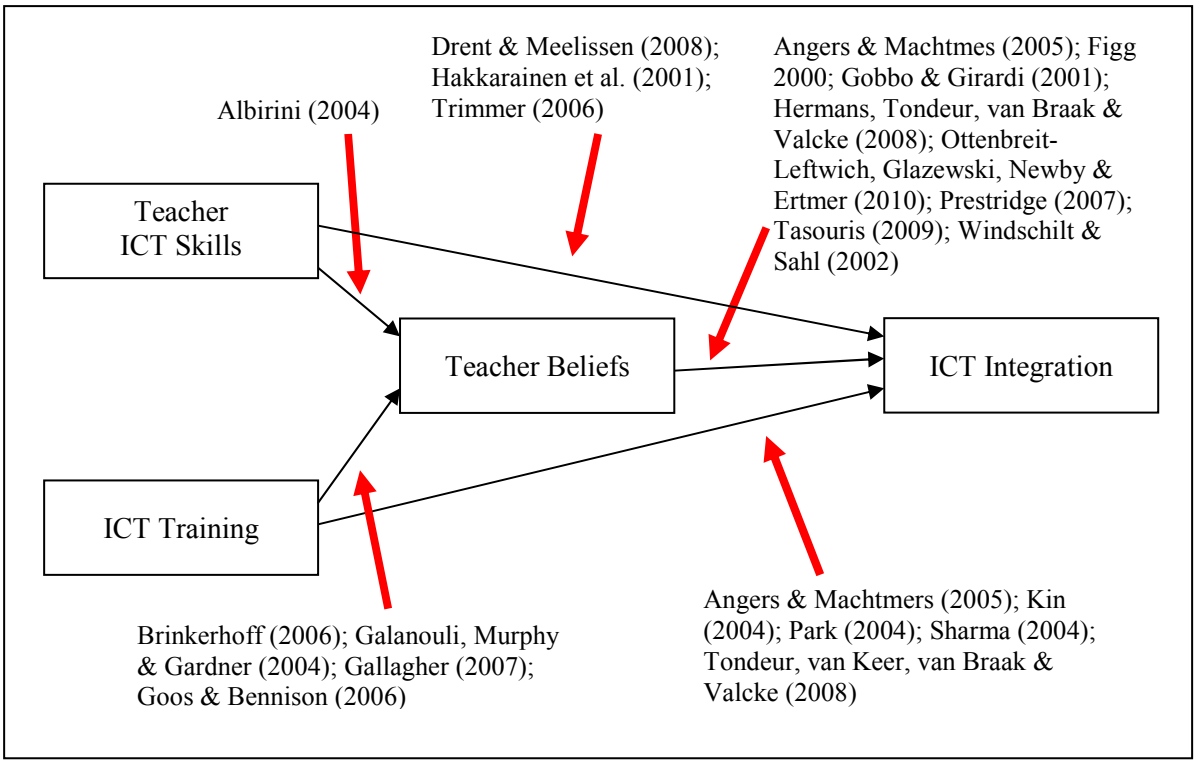

Figure 1.3: Literature supporting the general model

1.5 Research Objectives

The general purpose of this study is to identify the effects of Malaysian teachers' ICT skills, ICT training and their beliefs on ICT integration. Specifically, this study investigated whether these three factors had significant direct and indirect effects on ICT integration among school teachers by using the SEM methodoly. A general path model was developed in investigating the direct and indirect effects of *Teacher ICT Skills, ICT Training* and *Teacher Beliefs* on *ICT Integration.* This path model was based on the diffusion of innovations' theory and the Technology Acceptance Model (TAM) and conceptualized by the literature supporting the relationships of the factors.

1.6 Research Questions

The research questions are as follows:

1) Do teachers' ICT skills have significant direct effects on their beliefs and ICT integration?
2) Does ICT Training have significant direct effects on teachers' beliefs and their ICT integration?
3) Do teachers' beliefs have significant mediating effects of their ICT skills on ICT integration?

