Abstracts of the Papers Presented at the 9th European Conference on Games Based Learning

ECGBL 2015

Nord-Trondelag University College
Steinkjer

Norway

8-9 October 2015

Papers submitted to this conference have been double-blind peer reviewed before final acceptance to the conference. Initially, paper abstracts were read and selected by the conference panel for submission as possible papers for the conference. Many thanks to the reviewers who helped ensure the quality of the full papers.

This Booklet of abstracts and other conference materials is provided to conference participants for use at the conference.

Conference Proceedings

The Conference Proceedings is a book published with an ISBN and ISSN. The proceedings have been submitted to a number of accreditation, citation and indexing bodies including Thomson ISI Web of Science and Elsevier Scopus for indexing.

The Electronic version of the Conference Proceedings is available to download from **DROPBOX**. (**http://tinyurl.com/ECGBL2015**) Select Download and then Direct Download to access the Pdf file. Free download is available for conference participants for a period of 2 weeks after the conference.

The Conference Proceedings for this year and previous years can be purchased from http://academic-bookshop.com

E-Book ISBN: 978-1-910810-59-0
E-Book ISSN: 2049-100X
Book version ISBN: 978-1-910810-58-3
Book Version ISSN: 2049-0933
CD Version ISBN: 978-1-910810-60-6
CD Version ISSN: 2049-1018

Published by Academic Conferences and Publishing International Limited
Reading, UK
44-118-972-4148
www.academic-publishing.org

Contents

Preface

These proceedings represent the work of researchers participating in the 9th European Conference on Games-Based Learning, which is being hosted this year by Nord-Trondelag University College, Steinkjer, Norway, on the 8-9 October 2015.

The Conference has become a key platform for individuals to present their research findings, display their work in progress and discuss conceptual advances in many different areas and specialties within Games-Based Learning. It also offers the opportunity for like-minded individuals to meet, discuss and share knowledge.

ECGBL continues to evolve and develop, and the wide range of papers and topics will ensure an interesting two-day conference. In addition to the main streams of the conference, there are mini tracks focusing on the areas of the design of multiplayer/collaborative serious games, applied Games and gamification, the teacher's role in game-based learning, games for STEM (Science, Technology, Engineering, Mathematics) learning, assessment of digital game-based learning and pervasive and ubiquitous gaming for learning.

In addition to the presentations of research we are delighted to host the third year of the Serious Game competition, which provides an opportunity for educational game designers and creators to participate in the conference and demonstrate their game design and development skills in an international competition. This competition is again sponsored by SEGAN – Serious Games Network. With an initial submission of more than 60 games, 28 finalists will present their games at the conference. Prizes will be awarded to the games judged to demonstrate the best quality and originality of game play itself and the positioning and articulation of the game's contribution to the educational domain.

With an initial submission of 190 abstracts, after the double blind peer review process, there are75 research papers, 15 PhD research papers, 4 Non Academic papers and 8 work-in-progress papers published in these Conference Proceedings. These papers represent research from more than 40 countries, including Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Czech Republic, , Denmark, Finland, France, Germany, Greece, Hungary, Ireland, , Israel, , Italy, Japan, Malaysia, Norway, Portugal, Russia, Saudi Arabia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Taiwan/ROC, The Netherlands, The Netherlands, United Arab Emirates, UK and USA

We hope that you have an enjoyable conference and that it fulfills your expectations.

Robin Munkvold and Line Kolås
October 2015

Conference Committee

ECGBL Conference Director

Professor Thomas M Connolly, University of the West of Scotland, UK

Conference Executive:

Robin Munkvold, Nord-Trondelag University College, Steinkjer, Norway
Dr. Line Kolås, Nord-Trondelag University College, Steinkjer, Norway
Kristine Øygardslia, Norwegian University of Science and Technology (NTNU), Norway
Kristine Ask, Norwegian University of Science and Technology, Trondheim, Norway
Sara Brinch Norwegian University of Science and Technology (NTNU), Norway
Silje Hole Hommedal, University of Bergen, Norway
Alf Inge Wang, Norwegian University of Science and Technology (NTNU), Norway.
Helga Dis Sigurdardottir, Nord-Trondelag University College, Steinkjer, Norway
Dr Beata Godejord Nesna University College, Nesna/Mo i Rana, Norway
Vibeke Guttormsgaard , Norwegian Centre for ICT in Education, Norway
Ellen Brox, Norut (Northern Research Institute), Tromsø, Norway
Trond Olav Skevik, Nord-Trondelag University College, Steinkjer, Norway
Hugo Nordseth, Nord-Trondelag University College, Steinkjer, Norway
Knut Ekker, Nord-Trondelag University College, Steinkjer, Norway
Hans Christian Arnseth, University of Oslo in Norway
Kennet Silseth, Department of Education, University of Oslo, Norway

Mini track chairs

Prof. DI Dr. Maja Pivec, FH JOANNEUM University of Applied Sciences, Austria
Jordi Torrent, United Nations Alliance of Civilizations, NY, USA
Dr. Sylvester Arnab, Disruptive Media Learning Lab , Coventry University, UK
Helga Dis Alfheidardottir Sigurdardottir, Nord-Trøndelag University Norway
Anissa All, iMinds - MICT-Ghent University, Belgium
Dr Carlos Vaz de Carvalho, Porto Polytechnic (ISEP), Porto, Portugal
Dr. Kimmo Oksanen, The Finnish Institute for Educational Research, Finland
Christian Reuter, Technische Universität Darmstadt, , Germany
Viktor Wendel, Technische Universität Darmstadt, Germany
Dr. Stefan Göbel, Technische Universität Darmstadt, Germany
Assoc.Prof. Joze Rugeljuh, University of Ljubljana, Faculty of Education, Slovenia
Dr. Thorkild Hanghøj, Aalborg University, Denmark
Dr Daire O Broin, IT Carlow, Ireland
Dr Neil Peirce, Learnovate, Trinity College Dublin, Ireland

Committee Members
The 2014 conference programme committee consists of key people in the games based learning community, both from the UK and overseas. The following people have confirmed their participation:

Dr. Wilfried Admiraal (Leiden University, Leiden, The Netherlands); Dr. Minoo Alemi (Sharif University of Technology, Iran); Anissa All (iMinds-MICT-Ghent University, Belgi); Ana Almeida (Universidade de Coimbra, Portugal); ashish amresh (Arizona State University, United States); Dr. Daniel Aranda (Universitat Oberta de Catalunya, Spain); Dr. Sylvester Arnab (Coventry University, UK); Hans Christian Arnseth (University of Oslo in Norway , norway); Kristine Ask (Nord-Trøndelag University College, Steinkjer, Norway); Nikolaos Avouris (University of Patras, Greece); Isabel Azevedo (Instituto Superior de Engenharia do Porto (ISEP), Portugal); Jannicke Baalsrud Hauge (Bremer Institut f r Produktion und Logistik, Germany); Dr. Ana Barata (Instituto Superior de Engenharia do Porto (ISEP), Portugal); Dr. Wolmet Barendregt (Gothenburg University, department of applied IT, Sweden); Francesco Bellotti (University of Genoa, Italy); Mary Bendixen-Noe (Ohio State University, USA); Dr. Tobias Bevc (University of Augsburg, Germany); Dr. Bani Bhattacharya (IIT Kharagpur, India); Dr. Peter Blanchfield (School of Computer Science, University of Nottingham, UK); Dr. Melania Borit (UiT - The Arctic Univeristy of Norway (University of Troms), Norway); Natasha Boskic (The University of British Columbia, Canada); Dr. Rosa Maria Bottino (Istituto Tecnologie Didattiche - Consiglio nazionale Ricerche, Italy); Hadya Boufera (University Of Mascara, Algeria); Philip Bourke (Institute of Technology Carlo, Ireland); Dr. Liz Boyle (Univesity of the West of Scotland, UK); Dr Mairead Brady (Trinity College Dublin, Ireland); Dr. Tharrenos Bratitsis (University of Western Macedonia, Greece); Sara Brinch (Nord-Trøndelag University College, Steinkjer, Norway); Dr Cyril Brom (Charles University in Prague, Czech Republic); Prof. Anthony Brooks (Aalborg University, Denmark); Prof. David Brown (Nottingham Trent University, UK); Ellen Brox (Nord-Trøndelag University College, Steinkjer, Norway); Prof. Dr. Carsten Busch (University of Applied Sciences HTW-Berlin, Germany); Prof. Carlos Caldeira (University of Evora, Portugal); Dr. George Caridakis (University of the Aegean / NTUA, Greece); Dr. Thibault Carron (LIP6 - Paris, Université de Savoie, France, France); Dr. Rommert Casimir (Tilburg University, The Netherlands); António Castro (Instituto Superior de Engenharia do Porto (ISEP), Portugal); MS Hope Caton (Kingston University, UK); Dr. Erik Champion (Massey University, New Zealand); Prof. Maiga Chang (Athabasca University, Canada); Dimitris Charalambis (University of Athens, Greece); Dr. Darryl Charles (University of Ulster, UK); Prof. Nathalie Charlier (Catholic University of Leuven, Belgium); Dr. Yam San Chee (Nanyang Technological University, Singapore); Dr. Ming-Puu Chen (National Taiwan Normal University, Taiwan); Satyadhyan Chickerur (B V Bhoomaraddi College of Engineering and Technology, , India); Prof. Thomas Connolly

(University of West of Scotland, UK); Dr. Larry Crockett (Augsburg College, USA); Dr Reet Cronk (Harding University, USA); Tamer Darwish (Brunel University, UK); Ioannis Darzentas (University of Aegean, Greece); Dr. Sophia Delidaki (Hellenic American Educational Foundation, Greece); Dr. Ioannis Deliyannis (Ionian University, Greece); Dr. Muhammet Demirbilek (Suleyman Demirel University, Turkey); Helga Dis Sigurdardottir (Nord-Trøndelag University College, Steinkjer, Norway); Heiko Duin (BIBA - Bremer Institut f r Produktion und Logistik GmbH, Germany); Dr. David Edgar (Glasgow Caledonian University , UK); Dr Stine Ejsing-Duun (Aalborg University Copenhagen, Denmark); Knut Ekker (Nord-Trøndelag University College, Steinkjer, Norway); Dr Valerie Emin-Martinez (IFE-ENS Lyon, France); Dr. Paula Escudeiro (instituto Superior de Engenharia do Porto (ISEP), Spain); Patrick Felicia (Waterford Institute of Technology, Ireland); Georgios Fesakis (University of the Aegean, Greece); Dr. Brynjar Foss (University of Stavanger, Norway); Dr. Christos Gatzidis (Bournemouth University, UK); Prof Sebastien George (University of Maine, France); Prof. Panagiotis Georgiadis (University of Athens, Greece); Dr Natalia Gerodetti (Leeds Beckett University, UK); Dr. Andreas Giannakoulopoulos (Ionian University, Greece); Dr Lisa Gjedde (Aalborg University, Danmark); Beata Godegjord (Nord-Trøndelag University College, Steinkjer, Norway); Dr Beata Godejord (, Nesna University College, Nesna / Mo i Rana, Norway , norway); Dr. Stefan Goebel (Technical University Darmstadt, Germany); Pedro Pablo Gomez-Martin (Universidad Complutense, Madrid, Spain); Dr. Carina Gonzalez (University of La Laguna, Spain); Cleo Gougoulis (Peloponnesian Folklore Foundation, Greece); Dr. Dimitris Gouscos (University of Athens, Greece); Maria Grigoriadou (University of Athens, Greece); Dr. David Guralnick (Columbia University and Kaleidoscope Learning, New York, USA , USA); Vibeke Guttormsgaard (Nord-Trøndelag University College, Steinkjer, Norway); Dr. Thomas Hainey (University of the West of Scotland, UK); Dr Thorkild Hangh j (Aalborg University, Denmark); Dr. Anja Hawlitschek (Martin-Luther-University Halle-Wittenberg, Germany); Prof. Dr. Eng. Terseer Hemben (University of Phoenix, AZ/University of Riverside, CA, USA); Prof Helmut Hlavacs (University of Vienna, Austria); Silje Hole Hommedal (Nord-Trøndelag University College, Steinkjer, Norway); Paul Hollins (The University of Bolton, UK); Dr. Birgitte Holm Sorensen (Aalborg University, Copenhagen, Denmark); Prof. Rozhan Idrus (Universiti Sains Malaysia, Malaysia); Dr. Jose Ignacio Imaz (University of the Basque Country, UPV-EHU, Spain); Alf Inge Wang (Nord-Trøndelag University College, Steinkjer, Norway); Jeffrey Jacobson (Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA); Ruben Jans (Limburg Catholic University College, Belgium); Runa Jesmin (Global Heart Forum, UK); Dr. Larry Jones Esan (London Academy Business School, UK); Dr. Saule Juzeleniene (Vilnius University, Lithuania); Fragiskos Kalavassis (University of the Aegean, Greece); Prof. Konstantinos Kalemis (National Centre of Local Government and Administration, Greece); Dr. Michail Kalogiannakis (University of Crete, Faculty of Education, Crete); Dr. Anastasios Karakostas

