UNIVERSITI PUTRA MALAYSIA

INFORMATION SYSTEM CURRICULUM DESIGN MODEL FOR INSTITUTIONS OF HIGHER LEARNING

THONG CHEE LING

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AN INFORMATION SYSTEM CURRICULUM DESIGN MODEL FOR INSTITUTIONS OF HIGHER LEARNING

By

THONG CHEE LING

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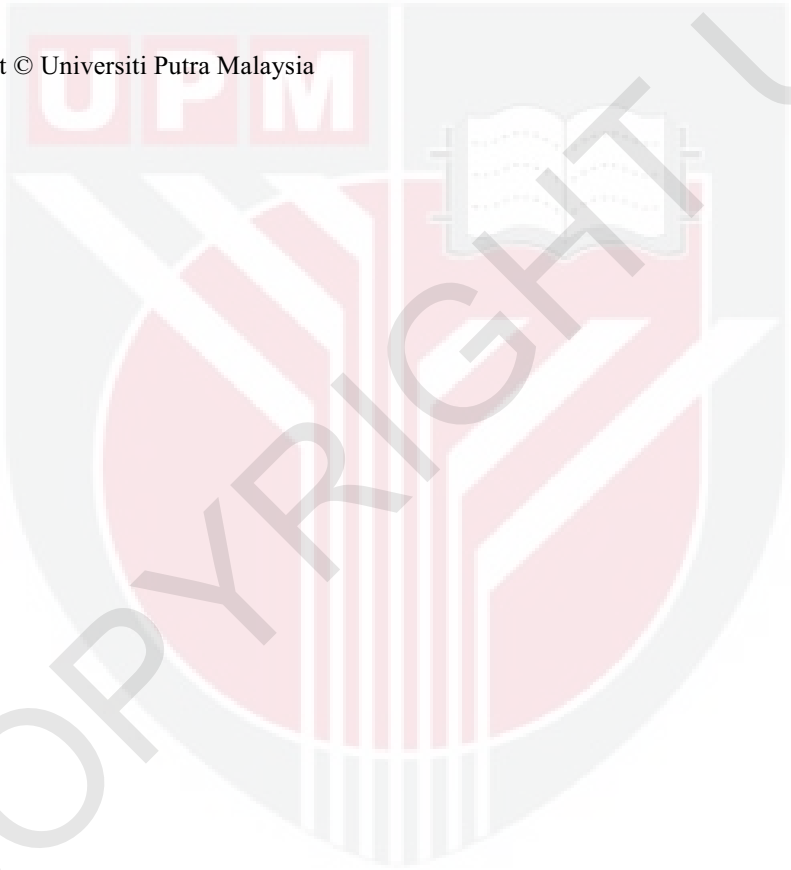

Abstract of thesis presented to Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

AN INFORMATION SYSTEM CURRICULUM DESIGN MODEL FOR INSTITUTIONS OF HIGHER LEARNING

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March 2015

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The Information System (IS) is important to Institution of Higher Learning (IHL) especially in the domain of curriculum design. Without the support of IS, curriculum designers in IHL faced difficulties during the curriculum design process. The difficulties include mapping of course learning outcome (CLO) to appropriate learning domains, aligning CLO to teaching and learning activities, aligning CLO to assessment tasks and meeting accreditation requirements such as student learning time. These tasks are time-consuming, error-prone and tedious. This is further confirmed by preliminary study conducted among 17 IHL in Malaysia. The findings of preliminary study show that there is a need to have an IS for curriculum design which provides step-by-step guidance in addressing issues faced by curriculum designers during the design process.

The literature concludes that there are numerous Curriculum Design Information Systems, but lack of step-by-step guidance to curriculum designers. Through the review of literature, it is also discovered that agent technology has not been adopted by IS for curriculum design despite its benefits such as it helps to automate repetitive tasks, as a result reducing time, error and effort of curriculum designers during curriculum design process. The curriculum design process possesses many activities such as CLO mapping and alignment. However, research on IS model for curriculum design that provides guidance to accomplishing the tedious tasks is scarce. Therefore, the availability of an IS model that can guide and assist curriculum designers both novices and experienced ones during the design process might help in reducing time, error and effort in their design. The main goal of this research is to introduce a model namely IS Curriculum Design (ISCD) Model that provides guidance to guide and assist curriculum designers during design process.