1.7 Research Hypotheses

According to Coryn (2013), "... a research hypothesis is a deductive guess that states the expected outcome of a study", (p. 21). He further categorized the numerous ways of expressing research hypothesis in social sciences, for instance, null hypothesis, alternative non-directional hypothesis and alternative directional hypothesis. In this particular study, a directional hypothesis was used to imply the expected direction of an expected difference. The general model depicting the hypothesis is presented in Figure 1.4.

The level of significance, α, that was used in this study is 0.05. The hypotheses of this study that correspond to the research questions stated are as follows:

H_1: Teachers' ICT skills will positively influence their beliefs in ICT integration

H_2: Teachers' ICT skills will positively influence their ICT integration

H_3: ICT Training will positively influence teachers' beliefs in ICT integration

H_4: ICT Training will positively influence teachers' ICT integration

H_5: Teachers' beliefs will positively influence their ICT integration

H_6: Teachers' ICT skills will have positive indirect influence on their ICT integration

H_7: ICT Training will have positive indirect influence on teachers' ICT integration

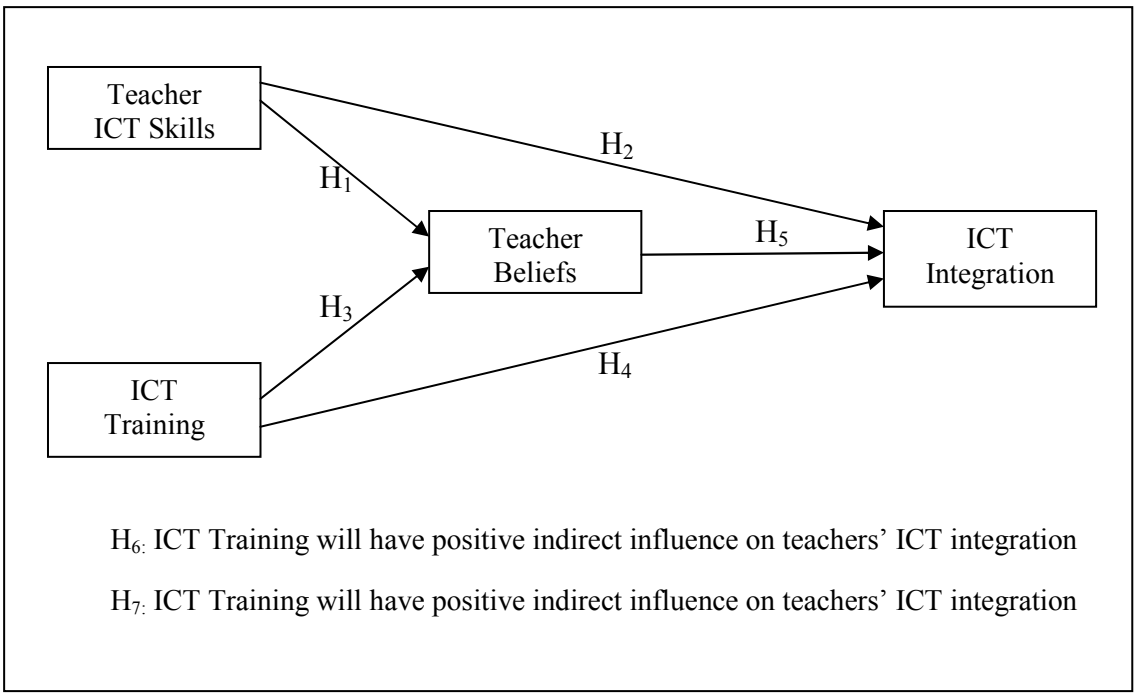

Figure 1.4: The general model depicting the hypotheses of this study

1.8 Operational Definitions

a) Teacher ICT skills

Particularly in this study, teacher ICT skills refer to their self-rated skills in several ICT applications such as word processing, programming and Learning Management System.

b) ICT training

ICT training in this study measures the participants' perception towards the benefits of in-service ICT training in general.

c) Teacher beliefs

The term teacher belief in this study refers to their perceptions of ICT effects on student and school.

d) ICT integration

In this particular study, Information and Communication Technology (ICT) integration refers to teachers' use of ICT in their teaching and learning activities as well as their administration tasks.