(Aristotle University of Thessaloniki, Greece); Dr. Elisabeth Katzlinger-Felhofer (Johannes Kepler University, Linz, Austria); Dr. Harri Ketamo (Satakunta University of Applied Sciences, Finland); Dr. Diane Jass Ketelhut (University of Maryland, College Park, USA); Dr Michael Kickmeier-Rust (Graz University of Technology, Austria); Dr. Kristian Kiili (Tampere University of Technology, Pori, Finland); Dr. Veit Koeppen (Otto-von-Guericke-University Magdeburg, Germany); Dr Line Kolås (Nord-Trondelag University College, Steinkjer, Norway); Prof. Maria Kordaki (University of the Aegan, Greece); MA Safak Korkut (Fachhochschule Nordwestschweiz; Institute for Information Systems in School of Business, Switzerland); Evangelia Kourti (University of Athens, Greece); Rolf Kretschmann (University of Texas at El Paso, USA); Dr. Timo Lainema (University of Turku, Finland); Prof. Miguel Leitao (ISEP, Portugal); Dr. Ximena Lopez Campino (Initium, Italy); Carrie Lui (James Cook University, Australia); Dr. Hamish Macleod (University of Edinburgh, UK); Dr. Rikke Magnussen (Danish school of education, Aarhus university/Steno Health Promotion Center, Denmark); Emanuela Marchetti (Aalborg University Esbjerg, Denmark); Bertil Marques (Instituto Superior de Engenharia do Porto (ISEP), Portugal); Dr. Jean-Charles Marty (LIRIS lab, Lyon, France); Dr Lukasz Marzantowicz (University of Szczecin, Poland); Stephanos Mavromoustakos (European University Cyprus, Cyprus); Florian Mehm (Technische Universität Darmstadt, Germany); Michail Meimaris (University of Athens, , Greece); Bente Meyer (The Danish University of Education, Denmark); Mr BREMPONG Michael Kwadwo Owusu (Odebrecht Infrastructure, Ghana); Prof. Florence Michau (Grenoble Institute of Technology, France); Dr. Christine Michel (INSA-Lyon, France); Dr. Jonathan Moizer (University of Plymouth, UK); Dr. Begoña Montero-Fleta (Universitat Politecnica de Valencia, Spain); Alexander Moseley (University of Leicester, UK); Dulce Mota (Instituto Superior de Engenharia do Porto (ISEP), Portugal); Constantinos Mourlas (University of Athens, Greece); Peter Mozelius (Stockholm University, Department of Computer and Systems Sciences, Sweden); Robin Munkvold (Nord-Trøndelag University College, Steinkjer, , Norway); Dr Rob Nadolski (Open University of the Netherlands, the Netherlands); Dr Karen Neville (University College Cork, Ireland); Dr Darren Nixon (Leeds Beckett University, UK); Hugo Nordseth (Nord-Trøndelag University College, Steinkjer, Norway); Dr Daire O Broin (Institute of Technology Carlow, Ireland); Kimmo Oksanen (Finnish Institute for Educational Research, University of Jyväskylä, Finland); Trond Olav Skevik (Nord-Trøndelag University College, Steinkjer, Norway); Dr. John O'Mullane (University College Cork, Ireland); Kristine Øygardslia (Nord-Trøndelag University College, Steinkjer, Norway); Dimitra Panagouli (Hellenic American Educational Foundation, Greece); George Papakonstantinou (University of Thessaly, Greece); Agis Papantoniou (Multimedia Laboratory of the School of Electrical and Computer Engineering (ECE) of the National Technical University of Athens (NTUA). , Greece); Dr. Marina Papastergiou (University of Thessaly, Greece); Paul Peachey (University of Glamorgan, Treforest, UK); Gilbert Peffer

(CIMNE, Spain); Dr. Neil Peirce (Trinity College Dublin, Ireland); Dr. Carmen Perez-Sabater (Universitat Politecnica de Valencia, Spain); Dr. Eva Petersson Brooks (Aalborg University Esbjerg, Denmark); Alexander Pfeiffer (Danube University Krems, Austria); Trygve Plohn (Nord-Trondelag University College, Norway); Elias Pimenidis (University of West of England, UK); Prof. Selwyn Piramuthu (University of Florida, Gainesville, USA); Prof. Dr. Maja Pivec (FH JOANNEUM University of Applied Sciences, Austria); Dr Audrone Poskiene (Kaunas University of Technology, Lithuania); Angeliki Poylymenakou (Athens University of Economics & Business, Greece); Dr. Aristidis Protopsaltis (Institut für Lern-Innovation Friedrich-Alexander-Universität, Germany); Rosa Reis (Instituto Superior de Engenharia do Porto (ISEP), Portugal); Prof. Dr. Bernd Remmele (WHL Graduate School of Business and Econmics Lahr, Germany); Ass. Prof. Simos Retalis (University of Piraeus, Greece); Dr. Pauline Rooney (Dublin Institute of Technology, Ireland); Dr. Eleni Rossiou (University of Macedonia,Thessaloniki, Greece); Dr. Maria Roussou (makebelieve design & consulting, Greece); Prof. Joze Rugelj (University of Ljubljana, SLovenia); Dr. Florin Salajan (North Dakota State University , Canada); Jordi Sanchez Navarro (Universitat Oberta de Catalunya, Spain); Assistant Professo Manthos Santorineos (School of Fine Arts in Athens, Greece); Dr Daniyar Sapargaliyev (Almaty Management University, Kazakhstan); Prof Maya Satratzemi (Department of Applied Informatics, University of Macedonia, Greece); Dr Etienne Schneider (University for Information Science & Technology Saint Paul, Macedonia); Dr. Olga Shabalina (Volograd State Technical University, Russia); Samir Shah (LeBow College of Business/Drexel University, USA); Dr. Markus Siepermann (Technische Universität Dortmund, Germany); Helga Sigurdardottir (Nord Trøndelag University College and the Norwegian University of Science and Technology, Norway); Mr Martin Sillaots (Tallinn University, Estonia); Kennet Silseth (University of Oslo, Norway , Norway); Dr. Gavin Sim (University of Central Lancashire, UK); Dr. Julie-Ann Sime (Lancaster University, UK); Chrysanthi Skoumpourdi (University of the Aegean, Greece); Prof. Venustiano Soancatl (Universidad del Istmo, Mexico); Dr. Heinrich Soebke (Bauhaus-Universit t Weimar, Germany); Elsebeth Sorensen (University of Aarhus, Denmark); Dr. Mark Stansfield (University of West of Scotland, UK); Martin Steinicke (University of Applied Sciences HTW Berlin, Germany); Andre Thomas (Texas A&M University, United States); Florica Tomos (Glamorgan University, UK); Uday Trivedi (R.C. Technical Institute, India); Dr. Thrasyvoulos Tsiatsos (Aristotle University of Thessaloniki, Greece); Dr. Chuang Tsung-Yen (National University of Tainan, Taiwan); Richard Tunstall (University of Leeds, UK); Dr Anisa Vahed (Durban University of Technology, South Africa); Dr. Andrea Valente (Aalborg University Esbjerg, Denmark); Dr. Richard Van Eck (University Of North Dakota, Grand Forks, USA); Dr. Peter Van Rosmalen (CELSTEC / Open University of the Netherlands, The Netherlands); Dr. Carlos Vaz de Carvalho (GILT - Graphics, Interaction and Learning Technologies, Portugal); Harko Verhagen (Stockholm University, Sweden); Dr. Ayelet

Weizman (Snunit center for the advancement of web-based learning, the Hebrew University, Israel); Viktor Wendel (Technical University Darmstadt, Germany); Prof. dr. Wim Westera (Open University of the Natherlands, Nederland); Mr Thomas Westin (Stockholm University, Sweden); Nicola Whitton (Manchester Metropolitan University, UK); Prof. Dorothy Williams (Robert Gordon University , UK); Amanda Wilson (University of the West of Scotland, UK); Andrew Wilson (Birmingham City University, UK); Dr Panagiotis Zaharias (Open University of Cyprus , Greece); Dr. Al-jona Zorina (ESCP Europe, France).

Biographies

ECGBL Conference Director

Professor Thomas M Connolly is the original instigator of this conference in 2007, Thomas Connolly is a Professor in the School of Computing at the University of the West of Scotland, having managed the Department of Computing and Information Systems for several years. Thomas worked for over 15 years in industry as a Manager and Technical Director in international software houses before entering academia. His specialisms are games-based learning, online learning and database systems. He has developed three fully online MSc programmes and developed and leads the undergraduate BSc Computer Games Technology programme. He is co-author of the highly successful academic textbooks Database Systems (now in its 4th edition) and Database Solutions (in its 2nd edition). He is a reviewer for several international journals and has been on the committee for various international conferences. He is a member of CPHC (Council of Professors and Heads of Computing) and member of the Higher Education Academy.

Conference Chair

Robin Munkvold has his education from the field of information technology and has, for the last 12 years, been working within projects related to ICT and pedagogy. During these years, he has published a book titled "Online learning" and has been coauthor of many papers within the themes of ICT and pedagogy. Robin was central in the building of the curriculum Games and entertainment technology at the Nord-Trondelag University College and has the latest years been Program Director as well as Dean within the University College.

Programme Chair

Dr Line Kolås has her PhD in the field of information technology, focusing on e-learning and educational technology. She has since 1999 taken part in a number of national and international R&D projects. The projects have resulted in a variety of publications: scientific papers / articles, reports, newspaper chronicles

etc. As associate professor at the Nord-Trondelag University College, Line is teaching at the study programmes of “ICT for teachers” and “Games and entertainment technology”.

Keynote Speakers

Prof Alf Inge Wang is currently working at the department of computer and information science at the Norwegian University of Science and Technology (NTNU) where he teaches courses on programming, software architecture, mobile application development and game development. He received his PhD in software engineering in 2001. His research interests are game development, game concept development, computer support for mobile collaborative work, peer-to-peer computing, software architecture, and software engineering education. He has published more than 50 scientific papers including several papers on games and game technologies. He has also been organizing several conferences and workshops on computer games (Conference on Entertainment Systems, CoGames, etc) and is the chair of JoinGame (Norwegian resource network on game research and development). He is also responsible for the development of a research and education program within computer/video games at the university (NTNU). Has previous experience from game development on Commodore 64, Amiga, and Java game development. Alf is one of the main resources behind the development and implementation of the system Kahoot! (https://getkahoot.com/ - a game based classroom response system).

Dr David Williamson Shaffer is a Professor of Learning Science at the University of Wisconsin-Madison and a Game Scientist at the Wisconsin Center for Education Research, where his work focuses on using games and simulations to develop and assess complex thinking skills. His areas of expertise include game development, learning analytics, quantitative ethnography, localization and customization of learning technologies, and automated mentoring. Dr Shaffer's M.S. and Ph.D. are from the Media Laboratory at the Massachusetts Institute of Technology, and he has taught grades 4-12 in the United States and abroad, including two years working with the Asian Development Bank and US Peace Corps in Nepal. Dr. Shaffer was a 2008-2009 European Union Marie Curie Fellow and was awarded a 2014-15 Fellowship from the European Institute for Advanced Study.

Mini-track Chairs

Anissa All works as a junior researcher at IBBT-MICT (Ghent University). Since January 2013, Anissa is working on a PhD through an IWT grant (Flemish agency for Innovation by Science and Technology). In this PhD research, she will develop a standardized procedure to assess effectiveness of digital game-based learning aimed at cognitive learning outcomes.

Dr. Sylvester Arnab is a Senior Research Fellow, co-leading research at the Disruptive Media Learning Lab, building on his R&D experience at the Serious Games Institute, UK. His research focuses on the potential of games science (serious games, gamification) and the pervasive approach to learning and gaming. To date Sylvester has over 50 academic publications. He has also keynoted at events related to serious games, gamification and technology-enhanced learning. Sylvester is a founding member of the Serious Games Society (seriousgamessociety.org/) and Health 2.0 Birmingham. He is also involved in the UK satellite hub for Games for Health Europe.