ISCD Model has the component of agent technology that is able to capture error and provide services in terms of notification and suggestions to curriculum designers so that they are guided during the design process. For this purpose, a literature study is

first conducted to identify the relevant Curriculum Design Information Systems and analyze their strengths and limitations. The structure of ISCD Model is based on three basic IS activities of input-process-output (IPO). The components and subcomponents of each activity are: Input consists of internal and external input; process consists of curriculum database, curriculum design module which subscribes the services of notification agent and curriculum design process which consists of step-by-step design process; output includes alignment matrix and reports.

The appropriateness and importance of these components of the model are then verified through expert review on curriculum design process in terms of its content and sequence; and survey is conducted among ninety curriculum designers in IHL on the proposed model. The results of expert review show the content and sequence of curriculum design process component are appropriate and systematic; and the findings of the survey show that all components and its subcomponents are agreed by respondents to be important and all mean scores are above 3.0. Subsequently, the ISCD Model is validated by being applied in the prototype. Then, a prototype namely Chloe's Curriculum Design Information System (C^2DIS) is developed and a survey is conducted to evaluate the usability and acceptance of the prototype. Eighty curriculum designers in IHL who have knowledge and experience on curriculum design participated in this survey.

The results of the survey show that the model is useful in terms of reducing time, error and effort of curriculum designers. It is also demonstrated that ISCD Model can be beneficial to curriculum designers in guiding and assisting them throughout the curriculum design process. A technology acceptance test using Technology Acceptance Model (TAM) is conducted to explore the impact of curriculum designers' perceptions pertaining to usefulness, ease of use, attitude towards and intention to use the system. The findings indicate that C^2DIS is an easy, effective and useful system to help curriculum designers in designing curriculum. This brings about the positive frame of mind towards using the system. This leads to the conclusion that ISCD Model can be used by curriculum designers in performing their work in a systematic manner with step-by-step guide during the design process.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluaan untuk ijazah Doktor Falsafah

MODEL SISTEM MAKLUMAT REKABENTUK KURIKULUM UNTUK INSTITUSI PENGAJIAN TINGGI

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Sistem Maklumat (IS) adalah penting untuk Institusi Pengajian Tinggi (IPT) terutamanya dalam domain reka bentuk kurikulum. Di IPT, tanpa sokongan sistem maklumat pereka kurikulum menghadapi kesukaran semasa proses reka bentuk kurikulum. Kesukaran termasuk pemetaan hasil pembelajaran kursus (CLO) bagi memperuntukkan pembelajaran domain, menjajarkan CLO untuk aktiviti pengajaran dan pembelajaran, menjajarkan CLO untuk tugas penilaian dan akreditasi mesyuarat keperluan seperti pembelajaran pelajar masa (SLT). Tugas-tugas ini adalah memakan masa, kesilapan yang sering berlaku dan membosankan. Ini turut disahkan oleh kajian awal dijalankan di kalangan 17 IPT di Malaysia. Hasil kajian awal menunjukkan bahawa terdapat keperluan untuk mempunyai sistem maklumat untuk reka bentuk kurikulum yang menyediakan panduan langkah demi langkah dalam menangani isu-isu yang dihadapi oleh pereka kurikulum semasa proses reka bentuk.

