

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

DEVELOPMENT OF A FRAMEWORK FOR EVALUATING THE QUALITY OF  
INSTRUCTIONAL DESIGN ONTOLOGIES

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF

MASTER OF MANAGEMENT  
IN  
INFORMATION SYSTEMS

AT MASSEY UNIVERSITY, WELLINGTON, NEW ZEALAND.

XIN LI

2009



## ABSTRACT

Instructional Design (ID) ontology can be used to formally represent knowledge about the teaching and learning process, which contributes to automatic construction of personalised eLearning experiences. While ID ontologies have been continuously improved and developed over recent years, there are concerns regarding what makes a quality ID ontology. This study proposes a framework for evaluating the quality of an ID ontology by synthesising the crucial elements considered in the ID ontologies developed to date. The framework would allow a more precise evaluation of different ID ontologies, by demonstrating the quality of each ontology with respect to the set of crucial elements that arise from the ontology. This study also gives an overview of the literature on ID ontology, as well as the implications for future research in this area.

## ACKNOWLEDGEMENTS

This research was made possible by the guidance and support provided by many people. I would like to thank my academic supervisors: Dr Barbara Crump and Dr Alexei Tretiakov for their sound advice throughout the entire research process.

Special thanks go to all the staff at McGirr Associates, for enquiring about my thesis progress and providing continual support.

I also acknowledge and sincerely thank Jelena Jovanovic, Ricardo Rocha Amorim, and Carsten Ullrich for their prompt replies and, for contributing their knowledge around eLearning ontologies.

In addition, I would like to thank Nicholas Roelants for proofreading and suggesting corrections to the thesis.

Finally, I am very grateful to my parents and my friend Yi Yang for their ongoing support and encouragement over the years.

## TABLE OF CONTENTS

ABSTRACT .....	i
ACKNOWLEDGEMENTS .....	ii
TABLE OF CONTENTS .....	iii
LIST OF TABLES.....	v
LIST OF FIGURES.....	vi
CHAPTER 1 INTRODUCTION .....	1
Background.....	1
Motivation and Objectives.....	1
Significance .....	3
Thesis Structure .....	3
CHAPTER 2 LITERATURE REVIEW.....	5
Background.....	5
<i>eLearning</i> .....	5
<i>Introduction to Ontology</i> .....	6
<i>Ontologies for eLearning</i> .....	7
<i>Instructional Design Ontology</i> .....	8
The Development of ID Ontology.....	9
<i>Support of Learning Design Standards</i> .....	9
<i>The Use of Concepts Hierarchy</i> .....	10
<i>Selection of Ontology Language</i> .....	11
<i>Consideration of Learning Style</i> .....	12
<i>Consideration of Domain Knowledge</i> .....	13
<i>The Application of Instructional Theories</i> .....	13
<i>The Use of Ontology Axioms</i> .....	14
<i>The Availability of an Authoring Tool</i> .....	15
Summary.....	16
CHAPTER 3 METHODOLOGY AND PROCEDURES .....	18
Methodology.....	18
<i>Research Purpose</i> .....	18
<i>Epistemology</i> .....	19
<i>Qualitative Research Approach</i> .....	19
Procedures .....	23

Ethical Considerations.....	29
Limitations.....	29
CHAPTER 4 DEVELOPMENT OF THE FRAMEWORK.....	31
The Framework .....	31
Selection of the Elements .....	33
Description of the Elements .....	36
<i>Compliance with Standards</i> .....	38
<i>The Use of Concepts Hierarchy</i> .....	39
<i>The Selected Ontology Language</i> .....	40
<i>Relations to Learning Styles</i> .....	41
<i>Relations to Domain Knowledge</i> .....	42
<i>Integration of Pedagogical Knowledge</i> .....	43
<i>The Use of Ontology Axioms</i> .....	44
<i>The Availability of an Authoring Tool</i> .....	46
Categorisation of the Elements.....	47
<i>Reusability</i> .....	47
<i>Personalisation</i> .....	48
<i>Quality Assurance</i> .....	49
<i>Applicability</i> .....	50
Expert Feedback on the Framework.....	50
CHAPTER 5 CONCLUSION AND FUTURE WORK .....	52
Conclusion.....	52
Limitations.....	55
Implications and Future Work .....	55
BIBLIOGRAPHY .....	56

## LIST OF TABLES

Table 1. <i>Review of Source Selection</i> .....	26
Table 2. <i>Development Background Details of the Four ID Ontologies</i> .....	35
Table 3. <i>Comparison Matrix Crucial Elements</i> .....	37



## LIST OF FIGURES

<i>Figure 1.</i> Research process framework.....	24
<i>Figure 2.</i> The framework for evaluating the quality of an ID ontology .....	32