Ricardo José Vieira Baptista is currently a Digital Media PhD Student at UT Austin|Portugal Program - International Collaboratory for Emerging Technologies, at University of Porto, researching training and certification in serious games and game-based learning. He is a researcher at INESC TEC and GILT with several participations in European projects and he developed Funchal 500, a Role Play Game (RPG) to celebrate the 500 years of the city of Funchal.

Dr Stefan Göbel holds a PhD in computer science and has long-term experience in Graphic Information Systems, Interactive Digital Storytelling, Edutainment applications and Serious Games. After five years work as researcher at Fraunhofer Institute for Computer Graphics, from 2002 to 2008 he was heading the Digital Storytelling group at the Computer Graphics Center in Darmstadt. In late 2008 he moved to TUD and is heading the prospering Serious Gaming group at the Multimedia Communications Lab.

Dr Thorkild Hanghøj is an Associate Professor at Aalborg University. He has more than 10 years of experience researching GBL in formal educational settings in number of countries. Thorkild has researched the important role of the teacher in relation to a broad range of different games such as The Power Game (ICT-supported debate game), Global Conflicts (serious game) and Minecraft (sandbox game). Moreover, he has also researched the use of Problem-Based Game Design in teacher education. He has recently received a large grant on the use of digital games and game-based teaching methods for the purpose of helping students in learning difficulties within the subjects Danish and Mathematics.

Silje H. Hommedal research focuses on perceptions of computer games in relation to gender. In her thesis that she defended in 2014, she focuses on how young women and men perceives different computer games as masculine or feminine and in what ways they use these perceptions in their construction of identity. The purpose of the research was to give knowledge on how gender and computer games are intertwined and affects each other. The doctoral thesis was written at The Department of Linguistic, Literary and Aesthetic Studies at the University of Bergen.

Dr Daire Ó Broin holds a Ph.D. in Computer Science from Trinity College Dublin, which focused on approaches to developing the conditions of flow. He has been a lecturer at IT Carlow since 2008, where he teaches on the Computer Games Development programme. His research interests include increasing engagement and intrinsic motivation in games and learning.

Dr Kimmo Oksanen is a project researcher at the Finnish Institute for Educational Research, University of Jyväskylä. His thesis was about supporting collaborative learning and evaluating learners' experiences in serious games. His current research interests include collaborative learning, game design, and game experience.

Prof. DI Dr Maja Pivec research interests are in the field of affective and emotional aspects of human-computer interaction, with emphasis on game design, game-based learning and innovative learning approaches, and different aspects of e-learning. She is editor and co-editor of four book publications in the area of innovative learning approaches and guest editor on several special

journal issues on Game-Based Learning. Her research work is published and presented at more than 100 international conferences and publications.

Dr Neil Peirce holds a degree in Computer Science, a Masters in Multimedia Systems and a PhD from Trinity College Dublin (TCD). He is currently a research fellow in the Knowledge and Data Engineering Group at TCD. Neil's PhD research focused on the personalisation of learning experiences within educational video games and he is member of the Serious Games Society.

Christian Reuter is a PhD candidate at the Multimedia Communication Lab, TU Darmstadt. He is researching authoring support for creating multiplayer (serious) games, including the use of appropriate game design patterns based on player interactions, formal analysis to detect game design or implementation errors and rapid prototyping support.

Dr. Jože Rugelj is Associate Professor of Computer Science in Education at the University of Ljubljana and a head of the Chair for compuer science didcatics at the Faculty of Education. His main research areas include use of ICT in education, cognitive aspects of multimedia support for learning, serious games in education, and innovative approaches to teaching computer science. He has actively participated in 7 European and 4 national projects on e-learning and serious games. He published the results of his research activites in 11 papers published in international scientific journals, 58 papers in conference proceedings and 13 chapters in scientific monographies. His papers have been cited 41 times in Wos ans SCOPUS.

Jordi Torrent after obtaining a degree in Philosophy at the University of Barcelona, Mr. Torrent followed graduate studies in Paris at the Sorbonne University (Film Esthetics) and at the Ecole Pratique des Hautes Etudes (Anthropology Filmmaking). From 1985 to 1990 he was Media Curator at Exit Art, New York. He was Media Educator Consultant for the Department of Education of New York City, where Mr. Torrent created Media Literacy Education. From 2004-2008 he was co-director of "Overseas Conversations", a series of international conferences focusing on youth, media and education. He co-edited, among other publications, the book "Mapping Media Education Policies in the World", published by Columbia University.

Currently Mr. Torrent manages the Media and Information Literacy initiatives at the United Nations Alliance of Civilizations (UNAOC).

Dr Carlos Vaz de Carvalho has a PhD in Information Systems and Technology. He is a Professor at the Engineering School of the Porto Polytechnic (ISEP) and the Director of the R&D group GILT - Graphics, Interaction and Learning Technologies until 2014. He was e-Learning Director (2001-2005) of ISEP and Director of the Distance Learning Unit of the Porto Polytechnic (1997-2000). He has published over 130 references on the subject including several books. He coordinated nine European Projects on the use of technology and games for learning.

Viktor Wendel is a PhD candidate at the Multimedia Communications Lab, Technische Universtität Darmstadt. His research interests include Game Mastering and automatic adaptation of collaborative multiplayer Serious Games based on player, learner, and interaction models and multiplayer Serious Game design. Further, he is an editor of ACM SIGMM Records.

Biographies of Presenting Authors

Azita Iliya Abdul Jabbar Prior to pursuing her PhD at Waterford Institute of Technology (WIT), Ireland, she was involved in eLearning project management and courseware design. Her interest in information and instructional design has led her to research and learn more about methods of teaching and learning, specifically in game-based learning.

Dr. Anna-Sofia Alklind Taylor studies the roles of instructors and how they can be facilitated within instructor-led game-based training environments. A core argument within her research is that serious games, as artefacts used for learning and training, cannot fully replace the instructors' tasks, but must rather be designed to facilitate the various activities of the instructors

Ana Cristina Almeida, Assistant Professor at the Faculty of Psychology and Educational Sciences, University of Coimbra (Portugal). Ana has had her PhD since 2004 in Educational Psychology (Cognition as Problem Solving). Research interests on promoting learning and development. Have some published and disseminated work.

Coordinates a research and intervention platform based on games: Active Learning Community Project (CAAtivas).

Nafisa Awwal specialises in the design, development and implementation of web-based educational assessments, reporting and other forms of data collection tools. She is involved indeveloping system architecture for traditional and innovative, individual and collaborative assessments for students in multiple languages. Her research also includes data management, analysis, and item writing.

Sanna-Mari Äyrämö is a PhD candidate in the Department of Art and Culture Studies, University of Jyväskylä, Finland. Her main research interests concern narrative learning game design and the multidisciplinary field of narrative theories. In her current research, she focuses on the question of how to utilize narrative to support learning in computer games.

Tyler Baron is a full time PhD student at Arizona State University in Arizona in the United States. He has just completed his first year in the Simulation, Modeling and Cognitive Science PhD program there. His research interests are game based learning , serious games and simulations.

Dr. Bob Barrett is a full professor for the School of Business at the American Public University in Charles Town, West Virginia, USA. He lectures both nationally and internationally on the topics of Intellectual Capital, Human Capital, Knowledge Management, HRD Forensics, and Human Resource Management, Disabilities in the Workplace, e-Portfolios, and e-Learning.

Dr Matthew Bates Matthew is a lecturer in multimedia applications and computer-assisted learning at Nottingham Trent University in the UK. His research interests include the positioning of games-based learning applications which encourage collaborative learning through the construction of new materials.

Michael Bedek, **MSc.**, graduated from the University of Graz in 2009 in psychology. Since then, he has been working at the Knowledge Technologies Institute of the Graz University of Technology. Currently, he is working on his PhD thesis which is about the application of Formal Concept Analysis for learner modelling and adaptive recommender systems.

Björn Berg Marklund's research focuses on examining how the practical realities of formal educational settings change the way games need to be designed and developed in order to be useful as educational tools. For games to have educational value

in formal educational settings, they need to be integrated into them, not superimposed on top of them.

Alexey Bezgodov, PhD, head of the Scientific Visualization Department at eScience Research Institute of ITMO University, Russia. The main interests are computer games technology, computer graphics and scientific visualization.

Natasha Boskic teaches graduate courses in the Master's of Educational Technology program. She obtained her PhD from the University of British Columbia, Vancouver. Her research was on ethics in alternate reality games. She also manages the Educational Technology Support unit in the Faculty of Education at UBC. Her interests are in creating engaging learning spaces.

Liz Boyle is a reader in psychology at the University of the West of Scotland. Recently her main research interests have been in learning and motivation in e-learning, digital games and social media where she has published journal and conference papers, edited books and book chapters. She is currently project coordinator of the Erasmus + YOUTHYES project.

Cyril Brom is an assistant professor at Faculty of Mathematics and Physics of Charles University in Prague. His research interest is in serious games, modelling behaviour and episodic memory of virtual human-like characters, in level of detail AI, and in computational biology.

Sophie Callies is a PhD student in cognitive computer sciences at University of Québec at Montréal (UQAM), Canada. Her thesis is in the field of serious games and their design. Her research interests are serious games, video games, game design, educational design, gamification, and cognitive sciences.

Tracey Cassells graduated from IT Carlow with a B.Sc(Hons) in Computer Games Development and is currently enrolled as a Masters student. Her research interests are in gamification and the effect of game elements on student engagement.

Fabio Chiarello is a Physicist/researcher, IFN-CNR Rome (Institute for Photonics and Nanotechnologies of Italian National Research Council). Scientific interests: superconducting devices and detectors, quantum computing and macroscopic quantum phenomena, terahertz technologies, micro and nano-systems. Expertise: devices design, ultra low noise and low temperature electric measurements, simulations and modeling, data analysis. Active in scientific dissemination with conferences, development of didactic board-games and exhibitions/laboratories for science festivals,

author of a book (Italian) on Quantum Mechanics and Quantum Computing for general public.

Ming-Hung Chu is a master student in the Institute of Creative Industries Design at National Cheng Kung University. He is an experienced teacher in industrial high school for 28 years. His expertise is in engineering graphics, computer 3-D modeling, creative design, new he design a serious game help students to master the orthographic projection learning.

Constantos Elias holds a Diploma in Electrical and Electronic Engineering from NTUA, Athens. Over 25 years experience in top Greek Information Technology companies, accustomed in multicultural / multinational environments, managing both commercial and research projects. Is recently involved in Business Process Management projects and development / deployment of custom gamification projects for international clients.

Larry J. Crockett is Profess of Computer Science at Augsburg College, Minneapolis, MN, USA. He took his Ph.D. from the University of Minnesota and has published three books, including Universal Assembly Language and The Turing Test and the Frame Problem. He directed the Honors Program for 16 years. Currently he teaches "Game Programming on the Web" as a senior experimental course.

Helga Dis IsfoldSigurdardottir received B.A. in social Anthropology, M.A. in Educational Program Evaluation from The University of Iceland. Currently a PhD candidate/research fellow at Nord-Trøndelag University College in Steinkjer, Norway and The Norwegian University of Science and Technology in Trondheim, her research focus is DGBL with a Science and Technology Studies approach.

Viktor Dobrovolný is a student of New Media Studies atFaculty of Arts of Charles University in Prague. His main study interestsare serious games and structure and transfer of knowledge. He assists in research on learning effects of serious games since 2012.

Ronald Dyer Lecturer, Project Management with experience across financial service, education, agriculture and energy focused organizational transformation initiatives. Worked on IT integration projects at Goldman Sachs, Citi-Bank and Inter-American Development Bank. Research includes individual/institutional performance utilizing technology innovation. Attended Grenoble Ecole de Management, France, researching Serious Games for Technology, Innovation & Change towards Doctorate in Business Administration. MBA in Project Management Henley Graduate School of Busi-

ness University of Reading, UK;undergraduate degree Wilfrid Laurier University, Canada in Business Administration.

Stine Ejsing-Duun is interested in the relation between technology, perception and cognition. Her ambition is to describe how technologies allow us to transcend ourselves. Her research has been connected to games, play and playful processes in various areas. Her present studies are within the fields of learning and art.