Kesusasteraan menyimpulkan bahawa terdapat banyak Sistem Maklumat Reka bentuk Kurikulum, tetapi mereka tidak mempunyai langkah demi langkah panduan kepada pereka bentuk kurikulum semasa proses reka bentuk kurikulum. Melalui kajian kesasteraan, ia juga mendapati bahawa teknologi agen belum diterima oleh IS untuk reka bentuk kurikulum walaupun faedahnya itu kerana ia membantu untuk mengautomasikan tugas-tugas yang berulang-ulang , hasilnya mengurangkan masa, kesilapan dan usaha pereka kurikulum semasa proses reka bentuk kurikulum. Proses reka bentuk kurikulum mempunyai banyak aktiviti-aktiviti seperti pemetaan CLO dan penjajaran. Walau bagaimanapun, penyelidikan mengenai model Sistem Maklumat bagi reka bentuk kurikulum yang memberi panduan untuk mencapai tugas-tugas yang membosankan sudah tiada. Oleh itu, adanya model Sistem Maklumat yang boleh membantu dan membimbing pereka kurikulum kedua-dua orang baru dan orang-orang yang berpengalaman dalam proses reka bentuk mungkin membantu dalam mengurangkan masa, kesilapan dan usaha dalam reka bentuk mereka. Matlamat utama kajian ini adalah untuk memperkenalkan model iaitu Sistem

Maklumat Kurikulum Design (ISCD) Model yang memberi panduan untuk membantu dan membimbing pereka kurikulum semasa proses reka bentuk.

ISCD Model mempunyai komponen teknologi agen yang mampu untuk menangkap kesilapan dan menyediakan perkhidmatan dari segi pemberitahuan dan pendapat anda kepada pereka kurikulum supaya mereka mendapat petunjuk semasa proses reka bentuk. Untuk tujuan ini, satu kajian kesusasteraan pertama dijalankan untuk mengenal pasti kurikulum yang berkaitan Sistem Maklumat Reka bentuk dan menganalisis kekuatan dan batasan mereka. Struktur Model ISCD adalah berdasarkan kepada tiga asas aktiviti Sistem Maklumat input-proses-output (IPO). Komponen dan komponen utama setiap aktiviti adalah: Input terdiri daripada input dalaman dan luaran; proses terdiri daripada pangkalan data kurikulum, kurikulum modul reka bentuk yang melanggan perkhidmatan agen pemberitahuan dan proses reka bentuk kurikulum yang terdiri daripada proses reka bentuk langkah demi langkah; output termasuk matriks penjajaran dan laporan.

Kesesuaian dan kepentingan komponen ini model yang kemudian disahkan melalui kajian pakar mengenai kurikulum proses reka bentuk dari segi kandungan dan urutannya; dan kajian dijalankan di kalangan sembilan puluh pereka kurikulum di IPT. Hasil kajian pakar menunjukkan kandungan dan urutan komponen proses reka bentuk kurikulum yang sesuai dan sistematik; dan dapatan kajian, didapati bahawa semua komponen dan komponen utama yang dipersetujui oleh responden untuk menjadi penting dan skor mean adalah di atas 3.0. Selepas itu, Model ISCD disahkan dengan dipohon dalam prototaip. Kemudian, satu prototaip iaitu Chloe Sistem Maklumat Reka Bentuk Kurikulum (C^2DIS) dibangunkan dan kajian yang dijalankan untuk menilai kebolehgunaan dan penerimaan prototaip. Lapan puluh pereka kurikulum di IPT yang mempunyai pengetahuan dan pengalaman dalam reka bentuk kurikulum mengambil bahagian dalam kajian ini.

Keputusan kaji selidik itu menunjukkan bahawa model yang berguna dari segi mengurangkan masa, kesilapan dan usaha pereka kurikulum. Ia juga menunjukkan bahawa ISCD Model boleh memberi manfaat kepada pereka kurikulum dalam membimbing dan membantu mereka sepanjang proses reka bentuk kurikulum. Ujian penerimaan teknologi menggunakan Teknologi Penerimaan Model (TAM) dijalankan untuk meninjau kesan persepsi pereka kurikulum yang berkaitan dengan kegunaan, kemudahan penggunaan, sikap terhadap dan berhasrat untuk menggunakan sistem ini. Dapatan kajian menunjukkan bahawa C^2DIS adalah sistem yang mudah, berkesan dan berguna untuk membantu pereka dalam mereka bentuk kurikulum. Ini membawa bingkai positif minda ke arah menggunakan sistem. Ini membawa kepada kesimpulan bahawa ISCD Model boleh digunakan oleh pereka kurikulum dalam menjalankan tugas mereka dengan cara yang sistematik dengan panduan langkah demi langkah dalam proses reka bentuk.

