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

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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.
ACKNOWLEDGEMENTS

My deepest gratitude goes first and foremost to Dr. Parviz Doulai, my supervisor, for his assistance and constant motivation in guiding me throughout this research. I am very grateful to him for walking me through all the stages of the writing of this thesis. Without his consistent and enlightening instruction, this thesis could not have reached its present form.

Secondly, I would like to express my heartfelt gratitude to my co-supervisors, Professor Ian Burnett and Mr. Peter Vial; their timely and constructive advice was critical in completing this thesis document. I am also greatly indebted to Eva Cheng, for her sense of responsibility, guidance and incredible patience in proof reading and helping me work out my problems during the whole course of my writing.

Last but not least, special thanks go to my beloved family and friends who have always supported and buoyed me up with maximum enthusiasm.
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### ABBREVIATIONS

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

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<td>Sloan Consortium</td>
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<td>SN</td>
<td>Sequencing &amp; Navigation</td>
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<td>VLE</td>
<td>Virtual Learning Environment</td>
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<td>WBT</td>
<td>Web-Based Training</td>
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<td>WWW</td>
<td>World Wide Web</td>
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