Dr Panagiotis Fotaris is a lecturer at University of East London and Programme Leader of the BSc (Hons) in Digital Media Design. His research interests include gamification, learning analytics, and Technology Enhanced Learning. He is also a member of the emotionUX usability lab team who explores user experiences from cognitive, emotional and affective perspectives.

Laura Freina is a research fellow at the Italian National Research Council where she is involved in the design and development of solutions to support personal independence for people with mild intellectual disabilities. In the last months, she has developed a Virtual Reality based Serious Game in support of the acquisition of basic spatial skills.

Regina Friess is Professor for Media Conception, since 2011, at the Digital Media Department of the University of Furtwangen, Germany. Before she was Lecturer for interactive media at the University of Arts in Berlin. She worked as graphic designer, 3D-modeler and as concept developer since 1993. Her academic interest focusses on interactive narration in audiovisual media.

Toru Fujimoto is an assistant professor at the Center for Research and Development of Higher Education, The University of Tokyo. He completed his graduate study at the Pennsylvania State University (Ph.D. in Instructional Systems). His research focus is on the design of learning environments using digital games and social media.

Andrea Gauthier is a biomedical communicatorfrom Toronto,Canada. Her education includes a bachelor of applied arts in Scientific Illustration and a Master of Science in Biomedical Communications. She is pursuing a PhD in medical sciences at the University of Toronto where she is investigating how the game design influences students' understanding of molecular systems.

Valerie Priscilla Goby, PhD, is a Professor at the College of Business, Zayed University, Dubai, UAE. She has published widely in business and education related areas, is on the editorial board of Journal of Business and Technical Communication, and

Business and Professional Communication Quarterly, and deputy editor of Learning and Teaching in Higher Education: Gulf Perspectives.

Anthi Gousiou is a PhD candidate at the Department of Cultural Technology and Communication, University of the Aegean. She holds a Bsc degree in Computer Science and a Msc in Computer Science from National and Kapodistrian University of Athens, Greece. Her research interests include game-based learning, gamification, use of ICT in education. She works as a Computer Science teacher in Secondary Education.

Jacob Habgood has a decade of experience working in the UK videogame industry and is now Senior Lecturer in Game Development at Sheffield Hallam University where he teaches PlayStation 4 programming. His research interests focus on effectively harnessing the motivational power of games for learning, as well as the affective motivational components of digital games themselves.

Paul Hollins is Director of the institute of Educational Cybernetics at the University of Bolton. Paul has been undertaking research into digital games and Learning for over a decade and has published extensively in the domain . Prior to returning to academia Paul worked for an International games Publisher responsible for licensing.

Ellen Houmøller is a master of Art in Modern Culture, Copenhagen Universityand Master in Lifelong learning and Adult Education. Aarhus University. Lecturer, Lillebaelt Academy for Professional Higher Education, department of It and Media, Odense, Denmark. I have special focus on e-learning and lifelong learning. I have done several courses in various subjects within strategic communication and management.

Robyn Hromek works as an educational psychologist in Sydney schools Australia and is an Honorary Associate of The University of Sydney. She has a Masters Degree in Educational Psychology. Robyn has developed a series of psycho-educational boardgames to teach social and emotional skills to young people and is currently writing therapeutic comics.

Dr. Hans Hummel is associate professor at the Welten institute of the Open University of the Netherlands (OUNL). Hans held the Chair on “Workplace learning and ICT” (2009-2014) at NHL University of Applied Science, lead the EMERGO project developing an approach and toolkit for serious games (Comenius Award, 2008), and acted as (co) author of 100+ refereed articles.

Sharon Hu has a longstanding interest in developing best practices for the hybrid learning environment and the use of multimedia in teaching and learning. Some projects Sharon has worked on include the use of collaborative annotation in online lecture videos, the development of a MOOC, and the inclusion of gamification to motivate and engage students

Jennifer Jenson is Professor of Pedagogy and Technology in the Faculty of Education and Director of the Institute for Research on Learning Technologies at York University, Canada. She has published widely on education, technology, gender, design and development of digital games, and technology policies and policy practices in K-12 schooling.

Bjarki Þór Jónsson got his Masters in Digital Games: Theory and Design from Brunel University, London. He has been developing new video game related courses in The Comprehensive College/Comprehensive Secondary School at Ármúli and The Tröllaskagi Upper-Secondary School where he currently is a teacher. Bjarki was a jury member for the Nordic Game Awards in 2014 and 2015.

Ronit Kampf, Ph.D., is a lecturer in the Department of Communication and the Program in Research of Child and Youth Culture at Tel-AvivUniversity. Her research interests focus on serious games and learning, particularly in the context of the Israeli-Palestinian conflict. She is a member of the Games for Peace initiative.

Aous Karoui is a PhD student at the University of Maine since October 2014. He received his master in "studying complex systems: natural and artificial cognition" from *EcolePratique des Hautes Etudes*in Parisin June 2014. His research interests are related to mobile technology, serious games and Human Machine Interaction.

Wijnand Kieft is teacher at a secondary vocational training centre with 5000 students. As coordinator at the Foundation for Practice-based Learning (SPL) in Amersfoort he is responsible for the developing of career building programs, programs for business skills and higher education preparation. His master thesis dealt with the use of the serious game Future = Now.

Andreas Lieberoth is an appliedgame psychology researcherat the Interacting Minds Centre, Aarhus University, and an associated researcher and game designer at the Centre for Community Driven Research (CODER). His Ph.D. was in cognitive and educational psychology. He has (co-)designed several games, both digital and analogue. His academic work centers on the social and cognitive psychology of gaming, espe-

cially in the context of player psychometrics, game based learning, citizen cyberscience and experimental studies of gamification.

Jordi Linares-Pellicer has a PhD in Computer Graphics. And is a lecturer and researcher at Universitat Politècnica de València in Spain. Currently leader of VertexLit research group focused on interactive technologies, games, serious games, virtual and augmented reality.

Gerrit Lochmann, has a master's degree in computer science and is working as a computer scientist at the Institute for Computational Visualistics of the University of Koblenz, Germany. His research interests cover the field of interaction within virtual environments as well as optimization methods for real time computer graphics.

Heide Lukosch is an Assistant Professor, Delft University of Technology, part of Multi-Actor Systems Department. Research focused on analyzing how organizations and their members, understood as interacting systems in a modern, complex society, use different media like games, simulations and virtual environmentsto enhance awareness/communication processes. PhD from Fernuniversität Hagen, Germany (study in media sociology). Interested in link between social/technical perspective on complex systems.

Rikke Magnussen is an associate professor at ResearchLab: ICT and Design for Learning, Department of Communication, Aalborg University. Her main research interest is how intelligent or game-based technology can open for new types of collaborative science practice and innovation processes to change science education in school and science learning in in-formal settings outside school.

Emanuela Marchetti PhD Student in Learning and Interaction Design, Aalborg University . Lecturer, Lillebaelt Academy for Professional Higher Education, department of It and Media, Odense, Denmark. I have a master degree in It Product Design from the University of Southern Denmark with specialization in user centred design and design anthropology. My PhD is about e-learning in the museum to support the practice of guided tours targeted at primary school pupils. I am also working on parallel projects on e-learning and user centred design methods.

Maria Margoudi is a Pedagogue, specialized in Digital Technologies in Education. She has a Master on Digital Technologies in Education from the National University of Athens (NUOA) and a Bachelor on Philosophy, Pedagogy and Phycology from the same institution. Currently she is a Scientific Assistant at Federal Polytechnic Institution of Lausanne (EPFL), Switzerland.

Giada Marinensi is researcherat Link Campus University, Department of Digital Administration and Social Innovation Centre(DASIC), and shecoordinates the research team specialized in Education and Hybridlearning. Herfields of scientificinterest are new technologies and methods in teaching/learning processsuchasserious games, mobile learning and interactive storytelling.

Bertrand Marne received his PhD in Computer Science in 2014 from UPMC University in Paris. He is a teaching and research assistant at UPMC and a member of LIP6 Laboratory. His research focuses on methodological and software tools for meta-design in order to increase acceptability of serious games for teachers

Jean-Charles Marty is a associate professor-LIRIS laboratory (Lyon, France). Leading SICAL (Situated Interaction, Collaboration, Adaptation and Learning) research team. Interests are observation of collaborative activities, through traces of these activities. Results are applied to Technology Enhanced Learning, particularly to Game-Based Learning Environments. Several projects in this field (Learning Adventure, Learning Games Factory, Serious Lab for Innovation, Pegase, Jen.lab, Janus). Organized International School on Game-Based Learning-France-2011 (gbl2011.univ-savoie.fr) and member of several conference committees or editorial boards of journals in this field.

Morten Misfeldt PhD is Professor and Research manager for the ICT and Designs for Learning group at the Department for Learning and Philosophy, Aalborg University in Copenhagen. He works with ICT and learning in mathematics education at several levels. He also works with the design and use of educational games.

Tomas Moesgaard is currently a master student at Aalborg University Copenhagen, studying medialogy. He used the last two semesters of the bachelor program as well as one on the masters, so far, to explore virtual reality and its application possibilities for learning. Most of the work has been based around museum installations.

Gillian Morrison is a PhD candidate at Swinburne University, Melbourne, Australiawith a BSc from the Australian National University and a Masters in Creative Media from RMIT University. She has worked in digital production for over 15 years and currently serves as Board Chair for the Australian Network of Art and Technology.

Peter Murar works as a special assistant at the University of Ss. Cyril and Methodius in Trnava. He is focused on digital marketing and in particular on content marketing and social media. Due to a variety of different circumstances, he has also turned his attention on user experience which he had engaged earlier.

Sofia Mysirlaki is a PhD candidate in the Department of Digital Systems of University of Piraeus (Greece), in the research Area of Technology-Enhanced Learning. She holds a Master of Science (Msc) in E-learning. Her research interests include Multi User Virtual Environments (MUVEs) and Game Based Learning (GBL).

Dr Nitin Naik is a senior lecturer at DSCIS, Ministry of Defence, UK. He received the Ph.D. degree in Computer Science from Aberystwyth University, UK. He also holds several academic qualifications: M.Tech., M.Sc., MBA, MSW, PGCTHE, B.Sc., Polytechnic (Electrical Engineering). His research focuses on game-based learning, systems security, artificial intelligence, and big data. He has been awarded with an accolade of Senior Fellowship by HEA, UK.

Hugo Nordseth is associate professor in computer science at Nord-Trøndelag University College, Norway. He teach courses in Game Design, ICT management and ICT for teachers including Game Based Learning. His research domain is use of technology in teaching and education with emphasis on e-learning and use of video and digital games in schools.

Benedict O'Donnell studied astronomy at University College London and received a PhD in materials science from the Ecole Polytechnique in France. He has since worked with the electricity supplier EDF and the International Energy Agency, and has since founded an energy consultancy called Heliocentric Solutions that coordinates a the Prometeruse project – which teaches school children about climate change.

Joseph Osunde is a PhD student with the eLearning team at the University of Greenwich, London, United Kingdom. His areas of academic interest include eLearning systems, Human Computer Interface (HCI) modelling and representation, Artificial Intelligent (AI) systems in relation to 'computer -based learning systems' and human factors such as gender.

Kristine Øygardslia is a PhD Candidate at the Norwegian University of Science and Technology (NTNU), Department of Education. Her background is from studying and designing serious games, and she is currently working on her PhD research project about the learning outcomes when elementary school students design their own computer games in the classroom.

Taima Pérez Degree in Graphic Design and European Master in Media Engineering for Education EUROMIM . Professional experience in graphic design,print publications and digital environments.. Conducted research projects at University of Poitiers

(France),Universidade Técnica de Lisboa UTL (Portugal) and Universidad Nacional de Educación a Distancia UNED, Madrid (Spain). Interned in de-learning department SCAD Savannah College of Art and Design, USAand Institut Français de l'éducation . PHD student in Educational Sciences at ENS Lyon.

Trygve Pløhn is a Research Scientist and a PhD Candidate at the Nord-Trøndelag University College (HiNT) and the Norwegian University of Science and Technology (NTNU). His research and professional interest are within Pervasive Games, Serious Games and Game Based Learning.

Waranya Poonnawat is a PhD student in the collaboration program between the University of the West of Scotland and Stuttgart Media University. Her research deals with a framework of using Business Intelligence on top of Business Simulation Games. Now, she bases in Germany to work on her research and give some lectures about Business Intelligence.