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APPROVAL

I certify that a Thesis Examination Committee has met on 27th March 2015 to conduct the final examination of Thong Chee Ling on her thesis entitled "An Information System Curriculum Design Model for Institutions of Higher Learning" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

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LIST OF ABBREVIATION

Abbreviation

AIM	Authoring Instructional Materials
AQF	Australian Qualification Framework
AT	Assessment Tasks
AUQA	Australian Qualification Agency
BOK	Body of Knowledge
C^2DIS	Chloe's Curriculum Design Information System
CBIS	Computer-based Information System
CDS	Curriculum Design System
CIS	Curriculum Information System
CLO	Course Learning Outcome
CMM	Capability Maturity Model
CMS	Curriculum Management System
COPPA	Code of Practice for Programme Accreditation
COPIA	Code of Practice for Institutional Audit
CQI	Continuous Quality Improvement
CurrMIT	Curriculum Management and Information Tool
DSS	Decision Support System
ES	Expert System
GGP	Guidelines to Good Practices: Curriculum Design and Delivery
GUI	Graphical User Interface
IHL	Institution of Higher Learning
ILO	Intended Learning Outcome
IS	Information System
ISCD Model	Information System Curriculum Design Model
ISO	International Standard Organization
KA	Key Activity
KBIS	Knowledge-based Information System
KMO	Kaiser-Myer-Olkin
KPA	Key Process Area
LO	Learning Outcome
MIS	Management Information System
MOHE	Ministry of Higher Education
MQA	Malaysian Qualification Agency
MQF	Malaysian Qualification Framework
NQF	National Qualification Framework
OBE	Outcome-based Education
OCDMM	Online Curriculum Design Maturity Model
PEO	Programme Educational Objective/Goal
PLO	Programme Learning Outcome
QA	Quality Assurance
SE	Software Engineering
SEI	Software Engineering Institute
SETARA '11	Rating System for Malaysian Higher Learning Institution 2011
SLT	Student Learning Time
SPI	Software Process Improvement
SWEBOK	Software Engineering Body of Knowledge
TAM	Technology Acceptance Model

TEQSA	The Tertiary Education Quality and Standard Agency
TLA	Teaching and Learning Activities
TPS	Transaction Proce

CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays technology development plays an important role in education industry. The application of technology particularly in the area of teaching and learning at curriculum design level is increasing (Smith and Killen, 2013). Throughout the years, there has been quite a number of Institutions of Higher Learning (IHL) progressively involved in technological application at curriculum design level especially in developed countries such as USA, Canada, UK and Australia (JISC, 2009; Slack, 2011; Walker, 2013).

Based on the study, technology (hereafter known as information system) is used to support and facilitate the daily work of managers and professionals in every field (Oz, 2008), and there is no exception for the field of curriculum design (Smith and Killen, 2013). Among all IS, there are: Authoring Instructional Materials (AIM) system, which is a set of software tools for curriculum design and maintenance for use in the Navy (Wallace et. al., 1993); Curriculum Information System (CIS) is being developed to provide comprehensive summaries of curricula content and structure (Friedman and Nowacek, 1995); Curriculum Management System (CMS) which is an automated system supports entire curriculum process from planning to implementation to assessment and it also known as an automated system that supports the definition, visualization, analysis and assessment of an educational institutions desired curriculum (Wilkes et. al., 2005); Curriculum Management and Information Tool (CurrMIT) is used in the field of medicine in IHL which is used to manage medical school curriculum and it is released and used by medical school members since 1999 (Joshua et. al., 2005); Web-based application that helps in designing any curriculum in real time and allowing the verification of the proposed curriculum coherence and the generation of statistics necessary for academic and accreditation purpose (Hamam and Loucif, 2009); Curriculum Design System (CDS) is used to redesign information system programme (Slack, 2011); and Curriculum Design Tool is used to facilitate alignment between university and learner providers as communication between them is a desired feature highlighted by government (UK) and many advisory agencies for programme development (academia/training) (Georgios et. al., 2012).