1.9 Summary & Overview of Chapters

This chapter has established the need to study ICT integration among teachers particularly in the Malaysian context by applying Structural Equation Modeling (SEM) technique. According to Byrne (2010), "...there are no widely and easily applied alternative methods for modeling multivariate relations, or for estimating point and/or interval indirect effects; these important features are available using SEM methodology", (p. 4). Additionally, SEM offers advantages in taking account the measurement error in the observed variables (Raykov & Marcoulides, 2006), thus the analysis to estimate the indirect effects can be done appropriately. In specific, this study attempts to investigate the direct and indirect effects of *Teacher ICT Skills, ICT Training* and *Teacher Beliefs* on *ICT Integration*.

The remainder of this thesis presents the following descriptions: Chapter Two will present the current development of ICT in Malaysian education to ascertain that all teachers were provided sufficient training and equipment to implement ICT in their teaching and learning activities and discuss the literature review to link the current research with prior research conceptually by identifying the major concept or factors involved in this study, namely, *Teacher ICT Skills, ICT Training, Teacher Beliefs* and *ICT Integration.* Next, Chapter Three includes the research design, population and sampling, as well as the instrumentation. In this chapter, the detail explanation about SEM will also be included.

Furthermore, Chapter Four will justify the refinement of the general model into a new hypothesized model by applying factor analysis. Then, the results of this study will be described by presenting the descriptive statistics, item correlations, assessment of the new hypothesized model and reporting the final model by analyzing the empirical evidence of the effects of *Teacher ICT Skills, ICT Training* (exogenous variables) and *Teacher Beliefs* (mediating variable) on *ICT Integration* (endogenous variable) among Malaysian school teachers. Finally, Chapter Five will delineate the discussion of the findings in terms of the direct and indirect effects of *Teacher ICT Skills, ICT Training, Teacher Beliefs* on *ICT Integration*.

Chapter 2

Literature Review

2.1 Introduction

The first part of this chapter will describe the standards or the requirements needed to be a competent teacher in the digital era learning environment. Then a short historical development of Information and Communication Technology (ICT) or sometimes cited as technology in education will be discussed in general and also specifically in Malaysia.

Furthermore, teacher training in Malaysia will be described to justify that all pre-service teachers are given sufficient training and support to implement technology in their future teaching and learning practices. The current studies in Malaysia pertaining to pre-service and in-service teachers will also be described to ascertain no path analysis studies are conducted regarding to technology integration within Malaysia context.

The second part of this chapter consists of a review of relevant literature pertaining to the relationship expressed in the general model. This chapter aims to identify and establish three factors affecting teachers' *ICT Integration*, namely, *Teacher ICT Skills, ICT Training* and *Teacher Beliefs*. This chapter end with a short summary to clarify the chapter.

2.2 Teacher Standards in ICT Learning Environment

A standard is a specific set of technical requirements that globally identifies the external behaviour of the service (Cerri & Fuggetta, 2007). According to Voogt and Knezek (2008), "ICT skills standards are important in defining achievement expectations for students and expected capabilities of educators" (p. 333). Standards for teachers are important to ensure that teachers have the ICT competencies needed to be the facilitator in the technology-enriched teaching and learning environment.

2.2.1 Malaysian Teacher Standard (Standard Guru Malaysia, SGM)

The Standard Guru Malaysia (SGM) was launched by the Deputy Prime Minister, Tan Sri Dato' Muhyiddin Yassin in 2009. This standard was developed to provide professional competencies guideline that should be required by teachers. The rationale for SGM was to ensure that all teachers have the knowledge and skill in teaching and learning that are in line with the Malaysian Qualifications Framework (MQF) and the basics of SGM development were the National Education Philosophy and the Teacher Education Philosophy. Furthermore, it will enable teacher education institutes and universities to provide courses and training that produce quality teachers.