Liesa Reitz, is a Master of Education student of English and Ethics at the University of Koblenz, Germany. Her research interests cover game-based and task-based language learning via Virtual Reality, intercultural communication training, cultural studies and the construction of gender in modern media and their implementation in the language

Saganenko-Galina-My main research interests are empirical methodology, methods in Sociology, development with colleagues the new reflexive technology based on open-ended questions and special computer program. For long time I have examined contents and formats of current teaching, its low effectiveness. I have developed new educational principles, applied techniques and educational games to transform education into enjoyable and effective activity.

Munir Salman is a PhD student interested in distributed research data management and social networking APIs. He holds Bachelor's and Master's degrees in Computer Science. He heads the IT department of the Munich Center for the Economics of Aging at Max-Planck-Institute for social law and social policy. Munir lives with his family in Munich, Germany.

Eric Sanchez is an assistant professor at the ENS deLyon, head of EducTice, aresearc hteam of the French Institute of Education and adjunct professor at the University of Sherbrooke (Canada). His research focuses on the uses of games for educational purposes. He is interested on behavioral and epistemic modellingand game design.

Guido Schmidt, is a master student of computer science with focus on graphics programming and image processing. He works as a research assistant at the Workgroup of computer graphics at the Institue of Computational Visualistics of the University of Koblenz.

Henrik Schønau-Fog Assistant Professor, department of Architecture, Design and Media Technology, Aalborg University, Copenhagen and co-director of The Center of Applied Game Research. Research interests are game design and -development, game enhanced learning models and games for learning, motivational factors and engagement in digital games and interactive media, interactive storytelling, emergent narratives and purposive games. Teaches and supervises projects in fields of games, animation and media technologies.

Dr Ian Stewart is Lecturer in Commercial Management of Projects, Programme Manager of the MSc in Management of Projects at the School of MACE, University of Manchester and a Fellow of the Higher Education Academy. He has extensive interdisciplinary experience, contextualising business and management education for engineering, projectised and high technology environments. Ian has special interest in use of simulations in teaching practice-oriented subjects in very large class sizes of mostly international students, especially the lecturer's experience of these situations

Annalisa Terracina In 1998 graduated in astrophysics. From 1999 to 2012. Sshe worked as software engineer in different ICT companies. In 2012 I resigned to accept a tenure as professor of physics in secondary high school. From November she is doing a PhD on game based learning.

Georgios A. Triantafyllidis is an Assistant Professor in the Department of Medialogy at Aalborg University Copenhagen (Denmark). His current research interests are: image/video processing/analysis, intelligent systems and 2D/3D computer vision.)

Dr Anisa Vahed is senior lecturer at Durban University of Technology, who is currently advancing her research skills through the Strengthening Health Care Systems project.Her other research interests include metallographic structure of newly developed dental materials, and theteaching and learning through discipline-specific games to enable students' access to, and acquisition of, knowledge.

Rajiv Vaid Basaiawmoit from the Aarhus University Centre for Entrepreneurship and Innovation works with student led innovation and entrepreneurship while also engaging in university-industry interactions. He combines a rather interdisciplinary background with a PhD in Biophysics, a Masters in Biotechnology and an MBA in sus-

tainability. He also works with gamification, entrepreneurship education and open innovation concepts

Andrea Valente has a PhD in Computer Science. Associate Professor, The Maersk Mc-Kinney Moller Institute, University of Southern Denmark. I have a Computer Science master degree with specialization in computer graphics and formal methods. My PhD at Torino University (Italy) was about formal languages and type systems. Currently I work on e-learning and knowledge management at the University of Southern Denmark (SDU).

Stephanie van Hove holds a Bachelor degree in Communication Management and a Master degree in Communication Sciences (New Media & Society, Ghent University, 2014). Her Master thesis focused on mobile dependency using both quantitative and qualitative data. Currently she is working on EduTab, which addresses the implementation of tablet apps in an educational context.

Herre van Oostendorp is Associate Professor Human-Media Interaction at the Department of Information and Computing Sciences, Utrecht University. He is working on the area of cognitive learning principles in serious games and developing a computational cognitive model of web-navigation.

Ellen Vanderhoven is a senior researcher at the Media and ICT research group of iMinds, Ghent University. In 2014, she finished her Ph.d.in Educational Sciencesat the department of Education at Ghent University. Ellen specializes in research about educational design, concerning both education about technology (media literacy) and technology for education (educational technology).

Iro Voulgari, PhD, is a member of the teaching personnel of the Faculty of Early Childhood Education at the University of Athens, and a researcher at the Department of Educational Sciences and Early Childhood Education at the University of Patras. Her academic interests involve game-based learning, and the social aspects of multiplayer games.

Charlotte LærkeWeitze is a PhD-fellow, IT-Learning-Design-lab,Department of Learning and Philosophy, Aalborg University, Copenhagen. She is interested in design of learning games and in the development and measurement of students' and teachers' motivation and engagement in learning situations.

Thomas Wernbacher works at Danube University in Krems, Austria and as a freelance media psychologist. After finishing his Master of Science in Media Psychology

at the Karl-Franzens-University Graz, he studied Applied Game Studies at the Danube University Krems. Currently his field of expertise covers gamification, game design &usability.

Thomas Westin's research interest concerns inclusion in digital culture. More specifically, he has done research about how to transform education for excluded pupils who also are gamers, and how to make games accessible for gamers with impairments. He is teaching game development and has contributed to award winning game accessibility guidelines and accessibility in games.

Jason Wong is Senior Lecturer at KDU University College, Malaysia. He received a B.S degree in Information System Engineering from Campbell University and M.S.C in Computer Game Technology from Liverpool John Moores University, UK. He has been teaching game programming related subject for over 10 years and actively involve in game related research projects. His current research involves using computer game as learning tool for learning object-oriented programming in tertiary level.

David Wortley is the author of "Gadgets to God", a historical perspective of mankind's changing relationship with technology over the last 60 years and a vision of the future impact of disruptive communications technologies on business and society. He is CEO and Founder of GAETSS (www.gaetss.com).

Serious Game Framework Confronted With Specificities of Industrial Training: Application to Steel Industry

Hamza Abed[1], Philippe Pernelle[2], Thibault Carron[1], Chokri Benamar[3], Marwene Kechiche[4] and Patrick Baert[4]

[1]LIP6, UPMC, Paris, France, [2]DISP, University of Lyon 1, Villeurbanne, France, [3]REGIM, ENI, Sfax, Tunisie, [4]ENISE, Saint-etienne, France

Abstract: Serious games are growing more and more in the context of lifelong training and initial education. They cover several areas (human science, engineering science, life science,) that are used for industrial or academic purposes. However, some fields induce specific issues. Thus, in the industrial area, the constraints inherent to the activity impact the development of a scenario and implementation of a serious gaming environment. Indeed, the objective of the industry training must both lead to the acquisition of knowledge and the transfer of skills. Moreover, the actual validation of these skills is paramount especially if their uses are located on an industrial site, where there are often risks associated with the security of persons and equipment. In many industries, some regulatory constraints impose an obligation of means for the training of staff. In the sector of production, the proliferation of interim requires inevitably targeted training. Finally, it should be noted that even for permanent staff, alternation and fragmentation of training periods seriously complicate the deep learning task. Finally, we can wonder if the serious game can bring relevant answers to specific problems of training in an industrial context? This article offers some answers to this question. Thus, in this work, we propose a serious game scripting framework adapted to the industrial context. This scripting framework is structured around two approaches: the first defines a global framework for scheduling a fun or playful scenario. Moreover, this framework allows to take into account the phases of availability of learners while maintaining motivation. The second approach defines an immersive framework for validating acquired and security compliance that is based on two complementary purposes: Use of alternate observation activities (games / real) and an immersive simulation (Virtual Reality) for security. In partnership with a company in the steel industry, we have developed a prototype of serious game in order to implement this scripting framework. The prototype is based on a generic game platform, on a tablet with use of RFID tag, and with an immersive virtual reality Head-Mounted-Display (HMD type Oculus®). In this article we will present the actions realized in the context of a professional activity related to the manipulation of a bridge crane.

Keywords: serious games, formatting, virtual reality, interaction

Technology Integration in Multiplayer Game Design

Monjurul Alom, Nafisa Awwal and Claire Scoular
Melbourne Graduate School of Education, The University of Melbourne, Australia

Abstract: Online multiplayer educational games can be designed to promote collaboration and assess abilities of students through their responses or actions within the game environment. This paper describes the design and integration process for such games, prototypes of which have been developed as part of the ATC21S™ research study by the University of Melbourne. HTML5 has been used in preference to other available technologies in creating the games to provide a consistent experience for students across all browsers, platforms, and devices. The multiplayer component of the games was supported with the use of the Web Socket application which enabled the communication protocol between the client and server to be established. Canvas is used to create all animations and game objects. The paper will describe justification for the use of additional technologies to facilitate the game flow and a positive user experience.

Keywords: game design, collaborative, HTML5, canvas, web socket

A MDA Approach to Facilitate the Serious Game Integration in an e-Learning Environment

Nada Aouadi[1], Philippe Pernelle[2], Jean-Charles Marty[1] and Thibault Carron[3]
[1]LIRIS, University of Lyon 1, Villeurbanne, France
[2]DISP, University of Lyon 1, Villeurbanne, France
[3]LIP6, UPMC, Paris, France

Abstract: The development of serious games has increased remarkably in recent years. Serious games provide motivation, dynamism and attractiveness and as a result, they have been integrated more and more into e-learning practices. This integration involves the creation of adapted and entertaining scenarios resulting from the gamification of learning processes and potentially of industrial processes. These game-based scenarios are generally executed thanks to a serious game environment but they should also be integrated more broadly into general learning paths. The creation and integration of serious games represent an expensive process in terms of time and funding. A conventionally simplified approach consisted in using standards.

Many standards exist for pedagogical scenarios. Unfortunately there are almost none defined for gamification and/or game-based scenario integration in order to reuse their elements. In this article, we propose a contribution that offers a suitable design and smooth integration of game-based scenarios into learning environments by (re)using existing standards and an engineering model-driven approach. Specifically, we use the methodology proposed by the OMG MDA. Several e-learning standards have been proposed, such as LOM, SCORM and IMS-LD. LOM is a standard used for describing interoperable and reusable learning objects in order to be able to exchange information. These standards are not capable of representing all of the dimensions of serious games as they neglect the fun aspects such as the type of the game, motivation and the integration of games in e-learning environments. However, several studies propose metadata schemes based on the LOM standard to describe serious games (LOMFR-SG, SG-LOM). From these two approaches, we propose a generic enriched description of metadata for serious games in order to characterize a generic meta-model. This meta-model represents an independent level of abstraction. Then, according to MDA, we propose a meta-model suitable for our generic Learning Adventure platform, as well as the Claroline Connect one (LMS). Our contribution permits a smooth integration of serious games in e-learning environments. We propose the use of MDA to facilitate the implementation of generic concepts within an existing Serious game platform and e-learning environment.

Keywords: game-based learning, MDA, serious game

Game Design for Learning to Solve Problems in a Collaborative Environment

Nafisa Awwal, Monjurul Alom and Esther Care
Melbourne Graduate School of Education, The University of Melbourne, Australia

Abstract: Gamification has become a central focus in education and training due to its perceived potential to make learning more motivating and engaging. The reason for this shift in focus is that, unlike traditional pen and paper assessments, those presented in the form of games are not only designed and encoded with enjoyable game playing mechanisms, but is also capable of capturing salient information about the problem solving processes that individuals use when they work through a problem with another individual. The Assessment and Teaching of 21st Century Skills (ATC21S™) project focused its research on assessing the processes with which a problem is solved in a collaborative environment. This paper draws on the ATC21S™ study, outliningits approach to assessmentdesign and providing justifications for

choices made to achieve participant engagement and maintain a learning flow through a game mechanic that preserves learning outcomes. The game design included false leads to encourage students to explore the space and learn through trial and error. These were part of an instructional technique that allowsstudents to learn problem solving skills in steps or through patterns when one or more of the steps are incorrect. This paper provides a consolidated view of the design process of the assessments used in ATC21S™and shows that learning can occur through exploratory as well as collaborative participation in problem solving within the game environment.
Keywords: learning, collaboration, problem solving, gamification, game design

Relationship Between Game Categories and Skills Development: Contributions for Serious Game Design

Ricardo Baptista[1], António Coelho[1] and Carlos Vaz de Carvalho[2]
[1]INESCTEC/FEUP, Porto, Portugal
[2]ISEP, Porto, Portugal

Abstract: Recently, Serious Games (SG) achieved a recognized position as a learning tool in several contexts. SG provide constructive learning environments in which errors can be made without real life penalties and where students get instant feedback from their actions when facing challenges. These challenges should be in accordance with the intended learning goals and they should adapt and/or be repeated according to the learner's level. This aspect is decisive in the acquisition of knowledge, experience and professional skills through the simulation of different situations and contexts. The effectiveness of competences' training is directly related to the success in their acquisition but, above all, it is related to the ability to apply them to successfully perform a given task. However, an optimal game design methodology for competence training is yet to be created. This article presents a study that identifies the most appropriate game categories to develop specific skills and competences. It considers a taxonomy with eight game categories (Action, Strategy, Playing, Sports, Management Simulation, Adventure, Puzzle and Quiz) that were matched with the Education Competences and Educational Competency Wheel. Analysing 116 serious games allowed identifying which categories were more efficient in the training of a specific competence and therefore should be reused in the same scope.