Although there are numerous information systems (IS) for curriculum design in IHL, there is a lack of step-by-step guidance to curriculum designers throughout the design process. It is further confirmed through the preliminary study conducted earlier. The findings of preliminary study show that curriculum designers faced difficulties during the curriculum design process in IHL. The difficulties including mapping of course

learning outcome (CLO) to appropriate learning domains, aligning CLO to teaching and learning activities, aligning CLO to assessment tasks and meeting accreditation requirements such as student learning time

According to Ajith Abraham (2013) who is the director of Machine Intelligence Research Labs (MIR Labs) Scientific Network for Innovation and Research Excellence in United States of America (USA), pertaining to future IS – "…system … providing quality of service … without requiring the need of much human intervention". In view of the needs of future feature of information system which does not require much human intervention, an IS model with intelligent components is proposed in the domain of curriculum design for IHL. Not many studies have constructed IS model with intelligent components particularly in the domain of curriculum design. Therefore, proposing an IS model with intelligent components in curriculum design remains a good trend in today's IHL.

1.2 Research Problem

In 1994, Bull et. al. note that the use of information technology (in this research, it is known as information system) in support of teaching and learning is probably the least developed of all the areas studied. Twenty years have gone, today the use of IS in teaching and learning particularly in the area of curriculum design remains a crucial issue to be discussed and addressed in IHL. In spite of the concerns over costs, research has continued into such aspects of curriculum design information system such as curriculum management system and curriculum information system. IS support for curriculum design remains a critical issue to be addressed in 21st century ever since paradigm shift of higher education to outcome-based education (OBE). According to Attard et. al. (2010), the shift from conventional-based education such as input-oriented curriculum design to putting students at the center of the educators' thinking such as OBE curriculum design is necessitated. Educators such as curriculum designers who design the curriculum need to rethink or redesign curriculum i.e. higher education course content in terms of learning outcomes; making students more aware of what skills, knowledge and competences they can expect to develop through their studies.

Throughout the years, there has been quite a number of IHL that are progressively involved in applying IS at curriculum design level. This is evidenced in the significant growth of application in the area of teaching and learning particularly in the domain of curriculum design. It is further confirmed through a preliminary study conducted among 17 IHL in Malaysia. Although there are numerous IS developed and used for curriculum design, there is lack of IS curriculum design model found in IHL. Moreover, research on IS model that provides guidance in accomplishing the curriculum design tedious tasks is scarce (Wallace et. al., 1993; Von Konsky, 2006). Therefore, having an IS model that can guide curriculum designers not only novices but also experienced ones during the design process might help in reducing time, error and effort in their design. This research is proposing an IS model for curriculum design which provide step-by-step guidance during the curriculum design process. Curriculum design process is a tedious process as it possesses many activities (or

steps). IS plays an important role in supporting or automating many steps during the design process such as mapping learning outcomes of a course to learning domain or generating report. This is inline with the notes given by Laudon and Laudon (2014) that IS improves business processes and also automate many steps in business processes that are formerly performed manually. Through the review of literature, it is also discovered that agent technology has not been adopted by IS for curriculum design despite the benefits of adopting agent technology is obvious such as it helps to automate repetitive tasks, as a result reducing time, error and effort of curriculum designers.

1.3 Research Question

This section presents the research questions and sub-questions. The five research questions are as follows:

Q1.What are the existing IS for curriculum design in previous work that is able to provide guidance?
Q2. How the IS used for curriculum design differs from each other in terms of its components particularly in utilizing agent technology?
Q3. What are the common IS model used for curriculum design in IHL?
Q4. How the common IS model being designed for curriculum design in IHL?
Q5. What are the usability and acceptance of the IS model in terms of efficiency in facilitating the work of curriculum designers?

For research Q3 and Q4, three sub-questions are derived and there are as follows:
Q3a.What are the important components (including the subcomponents) of the IS model?
Q3b.What are the relationships between components (including the subcomponents) of the IS model?
Q4a. How are the different components of IS model interact with each others in the curriculum design process?

