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2009

## Identification and prioritisation of variables influencing the cost of learning content development

Zhengui Wu  
*University of Wollongong*

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# **Identification and Prioritization of Variables Influencing the Cost of Learning Content Development**

A thesis submitted in fulfilment of the  
requirements for the award of the degree

**Master of Engineering (Research)**

From

**University of Wollongong**



By

**Zhengui Wu**

MIT (UOW), BCS (NAFU)

School of Electrical, Computer & Telecommunications Engineering

November 2009

## **CERTIFICATION**

I, Zhengui Wu, declare that this thesis, submitted in fulfilment of the requirements for the award of Masters of Engineering (Research), in the Faculty of Informatics, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Zhengui Wu

30 November 2009

## **ABSTRACT**

A dominant factor in cost analyses of e-Learning programs at tertiary education institutions is the measurement of direct and indirect costs associated with digital learning content, or in brief, learning content. In broad terms, over 60% of total e-Learning costs are related to design, development, publication and evaluation of learning content. The inclusion of new and emerging concepts and technologies including Learning Objects (LOs) and Learning Content Management Systems (LCMSs) into e-Learning programs at universities has opened up new opportunities and increased the complexity of learning content cost analyses.

This thesis constructs a model that offers a minimized cost for the design, development and publication of learning content in a typical e-Learning program. Steps towards building the target model include the investigation of factors that affect learning content development, identification and prioritization of variables influencing the development cost, discussion of the relationships between identified variables and the process of learning content development, and analyses of two extreme cost structures. Finally, by assigning relevant variables in the available cost structure, a cost-effective model that covers the three main processes for design, development and publication of learning content is constructed.

The cost-effective model introduced in this thesis covers not only the main subject notes but also content materials that are widely used in e-Learning programs. The proposed model takes into account subject notes and other materials which include quizzes, tutorial questions, critical thinking tasks and assignments as Learning Objects. In addition, based on this model, an experimental platform is designed and implemented to support the practical aspects of the proposed model noting its limitations and constraints. The experimental platform allows for the implementation of a simple case study for verification of development strategies adopted in the proposed cost-effective model. The reusability of Learning Objects used in the case study, and standards compliance of the resultant learning packages with different e-Learning platforms are also tested and documented.

As an efficient and effective method of enhancing and facilitating students' learning, e-Learning has obtained a wider acceptance among higher education institutions. The concept of Learning Objects and underlying models and technologies, including the proposed cost model, represent a cost-effective approach for accelerating the design, development and publication of learning content that can be highlighted in the development of e-Learning programs worldwide.

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## ABBREVIATIONS

ADL	Advanced Distributed Learning
ADSL	Asymmetrical Digital Subscriber Line
AICC	Aviation Industry CBT Committee
API	Application Programming Interface
ATRC	Adaptive Technology Resource Center
CAM	Content Aggregation Model
CD	Compact Disc
DNS	Domain Name System
DoD	Department of Defense
DOOR	Digital Open Object Repository
DSL	Digital Subscriber Line
DVD	Digital Video Disc
eXe	elearning XHTML editor
FAQs	Frequently Asked Questions
ICT	Information and Communication Technology
IEEE/LTSC	Learning Technology Standards Committee of the Institute of Electrical and Electronic Engineers
ISD	Instructional System Design
ISP	Internet Service Provider
ITRC	Iranian Telecommunication Research Center
LCMS	Learning Content Management System
LOs	Learning Objects
LOM	Learning Object Metadata
LMS	Learning Management System
LOR	Learning Object Repository
OSS	Open Source Software
QUIS	Quality, Interoperability and Standards
QTI	Question & Test Interoperability Specification
RLOs	Reusable Learning Objects
ROI	Return On Investment
RTM	Run-Time Environment
SCORM	Sharable Content Object Reference Model



**ABBREVIATIONS**

SCOs	Sharable Content Objects
Sloan-C	Sloan Consortium
SN	Sequencing & Navigation
VLE	Virtual Learning Environment
WBT	Web-Based Training
WWW	World Wide Web