Keywords: serious games, skills, competences, assessment, game type, game-based learning

Conflict Resolution of Game-Based Learning: When Teacher-Centered Approaches Need to Supersede

Bob Barrett
American Public University, Charles Town, USA

Abstract: While many educators and academic institutions are moving towards the switching of the traditional teacher-centered approach of instruction to a more liberal and "democratic" form of learner-centered approach to learning, there may be organizational issues affecting some parts of the transition. In particular, while some programs of study want students to become more engaged and motivated in their learning activities within the classroom, some may not have the necessary education or training to see the relevance of some learning activities over the use of others. A literature review was focused first on what is Games-Based Learning (GBL), in terms of the imagery of some archaic video games or mindless wonder (time filler) activities may be in the forefront of some educators or academic administrators. However, there is a growing piece of literature that has showing that a varied approach to learning, as well as teaching, can help to encourage, motivate, and engage more adult learners not only to participate more in their academic endeavors, but also may increase the likelihood of more student retention. While adult learning may also be focus on the accomplishment of certain class learning objectives, perhaps the learning objectives, syllabus, and overall classroom design and layout need to be re-evaluated to see if it is meeting the needs of today's adult learners, as well as offering a more enhance learning environment to engage and motivate more adults. Therefore, the use of Games-Based Learning offers a chance for more instructors to update their classroom layout and delivery of course content, as well as demonstrating to the student that despite various organizational issues and potential setbacks, the instructor is showing a level of interest in the student not seen in previous decades with a more "focused' approach to engage the learner and facilitate a "different type of learning environment" with a more modern-day approach.

Keywords: game-based learning, adult learning, online learning, learning activities

Designing Location-Based Gaming Applications With Teenagers to Address Early School Leaving

Matthew Bates[1], Maria Saridaki[2], Eleni Kolovou[2], Costas Mourlas[2], David Brown[3], Andrew Burton[3], Steven Battersby[3], Shirley Parsonage[4] and Terry Yarnall[4]

[1]Interactive Systems Research Group, Nottingham Trent University, UK

[2]Department of Communication and Media, School of Economic and Political Sciences, University of Athens, Greece, Ariu, Gaetana

[3]Interactive Systems Research Group, Nottingham Trent University, UK

[4]Greenhat Interactive Ltd, Birmingham, UK

Abstract: Early school leaving (ESL) is an urgent and serious problem, both for individuals and society as a whole. Factors such as learning difficulties, social problems or a lack of motivation, guidance or support all contribute to ESL, although the situation varies across EU countries. High rates of ESL are detrimental to making lifelong learning a reality and increase the risk of unemployment, poverty and social exclusion. Since normally there is not a unique reason for leaving education or vocational training, answers are no easy. In response to these concerns, the Code RED project (http://www.codered-project.eu) has been created to address the high proportion of drop out from Initial Vocational Education and Training (IVET) and ESL in the UK, Greece, Italy and Cyprus via the development of new games-based learning applications (both desktop and mobile) to inform young adults (aged 16+) of the issues surrounding ESL. Location-based gaming (LBG) applications represent a form of play that is designed to be undertaken on a device in motion which changes the game experience based on the location. The design of these products presents many challenges to developers surrounding user interfaces, processing power and the availability of space. The ARIS platform (Augmented Reality and Interactive Storytelling) covers a broad field of LBG design components such as geo-location data, location-sensitive informational objects, interactive dialogues and QR code input. As such, ARIS has been selected by Code RED researchers to teach LBG and mobile augmented reality design concepts and prototype new design ideas with young adults. This paper will discuss the issues which are contributing to ESL within the EU and report upon the results of a short term participatory design initiative within Code RED to co-design new location-based gaming applications with participating IVET students (aged 14+) to address these issues. In the UK, participating students were successful in formulat-

ing a game concept suitable for transfer into LBG surrounding lifestyle choices such as alcohol and drug abuse which may contribute to ESL. In Greece, participating students with learning disabilities were successful in creating a fictional 'solve the mystery' LBG using the ARIS platform. Students decided to focus the game's narrative on the issue of exclusion from school and jumping into fast conclusions during schooling years. In Italy, participating children were successful in designing an orienteering-based LBG to promote cultural heritage via exploration of an ancient castle. This process also enabled participants to research and learn more about this local landmark. The paper will discuss the application of the participatory design methodology between project partners and will document the LBG output from this process. Finally, the paper will identify how these products will be positioned as part of future work to address ESL.

Keywords: location-based games, participatory design, employability, early school leaving, ARIS

Non-Invasive Assessment of Motivation in a Digital Educational Game

Michael Bedek, Paul Seitlinger, Simone Kopeinik and Dietrich Albert

Knowledge Technologies Institute, Graz University of Technology, Graz, Austria

Abstract: Digital educational games (DEGs) have the potential to provide an intrinsically motivating learning context. With adaptive mechanisms that react to the learner´s current motivational state this potential can be further exploited. A learner model, based on continuous and valid assessment of a learner's motivational state is required. However, it would impair the flow-experience (Csikszentmihalyi, 1990) if a learner is repeatedly asked to evaluate his or her current motivational state, e.g. by a questionnaire that occurs in short time intervals on the screen. Hence, it is necessary to apply an approach that assesses the motivational state in an ongoing, implicit and non-invasive way. We suggest a non-invasive assessment procedure that is based on the observation and interpretation of so-called behavioural indicators (BIs), i.e. learner´s actions and interactions with the virtual environment that are gathered as log-data. A substantial set of behavioural indicators has been elaborated, such as mouse-click rate, whereby some of them are derived from information foraging theory (Pirolli and Card, 1999). For example, the relative amount of time the learner is exploring the virtual environment can be considered as between-patch processing while the relative amount of time the learner is communicating with other game characters can be considered as within-patch processing. Values for each behavioural indicator (e.g. amount, frequency, seconds, etc.) are gathered repeatedly after pre-

defined time slices, lasting for 40 seconds. The paper describes the results of an empirical investigation to examine the predictive validity of the BIs. Participants played a DEG while being asked to answer items of a short form of the Questionnaire of Current Motivation (QCM; Rheinberg, Vollmeyer and Burns, 2001). The QCM has been developed to measure current motivation in learning situations with respect to four factors: anxiety (of failure), probability of success, interest and challenge. Multiple linear regression models with the BIs as predictor variables and the QCM´s scales as criteria allowed for predicting probability of success, interest and challenge. There was no valid BI for the fourth scale of the QCM, anxiety. We conclude that our approach, being a valid non-invasive assessment procedure suits well to fairly evaluate the effectiveness of on-line game adaptations that aim to enhance the learner`s motivational state.

Keywords: game-based learning, motivation, non-invasive assessment, behavioural indicators, predictive validity

Learning AI Techniques Through Bot Programming for a Turn-Based Strategy Game

Alexey Bezgodov, Andrey Karsakov, Ksenia Mukhina, Dmitry Egorov and Artem Zakharchuk

ITMO University, Saint Petersburg, Russia

Abstract: Video games have become an integral part of the educational process. Born and raised in the digital era, Russian students of the 21st century are seduced by entertainment and in contrast they perceive STEM educational activities as boring and annoying. To spark an interest in Artificial Intelligence (AI) programming we decided to implement a competitive contest in the educational process. By combining the developments of the eScience Research Institute and educational techniques, we have introduced elements of entertainment to a group project of 6 ECTS during the second semester of the Double Degree Master's Program in Computational Science. The main goal of this project is to teach students basics of AI programming by creating bots for a strategy video game. Typical tasks and multi-domain specificity stimulate students to discover and apply new information from available sources promoting the principles of self-education and lifelong learning. An exaggerated and concentrated example of diverse behavioral patterns in the game should help students to transfer the patterns acquired from the games to solve real-life problems.

Keywords: artificial intelligence, competitive programming, turn-based strategy, gamedev, game development

Students as Digital Games' Evaluators: Enhancing Media Literacy and Learning Through Game Playing and Evaluation Methods

Vassilis Bokolas[1], Nikolaos Amanatidis[2] and George Koutromanos[3]
[1]Hellenic American Educational Foundation/ ASPETE, Athens, Greece
[2]1st Experimental Primary School of the Aristotle University, Thessaloniki Greece
[3]Faculty of Primary Education, National and Kapodistrian University of Athens, Athens, Greece

Abstract: Digital games are recently in constant debate in the educational community on issues such as promoting media education and learning as well as engaging students in activities that enforce subject cognition and effective collaboration learning assignments. At the same time, these particular principles 'serve' the trend of the Media Education. Hence contemporary changes in the wider media field require a re-evaluation of the fundamental aims and methods of media education – not just as far as the content of the curriculum is concerned, but also in terms of a pedagogical method process. In this article, based on the above framework, the researchers are trying to portray the implementation and evaluation of a learning and teaching scenario, in which learners-primary school students are gradually exposed to the role of a video digital games evaluator, learning about them, playing them and gradually setting up the evaluation criteria through the constant coordination of the teacher-facilitator. As a culmination of their efforts, the students evaluate the digital games they selected and played as well as create an on-line journal, on which they demonstrate in both numerical and descriptive ways their outcomes. Via the utilisation of specific guidelines and evaluation criteria to be defined by them, students, evaluate and formulate a review of the characteristics of their favourite video game. Subsequently, based on the assessment panel they compose an analysis, describing the characteristics of the digital games in question as well as attempt to provide advice to prospective users-players on their correct educational integration. Although limitations existed on mapping the evaluation criteria and guiding the students to adopt and promote the required competences, the attractiveness of the tasks in question connected and supported by the careful pre-planning of the scenario seemed to aid the effectiveness of the project. New competences and knowledge developed such as a critical eye on the digital games, evaluation techniques on digital games in learning settings as well as enhancement of cognition on certain issues and subjects.

Keywords: media literacy, learning, students, evaluation, digital games

The Ludic and Narrative Components in Game Based Learning: A Classroom Training Experience

Brunella Botte, Alfredo Imbellone, Giada Marinensi and Carlo Maria Medaglia
Link Campus University - Digital Administration and Social Innovation Center - DASIC, Rome, Italy

Abstract: This paper addresses the relationship between ludic and narrative components in a game-based classroom training experience, and their role as mediators in the relationship between level of satisfaction and learning. The study was conducted on a sample of 62 users, through a set of workshops where Lego® Serious Play® method was enriched with a narrative structure, based on role-playing session. Considering the Ludology - Narratology debate, this paper is a further study which aims to investigate, empirically, the role of both elements in serious games and, consequently, in learning. A first confirmatory factor analysis was conducted to verify that the two factors, namely the ludic and the narrative one, could be used to cluster the measured variables. Then, a path analysis showed the relationship among all the variables. The study showed, as first result, that the degree of satisfaction is the main predictor of the learning results and that the influence of narrative and ludic components on the player experience are really alike, with a slight dominance of the ludic one. The second result is that the mediation of the game components, both of the ludic and of the narrative one, has an unbalanced structure. One of the interpretation of this result is that the relationship between satisfaction and game mechanics is stronger than the relationship between game mechanics and learning. In other words, part of the engagement and enjoyment that is produced by the game context does not result in effective learning.