Sub-question Q3b is then hypothesized and presented in Chapter 7 in order to show whether they are accepted or rejected. For sub-question Q4a, the appropriateness of the content and sequence of curriculum design process is conducted through expert review and results are presented in Chapter 7.

1.4 Research Objective

The main aim of this research is constructing an IS Model which is used to guide and assist curriculum designers in designing curriculum for IHL. To achieve the aim, the research objectives are:

1. To propose an IS model for curriculum design in IHL;

2. To develop a prototype based on the proposed model in evaluating efficiency

For research objective 1, two sub-objectives are derived and there are as follows:

RO1a. To integrate components of the proposed model which are curriculum design module, curriculum design process and curriculum database;
RO1b. To enhance the current curriculum design IS using agent technology

1.5 Research Scope

There are four stages involved in curriculum design, and there are planning, developing, implementing and evaluating stages. Out of these four stages of curriculum design, this research focuses on developing stage and the curriculum design activities involve at this stage are state programme goal(s) (or programme learning outcomes), develop courses; and identify teaching and learning activities and assessment tasks. This research also focuses on outcome-based education (OBE) which is one of the curriculum design models and the subject or domain area is software engineering education.

1.6 Research Contribution

This research presents an IS Model, which can guide and assist curriculum designers in designing curriculum. The IS model is able to provide step-by-step guidance to curriculum designers throughout the entire design process. The IS model can be applied in IHL for curriculum design. Prototype which is developed based on the proposed model is also part of the research contribution.

1.7 Organization of the Thesis

The overall structure of the thesis is organized in eight chapters. The first chapter is the introductory chapter covering the background of the study, problem statement, research objectives, and scope of research, research contribution and thesis organization. Chapter 2 reviews literature cover the basic concepts of IS, basic concepts of curriculum design and IS in curriculum design domain. This chapter provides important information to be taken into consideration in achieving the research goal. Chapter 3 explains the research methodology comprising five main phases: literature review; preliminary study; model development; prototype development and model validation; and model evaluation and discussion. Chapter 4 presents the results and findings of preliminary study which is conducted using survey and expert review. The preliminary study is carried to identify difficulties faced by curriculum designers in IHL and the desired features of IS. Chapter 5 discusses the development of the proposed model. This chapter describes structure of the model including its components and sub-components in detail. Chapter 6 discusses the development of prototype and implementation. Prototype development describes the development of prototype in detail including system architecture, software design and technology platform. Prototype implementation describes how the prototype is implemented in

IHL in Malaysia. Chapter 7 presents the results and findings of model development verification, model validation and model evaluation and discussion. Model development verification comprises analyzing the main components of the model and their relationships; model validation including technology acceptance test gauges the overall acceptance of the prototype and usability test discusses analysis results of users' perceived usefulness in terms of time, error and effort. Chapter 8 presents the conclusions on this research.

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Construct	Item	Min	Max	Mean	Standard Deviation (SD)	Variance	Skewness	Kurtosis
Perceived Usefulness	PU1	1	5	4.10	0.668	0.446	-0.115	-0.714
	PU2	1	5	4.05	0.593	0.352	-0.011	-0.071
	PU3	1	5	4.08	0.725	0.526	-0.728	0.981
	PU4	1	5	3.84	0.770	0.594	-0.392	0.005
	PU5	1	5	3.84	0.849	0.720	-0.954	1.853
	PU6	1	5	4.01	0.755	0.569	-0.565	0.331
	PU7	1	5	4.15	0.695	0.484	-0.674	0.929
	PU8	1	5	4.33	0.742	0.551	-0.609	-0.939
Ease of Use	PEU9	1	5	4.19	0.713	0.509	-0.935	1.634
	PEU10	1	5	4.05	0.654	0.428	-0.607	1.367
	PEU11	1	5	3.93	0.792	0.627	-0.962	1.926
	PEU12	1	5	4.05	0.654	0.428	-0.885	2.352
	PEU13	1	5	3.94	0.735	0.540	-0.293	-0.135
	PEU14	1	5	3.96	0.702	0.492	-0.174	-0.300
	PEU15	1	5	3.99	0.720	0.519	-0.607	-0.743
	PEU16	1	5	4.21	0.910	0.828	-0.853	-0.303
Attitude	A17	1	5	4.11	0.636	0.405	-0.399	0.724
	A18	1	5	4.00	0.694	0.481	-0.233	-0.166
Intention to Use	ITU19	1	5	4.24	0.997	0.994	-1.442	1.762
	ITU20	1	5	4.00	0.857	0.734	-1.238	2.001

