MULTIMEDIA IN EDUCATION

Adaptive Learning and Testing

This page intentionally left blank

MULTIMEDIA IN EDUCATION

Adaptive Learning and Testing

Irene Cheng

University of Alberta, Canada

Lluís Vicent Safont

Ramon Llull University, Spain

Anup Basu

University of Alberta, Canada

Randy Goebel

University of Alberta, Canada

World Scientific

NEW JERSEY • LONDON • SINGAPORE • BEIJING • SHANGHAI • HONG KONG • TAIPEI • CHENNAI

Published by

World Scientific Publishing Co. Pte. Ltd.

5 Toh Tuck Link, Singapore 596224

USA office: 27 Warren Street, Suite 401-402, Hackensack, NJ 07601

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

MULTIMEDIA IN EDUCATION

Adaptive Learning and Testing

Copyright © 2010 by World Scientific Publishing Co. Pte. Ltd.

All rights reserved. This book, or parts thereof, may not be reproduced in any form or by any means, electronic or mechanical, including photocopying, recording or any information storage and retrieval system now known or to be invented, without written permission from the Publisher.

For photocopying of material in this volume, please pay a copying fee through the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, USA. In this case permission to photocopy is not required from the publisher.

ISBN-13 978-981-283-705-9

ISBN-10 981-283-705-1

Printed in Singapore.

Contents

<i>List of Contributors</i>	ix
1. Introduction and Overview	1
1.1 The Trend Towards Online Multimedia Education	2
1.2 Framework of an Online Multimedia Education System	3
1.3 Innovative Item Types for Learning and Testing	4
1.4 3D Items	5
1.5 Drag and Drop Items (2D and 3D)	7
1.6 Logical-Mathematical Items	7
1.7 Language Items	8
1.8 Educational Games	9
1.9 Automatic Difficulty Level Estimation	11
1.10 Testing Beyond Subject Knowledge	12
1.11 Adaptive Testing and Student Modeling using Multimedia Items	13
1.12 Multimedia Item Authoring Graphical Interface	15
1.13 Learning Management Systems	16
1.14 Statistical Analysis for E-Learning	16
1.15 Multimedia Edutainment: Designing Professional Profiles	17
1.16 Multimedia Education on Mobile Devices	18
2. Learning Management System	21
<i>L. Vicent and M. Segarra</i>	
2.1 Introduction. What is a LMS?	21
2.1.1 Tools	22
2.1.2 Reasons for using LMS	23

2.2	History of LMSs	24
2.2.1	1960's	24
2.2.2	1970's	25
2.2.3	1980's	26
2.2.4	2000's	27
2.3	Tools and Services	28
2.3.1	Communication and collaboration tools	29
2.3.2	Assessment tools	30
2.3.3	Learning activities and resources	31
2.4	Interoperability Standards	32
2.4.1	AICC and ADL SCORM	32
2.4.2	IMS specifications	33
2.4.3	Advantages of standards and specifications	35
2.4.4	Problems with standards and specifications	35
2.4.5	Web sites of interest on the last standards compat- ible tools	36
2.5	The Future of LMSs	37
2.5.1	Web 2.0 and e-learning 2.0	37
2.5.2	Mobile electronic learning	40
2.5.3	Standards and specifications	40
2.5.4	Emotional development?	42
2.5.5	3D Virtual environment	43
2.5.6	Future trends	45
3.	Multimedia Edutainment: Designing Professional Profiles	49
	<i>O. G. Pañella, D. F. Escudero, M. P. Zaragoza and E. V. Portero</i>	
3.1	Introduction	49
3.2	Education in Multimedia and Entertainment through Edutainment	50
3.2.1	Definitions	50
3.2.2	And the Academia got to believe in it	51
3.3	Product Life Cycles	53
3.4	Skills, Competences and Profiles	55
3.4.1	General skills	55
3.4.2	Specific skills	56
3.4.3	Profiles	57
3.5	Modules	59

3.5.1	Edutainment within the Multimedia Engineering Studies	61
3.6	Edutainment Experiences	62
3.6.1	ALGTEC	62
3.6.2	SmashBall	66
3.6.3	I-Shadows	67
3.6.4	SIMUSOLD	69
3.6.5	Blink and LightClimber	71
3.7	Conclusion	72
4.	Educational Games	77
	<i>S. Rodriguez, I. Cheng and A. Basu</i>	
4.1	Introduction	77
4.1.1	Benefits of educational games	78
4.2	Computer Games and Applications	85
4.2.1	Educational games	85
4.2.2	ITS and game-based ITS	88
4.3	Intelligent Tutoring Systems and Computer Games	91
4.3.1	Student model	93
4.3.2	Tutoring model	97
4.3.3	Game module	98
4.4	Example of Integration of an ITS and Computer Games	100
4.4.1	ITS global models	100
4.4.2	Game module	102
4.4.3	ITS evaluation	113
4.5	Discussion	120
5.	Automatic Difficulty Level Estimation of Multimedia Math Test Items	125
	<i>R. Shen, I. Cheng and A. Basu</i>	
5.1	Introduction	125
5.2	Multimedia Items and Item Generation	127
5.3	Difficulty Prediction for Traditional Math Item Types	129
5.4	Item Response Theory	130
5.5	Parameter-Based Estimation of Difficulty Level for Math Item Types	132
5.6	Summary	136

6. Tracking Students' Thinking in Solving Complex Process 139

I. Cheng, N. Rossol and R. Goebel

6.1 Introduction 139

6.2 Motivation 140

6.2.1 Design and implementation 144

6.3 Process Dependency Graph (PDG): The Sequence of Steps in Problem Solving 149

6.3.1 Step-by-step guidance 150

6.3.2 Performance Monitoring Graph (PMG): Intelligent analysis of student thinking 151

6.3.3 Fair and in-dept performance assessment 151

6.3.4 Visual trails for educators 153

6.3.5 General opinions from a free-trial 154

6.4 Conclusion 157

7. Statistical Analysis in E-learning 159

L. Vicent and X. Gumara

7.1 Introduction 159

7.2 Why Statistics in E-learning? 160

7.3 Effective Statistical Analysis 161

7.3.1 Basic statistical analysis 161

7.3.2 Graphs 164

7.3.3 Multivariate analysis 166

7.4 How Can We Benefit from Statistical Analysis? 171

7.4.1 Evaluation of the effectiveness of a question . . . 171

7.4.2 Evaluation of the reliability and the consistency of the test 172

7.4.3 Evaluation of the performance of students in skills 172

7.4.4 Classifying students according to skills performance 175

7.5 Conclusion 177

List of Contributors

Lluís Vicent Safont, Marc Segarra Calvís, Xavier Gumara Rigol,
Oscar García Pañella, David Fonseca Escudero, Marc Pifarré Zaragoza and
Eva Villegas Portero,
La Salle Open University — Universitat Ramon Llull (La Salle Barcelona)

Saul Rodriguez, Rui Shen, Nathaniel Rossol, Irene Cheng, Anup Basu and
Randy Goebel,
University of Alberta, Department of Computer Science, Canada