Keywords: serious games, narrative, ludology, role playing game

Mathematical Self-Efficacy as a Determinant of Successful Learning of Mental Models From Computerized Materials

Cyril Brom and Filip Děchtěrenko
Charles University in Prague, Czech Republic

Abstract: Computerized animations, simulations and games are useful tools for supporting acquisition of mental models. Various personal characteristics, such as prior knowledge and spatial abilities, can influence, in various ways, effectivity of learning

from these materials. In comparative studies with between-subject design that investigate learning effects of these materials, it is important to control for these variables because they should be taken as covariates in case the two (or more) research groups are not sampled equally (which happens even in the case of random assignment of participants to the research groups). In addition, it would be useful to have interventions that measure these variables with as few items as possible; to avoid unbearably long questionnaires. In this initial exploratory study we investigate if mathematical self-efficacy, measured by a single question, and self-assessed ability of acquiring mental models (SAAMM), also measured by a single question, predicts learning outcomes; as concerns mental models acquisition. Re-analyzing data from our four recent studies on one of the well-known principles of multimedia learning, personalization principle (N = 75, 85, 76, 41; college students with diverse background), we show that mathematical self-efficacy and SAAMM are moderately correlated (r = .32 - .40) and indeed related to learning outcomes, measured by transfer tests (r = .22 - .57 and .28 - .48, respectively). However, the reasons behind these relationships seem to be complex and diverse, and at least partly dependent on treatments' characteristics. For a complex simulation using graphs and resembling an educational computer game, this relationship can be, to a large extent, explained by mutual relationships between graphing skills, frequency of game-playing, mathematical self-efficacy, SAAMM, and learning outcomes. For a short animation on an electrophysical topic, it can be explained by mutual links between prior electrophysical knowledge, mathematical self-efficacy, SAAMM, and learning outcomes. Only for a short animation on a math/physics-unrelated topic, we could not explain the relationship between mathematical self-efficacy, SAAMM, and learning outcomes by a third variable (however, the graphing test was not administered in this case). In general, this study indicates that our two questions for assessing mathematical self-efficacy and SAAMM are promising instruments for measuring variables that should be controlled for in studies on learning effects of computerized materials with between-subject design, but more research is needed to pin down details.

Keywords: mental models, mathematical self-efficacy, learning outcomes, animations, simulations, serious games

Digital Support of Role-Play and Simulation Games in Classroom Settings

Carsten Busch, Sabine Claßnitz, Alexander Kramer and Martin Steinicke
Creative Media Research Group, University of Applied Sciences HTW-Berlin, Germany

Abstract: In this paper we describe the development of a software tool, which could be used to enrich non-digital role-plays and simulations in educational settings. It enables the integration of video as well as audio file citation and management with further functionality like smart board and mobile device integration. The tool was originally developed for the "Marshall McLuhan Salon" (MMS) of the Canadian Embassy in Berlin to support the work of the embassy´s tour guides, who facilitate teaching of school classes and university student groups. While developing the MMS solution we saw the possibilities in using the tool in other contexts and with other didactical approaches. This paper starts by describing the pre-intervention state of the MMS and then depicts our software solution to the needs of the MMS. Following we highlight some core insights from our usability testing in the embassy, which we heeded when developing the concept for a digital support of role-play and simulation games in classroom settings. Before describing its potential application in a simulation game on the energy turnaround, we showcase the combination of the three core components to support simulation games in the classroom. The paper thus shows that our tool can be used for educational experience that closes the gap between the media rich lives of youths and the valuable method of role-play and simulation games.

Keywords: role play, simulation games, class room, shared screen, bring your own device (BYOD)

An Empirical Evaluation of a Serious Simulation Game Architecture for Automatic Adaptation

Sophie Callies[1], Nicolas Sola[1], Eric Beaudry[1] and Josianne Basque[2]
[1]Department of Computer Science, UQAM, Montréal, Canada
[2]Department of Education, TELUQ, Montréal, Canada

Abstract: This paper presents an architecture designed for serious simulation games to automatically generate game scenarios adapted to player's level and knowledge.

We detail two central modules of the architecture: (1) the player model and (2) the adaptation module. The player model estimates the current knowledge of the player using a Bayesian Network (BN). The evidence variables in the BN are assigned through the observation of player's actions and the current state of the simulation. Considering the estimated player's knowledge and skills, the adaptation module uses automated planning algorithms to dynamically adjust the parameters of the simulation, in order to generate scenarios that will be well suited to improve player's knowledge and skills. We implemented our proposed game architecture in a simulation serious game named Game of Homes. The purpose of this game is to teach the basis of real estate. The player is a virtual real estate broker in a city who has to seek for brokerage contracts, estimate the value of houses, fix asked prices, perform visits, and close the deals. The player competes with other brokers driven by artificial intelligence (AI). We conducted a pilot experiment with human participants (N=10) to validate our architecture in Game of Homes. On day 1, participants were asked to take a pre-test about real estate skills taught in our game. On day 2, participants played Game of Homes for approximately 90 minutes and then filled up a motivation questionnaire. On day 3, participants took a post-test. Preliminary results show that in addition to induce strong motivation among the players, Game of Homes significantly improved real estate skills between pre-tests and post-tests. Results suggest that our serious game architecture allows (a) to induce learning process by providing content adapted to the player progression and (b) to keep the player motivated and interested during the game by adapting the challenge and providing new content.

Keywords: player model, game adaptation, game scenarios, serious simulation game, assessment in games-based learning

Gamifying Activities in a Higher Education Course

André Campos[1], Edwyn Batista[1], Alberto Signoretti[2], Renato Gardiman[1]and Charles Madeira[1]

[1]Federal University of Rio Grande do Norte, Natal, Brazil

[2]State University of Rio Grande do Norte, Natal, Brazil

Abstract: Some professional areas requires deep practical experience in order to master an ability. In the context of programming, for instance, the learning-by-doing approach does not only help students to better understand a concept, but also facilitates the identification of problem-solving patterns. Thus, it involves the exhaustive study of variants and the replication of solutions applied to different contexts. However, the maintenance of the student practice for the entire academic period is a challenge for any teacher. In order to keep student motivation, an online e-learning

environment, named Kodesh (Koding Shell), was developed as a way to provide to facilitate student practice. Some elementary gamified elements based on PBL (Points, Badges and Leaderboards) approach were introduced in the environment. These components proved to be an essential feature for the motivation of some students, but not for all of them. This teaching strategy confirmed some pitfalls, but also some potentials, which could be improved in a new version of the environment. Besides Kodesh, a set of game-based dynamics were also introduced during the lecture classes. In the classroom, students could join groups to collaborate and compete against others groups by solving challenges and puzzles. Again, this approach also showed its pitfalls and possibilities, which were useful for defining a suite of requisites for a mobile game following the “bring your own device” (BYOD) approach. This paper presents a summary of the reflexions and lessons learned from five academic semesters applying those gamification strategies in a higher education introductory programming course. The learned lessons resulted in a collection of guidelines that was used to drive the improvement of the Kodesh environment and the development of a mobile-based game named Desafio which means Challenge in Portuguese.

Keywords: e-learning, game-based learning, gamification, BYOD, programing learning

A Training Framework for the Creation of Location-Based Experiences Using a Game Authoring Environment

Samantha Clarke[1], Petros Lameras[1], Ian Dunwell[1], Olivier Balet[2], Thibaut Prados[2] and Elena Avantangelou[3]
[1]Serious Games Institute, Coventry, UK
[2]Diginext, Toulouse, France
[3]EXUS, Athens, Greece

Abstract: To support the development and implementation of location-based experience (LBE) as a future educational practice, we evaluate a practical approach to training and guidance, which seeks to transfer an understanding of the design and creation methods for LBEs to practitioners from multi-disciplinary backgrounds. A preliminary version of the "LBE Training Framework" is presented, facilitating consideration of constructivist pedagogical theories, training processes, visual design principles, and technical and design constraints when training end-users. The LBE Training Framework is informed by the MAGELLAN Training Framework, which utilises a constructivist paradigm to train participants on how to use the MAGELLAN Authoring Tool. To inform future iterations of the LBE Training Framework and assess the efficacy of the training methodology adopted, this paper presents a case study following

a training workshop that featured the initial release of the MAGELLAN Authoring Tool. This workshop, conducted in Greece with 14 end-user participants from multi-disciplinary backgrounds, was used to gather data and evaluate the Training Process taken from the MAGELLAN Training Framework. End-user feedback and user evaluation observations were collected from the workshop participants through a series of questionnaires, one-to one interviews, and focus groups. This paper presents an analysis of the findings, and considers the delivery methods and the training content used at the workshop, informed by the MAGELLAN Training Framework which is presented in the LBE Training Framework, a training paradigm for LBE's.

Keywords: location-based experiences, location-based training, training framework, location-based games

The Great and the Green: Sustainable Development in Serious Games

Darragh Coakley and Roisin Garvey
Department of Technology Enhanced Learning, Cork Institute of Technology, Cork, Ireland

Abstract: Sustainable development education remains a hugely relevant and urgent pursuit across all sectors of society. In 2002, the United Nations General Assembly declared 2005-2014 the UN Decade of Education for Sustainable Development. Within the European Union, there has been a focus on establishing regulations with regard to environmental awareness and prevention solutions in European countries over the past 30 years. The U.S. Partnership for Education for Sustainable Development (USPESD) was conceived in 2003 and is dedicated to education for sustainable development in the United States. This paper puts forth the case for the use of serious games to help support this noble cause through the use of games for conventional skills and knowledge development related to sustainable development, in addition to the use of games to help promote a shift in fundamental attitudinal dimensions by constituting a form of procedural rhetoric (Bogost, 2007) based around the learner experiences of rule-governed variables related to sustainability education. This paper offers a qualitative meta-analysis of the learning computer and video games have been shown to support and goes on to focus in on the specific area of games which are aimed at fostering knowledge and skills related to sustainable development, in addition to cultivating a range of important generic metacognitive and 21st century skills. The authors map a range of such skills and learning to a spectrum of existing commercial and serious video game titles, across a wide range of game genres, including strategy games, simulation games, action games, amongst others.

Keywords: serious games, game based learning, games for change, sustainability

Failure's Paradoxical Relation to Success: What Games can Teach us That the Academy Misses

Larry Crockett
Augsburg College, Minneapolis, USA

Abstract: This paper explores the relation of chaos to pattern in Wolfram's Rule 30 en route to exploring the essential role failure plays in the success of a game. Tentative pattern identified in the face of game chaos encourages the player to postulate new patterns that aid in dealing with failure. Identification of a usable pattern provides cognitive traction for a player attempting to overcome odds, discern relationships, vanquish menacing opponents, and consolidate winning strategies that temporarily stave off disaster. In a good game, there is just enough pattern for a good player to identify and thus win. In a great game with only evanescent pattern, a great player sustains temporary success by learning from failure. Games can therefore teach higher education a paradoxical lesson it currently poorly understands--namely, that failure has an essential role to play in academic success.

Keywords: Wolfram Rule 30, pattern, academic failure, failure in games, degenerate strategy, player failure and game success

---

The JamToday Network: Towards Applied Games for Learning Environments

David Crombie, Viktor Wijnen, Willem-Jan Renger and Pierre Mersch
HKU University of the Arts Utrecht, Utrecht, The Netherlands

Abstract: In recent years, the Game Jam approach has been increasingly effective in bringing appropriate stakeholders together around broad themes and challenges. There is now also a need to focus on establishing a sustainable learning hub for raising awareness of applied games addressing different themes and their use within learning environments. The European Game Jam Network, JamToday (www.jamtoday.eu), is establishing a central networking hub for the sustainable implementation and uptake of the next generation of educational games across Europe. Game Jams have been instrumental in stimulating innovation in the creation, implementation and deployment of educational games. JamToday is supporting this by creating toolkits and providing support for events across Europe, at local, regional and national levels. The JamToday hub thus provides stewardship for this emerging area and ensures that stakeholders maintain a balanced understanding of the main issues and the implementation hurdles that need to be overcome. JamToday seeks to

provide a replicable model of good practice in the design of transformative environments and to provide methods and tools that have been validated from several perspectives. Each year, JamToday sets up game jams at several locations across Europe, focusing on a different theme each year. Combining observatory and knowledge-base functions, JamToday provides methods for measuring and assessing the impact of different approaches. This paper presents early results of the first European applied game jam network. It presents the work achieved by the JamToday Network to date and details of the practical tools and methodologies developed by the JamToday Network to support game-design approaches for learning environments from design to transfer and evaluation.