There are three main standards within the SGM, namely, teachers' professional practice, teachers' knowledge, and teachers' skill in teaching and learning. However, the SGM is the only current standards as guidelines for Malaysian teachers and there is no specific explanation or guidelines on ICT

competencies. Thus, this is the right time to establish our own ICT standards to compliment the SGM. The new standards on teachers' ICT competencies will enable school administrators as leaders and teachers as the implementers to a clearer view and guideline on how to integrate technology in teaching and learning activities and not merely just for their management tasks and presentation purposes.

2.2.2 National Educational Technology Standards for Teachers

The International Society for Technology in Education (ISTE) has initiated the National Educational Technology Standards (NETS) Project to develop technology standards for educational use to facilitate and improve schools in the United States. The NETS is a predominant set of standards in the United States' K-12 schools and teacher education institutions following the adoption of the standards by the National Council on Accreditation of Teacher Education (Stuve & Cassady, 2005). The NETS for teachers (NETS•T) was developed to provide a framework and performance indicators for implementing technology in teaching and learning activities.

For instance, teachers should meet these following five standards: facilitate and inspire student learning and creativity, design and develop digital-age learning experiences and assessments, model digital-age work and learning, promote and model digital citizenship and responsibility, and engage in professional growth and leadership. From these standards, there are detailed performance indicators for each of the standards. For an example, teachers collaborate with students, peers, parents and community members using digital tools and resources to support student success

and innovation as one of the performance indicators in the model digital-age work and learning. Although ISTE provided the standards and also rubric as references for school administrations and teachers themselves as guidance, there were no teacher assessment made for the teachers to measure how and to what extent their knowledge and skills were, based on the NETS•T standards.

2.2.3 Scotland ICT Core Skills

ICT in Scotland education system is monitored and reviewed by the Learning and Teaching in Scotland (LTS) established under the Scottish Executive Education Department (SEED) (MacBride, 2003). LTS was formed in January 1998 from two different bodies of organisations, namely, the Scottish Consultative Council on the Curriculum and the Scottish Council for Educational Technology. According to MacBride (2003), one of LTS role is "to undertake, manage, quality assure and support a program of research and development work relating to the school and pre-school curriculum and to the use of ICT in Scottish education as agreed with the Scottish Executive" (p. 195).

Although the Scotland education system does not have any specific ICT standards for teachers, the Scottish Qualifications Authority (SQA) (2001) has listed ICT as one of the Core Skills framework that are important in employment and education. Core Skills is defined by the SQA (2001) as "the broad, transferable skills that people need to be full, active and responsible members of society" (p. iv). There are two components embedded in the ICT Core Skills, namely, accessing information (the ability to use ICT to support a range of information-accessing activities) and

providing/creating information (the ability to use ICT to provide, create, and process information).

Same as Malaysia, with many ICT initiatives by the government, there were also several ICT programs initiated by the Scottish government such as the New Opportunities Fund (NOF) and National Grid for Learning (NGfL) to ensure teachers' ICT integration in the classrooms. In 2004, SEED developed the Teachers' Use of and Attitudes towards ICT Questionnaire to investigate the impact of ICT initiatives in Scottish schools. From the study, the NOF initiative which provided ICT training for teachers had been found to increase their confidence to try new approaches and activities with the support of ICT (Condie, Munro, Muir & Collins, 2005). Teachers claimed that students were able to grasp difficult concepts and also increased motivation and led to independence in learning.

2.3 Information and Communication Technology (ICT) in Education

In the late 1950s, computers were used in large universities for administration purposes such as student records and payroll but then in the early 1970s, the computers are more affordable that cause higher availability of the machines (Impagliazzo & Lee, 2004). But, the computers were still used for administration purposes in schools. Only by the 1980s, computers began to move out of the realm of the business world and emerge into the classrooms by the launched of affordable Macintosh by Apple Incorporation in 1984 (Campbell-Kelly & Aspray, 1997).