BIODATA OF STUDENT

Thong Chee Ling completed her primary education in Ipoh, Perak and her secondary education was completed in Petaling Jaya, Selangor. After her secondary education, she was accepted by University Putra Malaysia (UPM) to pursue her tertiary education. She obtained both her bachelor's degree in computer science and masters' degree in information technology from UPM. In 2009, she started her Ph.D in information system at Faculty of Computer Science and Information Technology in UPM. Her research interests include information system in education, management information system and software enginnering.

LIST OF PUBLICATIONS

Journal Publication

1. Thong Chee Ling, Yusmadi Yah Jusoh, Rusli Abdullah, and Nor Hayati Alwi (2012), "Towards A Curriculum Design Maturity Model, Journal of Soft Computing and Software Engineering (JSCSE), Vol.2, No. 10, pp.1-10, 2012, e-ISSN:2251-7545.
2. Thong Chee Ling, Yusmadi Yah Jusoh, Rusli Abdullah, and Nor Hayati Alwi (2012), "A Maturity Model for Curriculum Design", Asian Transactions on Computer ATC, Vol. 2, Issue 05, ISSN: 2221-4275, pp 12-17
3. Thong Chee Ling, Yusmadi Yah Jusoh, Rusli Abdullah, and Nor Hayati Alwi (2012), "A Review Study: Applying Capability Maturity Model in Curriculum Design Process for Higher Education". International Journal for the Advancement of Science & Arts (IJASA) Vol.1 No.1 2012 issue, pp. 46-54

Book Chapter

4. Thong Chee Ling, Yusmadi Yah Jusoh, Rusli Abdullah, and Nor Hayati Alwi (2013), Application of Curriculum Design Maturity Model in Private Institution of Higher Learning in Malaysia: A Case Study. In IAENG Transaction on Engineering Technologies (pp. 579-590). Springer Netherlands.

Proceedings

5. Thong Chee Ling, Yusmadi Yah Jusoh, Rusli Abdullah, Nor Hayati Alwi, and Lee Kim Cheong. "Identifying Difficulties in Curriculum Design for Institution of Higher Learning in Malaysia". Abstract of The Academic Development in Higher Education 2011, November 2-4, 2011, Selangor
6. Thong Chee Ling, Yusmadi Yah Jusoh, Rusli Abdullah, Nor Hayati Alwi, and Lee Kim Cheong. "A Literature Study on Capability Maturity Model in Supporting Quality Design Process for Higher Education". Abstract of The Academic Development in Higher Education 2011, November 2-4, 2011, Selangor
7. Thong Chee Ling, Yusmadi Yah Jusoh, Rusli Abdullah, and Nor Hayati Alwi (2012), "Educators' Perception Towards Automation of Curriculum Design Process for Institution of Higher Learning in Malaysia", In Proceedings IEEE Symposia for Computer and Informatics 2012, March 15-16, 2012, Penang, Malaysia, pp. 75 – 80.
8. Thong Chee Ling, Yusmadi Yah Jusoh, Rusli Abdullah, and Nor Hayati Alwi (2012), "Applying Capability Maturity Model to Curriculum Design: A Case Study at Private Institution of Higher Learning in Malaysia", Proceedings of

the World Congress on Engineering 2012, Vol II, WCE 2012, July 4-6, 2012, London, UK. Pp. 1070-1075. ISBN: 978-988-19252-1-3 and ISSN:2078-0958 (Print); ISSN:2078-0966 (Online)
[This paper awarded with Certificate of Merit for The 2012 International Conference of Information Engineering]

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