Keywords: game-based learning, applied-game design, game jam, co-design

Beyond Power Systems Analysis: Game-Based Learning as an Instructional Alternative

Ronald Dyer
University of Liverpool, Management School, UK

Abstract: The translation of theoretical principles into practical application exposing undergraduates to real-life situations remains a challenge. The integration of problem-based learning approaches (Albanese & Mitchell, 1993) is requisite for instilling problem-solving abilities which inform good pedagogical practices. Game-based learning presents an opportunity to provide a degree of verisimilitude (Popper, 1963). Verisimilitude refers to the appearance or semblance of truth, likelihood or probability. As an essential ingredient to ensuring that engineering undergraduates possess both technical and applied competence the introduction of "probability or likelihood" necessitates a vehicle representing a facsimile of real-world industry challenge they will face upon graduation. This case study evaluates the results of students' exposure to a serious game as an alternative approach to traditional class-based business course delivery integration into the electrical engineering programme. It further analyzes critical factors as degree of flow (Csikszentmihalyi, 1990), challenge, usability and cognitive load (Sweller, 1994) to assess participant experience when exposed to immersive environment closely resembling real workplace scenarios via the introduction of new subject matter.

Keywords: game-based learning, verisimilitude, flow, cognitive load, problem-solving

Creativity and Playfulness: Producing Games as a Pedagogical Strategy

Stine Ejsing-Duun and Helle Skovbjerg Karoff
Aalborg University Copenhagen, Department of Communication, IT and Learning Design, Copenhagen, Denmark

Abstract: This article explores how student behavior and interactions change when teachers use "producing games" as a primary pedagogical strategy (Papert, 1980; Ejsing-Duun and Karoff, 2014). Based on student and teacher actions and responses, as well as on students' production—observed during fieldwork—this paper emphasizes the importance of understanding how students explore creativity and playfulness while producing in learning situations. This paper is based on a large research project called "Children as Learning Designers in a Digital School (2013–2015)," funded by Denmark's Ministry of Education. The study includes fieldwork in five Danish public schools, involving about 500 students, and it is based on six interventions in the first, second, fifth, sixth, and tenth grades. The article's empirical data consist of observations, participatory observation, and productions students created during the interventions. This paper presents an analysis of how students are creative and playful while producing learning material as games, during two interventions in the research project. The study is based on a specific understanding of the creativity (Boden, 2004) and playfulness (Karoff, 2013) that occur in learning situations. We want to approach creativity and playfulness as new ways of playing it safe when using material, through six areas of change that inform "how today's kids play and learn, and, more generally, how they see themselves, relate to others, dwell in place, and treat things" (Ackermann, 2013, p. 119). As a result, this paper contributes to the field by analyzing and discussing how educators deal with children's production processes in a school setting and how teachers can conceptualize and nurture play and creativity as drivers for learning. We further argue that playfulness is necessary for creativity to occur. From this point of view, understanding how learning activities can support creativity—an essential twenty-first century skill—becomes more accessible.

Keywords: production of games, creativity, playing, learning.

Enhancement and Assessment of Engineering Soft Skills in a Game-Based Learning Environment

Csilla Fejes[1], Lorenzo Ros-McDonnell[1] and Péter Bajor[2]
[1]Technical University of Cartagena, Cartagena, Spain
[2]Széchenyi István University, Győr, Hungary

Abstract: Engineering education literature shares a consensual vision of the importance of soft skills for every workplace. Despite of the growing demand for graduates with high EQ (Emotional Intelligence Quotient), one of the main challenges of the industry is the lack of soft skills, in particular, communication and negotiation skills, problem-solving skills, interpersonal skills, as well as critical and creative thinking skills. This paper investigates the enhancement of skills in a game-based learning environment, which was specifically designed to develop both hard (technical) and soft (personal) skills of engineering students through hands on experiences and observations. The acquired data is gathered using data triangulation, and it consists of self-assessments, observations, questionnaires and technical measurements. Preliminary results indicate that the environment has a significant impact on soft skill development, and show a correlation between soft-skill development and the level of motivation and self-evaluation.

Keywords: evaluation, game-based learning, hard skills, motivation, soft skills

From Hiscore to High Marks: Empirical Study of Teaching Programming Through Gamification

Panagiotis Fotaris[1], Theodoros Mastoras[2], Richard Leinfellner[3] and Yasmine Rosunally[4]
[1,3] University of East London, London, UK
[2]University of Macedonia, Thessaloniki, Greece
[4]University of West London, London, UK

Abstract: Unlike conventional taught learning, video games are very successful at keeping players constantly motivated and engaged on a set of tasks for many hours without apparent loss of focus. Additionally, when playing, gamers solve complex problems without experiencing the fatigue or frustration, which would normally accompany a comparable learning task. Any methods able to deliver deep learner engagement are naturally of interest to the academic community, thus resulting in an

increasing interest in adopting gamification – the integration of gaming elements, mechanics, and frameworks into non-game situations and scenarios – as a means to drive student engagement and improve information retention. However, its application to education has been a challenging task, as attempts have generally been restricted to a one-dimensional approach, such as transposing a trivial reward system onto existing teaching material. The empirical evidence presented in this paper suggests that a gamified, multi-dimensional, problem-based learning approach may yield improved outcomes even when applied to a very complex and traditionally dry task like the teaching of computer programming. This quasi-experimental study employed a real time sequence of scored quizzes, instructor feedback, and live coding to deliver a fully interactive learning experience. By using a combination of the classroom version of the TV game show "Who Wants To Be A Millionaire?", the "Kahoot!" Classroom Response System (CRS), and Codecademy's online interactive platform on a Python programming course, students were allowed to experience multiple interlocking methods similar to what would be found in a top quality game experience. Empirical data on learning outcomes from the gamified group were compared with a control group that followed a traditional learning path, which had been used during previous cohorts. Whilst this was a relatively small study, the results were quite interesting in a number of key metrics, including attendance, downloading of course material, and final grades.

Keywords: gamification, game-based learning, learning and teaching, technology enhanced learning, virtual learning environment, classroom response system

Immersive vs Desktop Virtual Reality in Game Based Learning

Laura Freina[1] and Andrea Canessa[2]
[1]CNR-ITD, Genova, Italy
[2]BioLab - DIBRIS - Università degli Studi di Genova, Italy

Abstract: Virtual environments are recognized as more effective than other digital approaches for the acquisition of several abilities. This is because the brain recognizes the virtual world as real and this facilitates the transfer of the newly acquired skills to the real world. In this paper, we present a game that has been designed and developed with the aim of teaching spatial orientation abilities to teenagers with mild intellectual impairments. In particular, the game focuses on the training of two basic skills: perspective taking and mental rotation. Perspective taking refers to the ability of imagining how the world looks like from another person's point of view, while mental rotation is the ability to mentally represent and manipulate physical objects

in one's mind. The game, which takes place in a virtual environment, shows the player a scene with some objects on the table. The player has to choose among four provided alternatives, the one that shows how the scene would look like from a different side of the table. The game was first developed to be used with either a desktop pc monitor or an interactive touch table. In this case, a virtual world is represented, but the player is not completely immersed in it, he just looks at the scene from outside. A second version of the same game has then been developed using a Head Mounted Display (HMD), which makes the player feel immersed in the virtual environment, where he can freely move around just as if it was real. In this paper, we discuss both advantages and disadvantages of the immersive Virtual Reality (VR) compared to the desktop VR. In fact, on the one hand, having the possibility to "dive" into the virtual world allows the player to: Better build a mental model of the scene and the involved objects by freely moving around the table and examining the objects from all the possible perspectives; Manage by himself the amount of help needed: it is always possible, at any time of the game, to move to the other side of the table and see what the scene looks like. Increase his involvement in the game by exploring the virtual world as he pleases. Have a better learning transfer thanks to the similarities between the virtual and the real worlds. On the other hand, using a HMD can be tiring and cause sickness to some players. Furthermore, the presence of a complete environment in which to move and explore, can draw the attention away from the main task of the game and therefore influence learning negatively. Experiments are planned to verify the foreseen advantages and disadvantages involving young adults with mild intellective disabilities.

Keywords: innovative games-based learning, virtual worlds, perspective taking, mental rotation

Game-Based Learning for Youth Career Education With the Card Game 'JobStar'

Toru Fujimoto[1], Yuki Fukuyama[2] and Tomoko Azami[3]
[1]Center for Research and Development of Higher Education, The University of Tokyo, Japan
[2]College of Arts and Science, The University of Tokyo, Japan
[3]Independent Learning Game Designer, Tokyo, Japan

Abstract: Rapid advancement in science and technology drives social change in various ways. While computerization has enhanced our work's productivity, recent research foresees a high probability that computers and robots will replace workers in

many jobs, such as telemarketing, hand sewing and watch repair, in the near future. Career education for youth is a crucial social issue and must be updated to prepare for future social needs. Current job search tools based on a self-analysis test tend to be serious; it is difficult to change a job seeker's viewpoint from current job opportunities to future possibilities. The present situation in career development is emotionally unhealthy for youth, and it is necessary to create more opportunities to help them build a positive attitude towards their profession. This study aims to help youth advance towards a better career by developing and implementing a card game for career education called 'JobStar'. The game is easy to apply to a normal classroom setting and positively and playfully involves students in discussions regarding future jobs. The game requires participants to analyse social issues and articulate future job needs. A game-based career education workshop was conducted to evaluate the impact of the game activity on participants. Results of a pre- and post-survey for participants indicated that the game offered an engaging opportunity that enhanced social interactions and facilitated participants' learning from each other during the game play. Participants gained a positive attitude regarding their future paths. Their experience with the game made them more confident about their competence in choosing their occupations. The game created a playful context for thinking about a serious topic that youth tend to be reluctant to consider and supported participants in practicing idea generation and verbally presenting their ideas by promoting interaction among participants.

Keywords: career education, card game, serious games, game-based learning

On the Development of Constructivist Educational Computer Card Games: The CLASS-Platform

Anthi Gousiou and Maria Kordaki
Dept of Cultural Technology and Communications, University of the Aegean, Mytilene, Greece

Abstract: This paper introduces the design of "CLASSification" (CLASS); a web-based platform for the development of single-player, classification-based Educational Computer Card Games (ECCGs) by non programmers – educators, and students. Within CLASS, they would have the opportunity to create their own ECCGs for the learning of specific disciplines, across several learning subjects and educational levels, using a simple and user-friendly "setup environment". CLASS also provides opportunities for the design of ECCGs using modern social and constructivist theories of learning, in combination with basic game design principles. Specifically, the "7-step modeling

methodology" for the design of constructivist ECCGs (Kordaki, 2015) was taken into account during the design of this platform. Based on the aforementioned methodology, the content of various types of cards need to be set by the designer according to the learning subject that the ECCG will be used for, namely: (a) cards related to the learning subject in question, (b) motivation cards, (c) challenging cards (to help students clarify their non-scientific conceptions), (d) scaffolding cards, and (e) information about the game cards. During the design stage, educators/designers should have in mind, the common learners' misconceptions related to the learning subject in question. Learners are asked to play with the aforementioned types of cards, featuring both figures as well as textual statements. Players/learners have to make appropriate classifications – according to specific concepts/criteria defined by the educators during the design stage – by forming valid groups of cards. By playing this type of ECCGs, students are supported to develop various cognitive and critical thinking skills, such as: Observation, recognition, knowledge recall, comparison, classification, identification of relationships among entities as well as analysis of the structural elements of a group and synthesis of valid groups of entities. To clarify both the design-mode and the play-mode of CLASS ECCGs, a brief example of an ECCG about nutrition education is presented.

Keywords: educational computer card games, platform, classification, educators, cognitive skills

Zombie Division: A Methodological Case Study for the Evaluation of Game-Based Learning

Jacob Habgood
Sheffield Hallam University, Sheffield, UK

Abstract: This paper discusses the methodological designs and technologies used to evaluate an educational videogame in order to support researchers in the design of their own evaluative research in the field of game-based learning. The Zombie Division videogame has been used to empirically evaluate the effectiveness of a more *intrinsically integrated* approach to creating educational games. It was specifically designed to deliver interventions as part of research studies examining differences in learning outcomes and motivation predicted by theoretical contrasts in educational design. The game was used in a series of evaluative studies, which employed experimental methodologies based around one or more treatment groups and a control. Multiple choice questions were used to measure knowledge and understanding before and after interventions (pre, post and delayed) and time-on-task was used as a measure of motivation and preference during interventions. Qualitative interview data was also collected and analysed as part of many of the studies in order to help

support and explain the findings in more detail. The experimental methodologies applied in these studies were augmented by a range of bespoke technology systems. This included an automated testing system which could randomly assign participants to treatment groups so that pre-test statistics were closely matched between groups. Large quantities of process data were recorded about players' interactions with the game in the form of time-stamped log files, and a stream of compressed controller data was saved allowing an entire playing session to be replayed in a video-like form. This rich set of process data was mined as part of a post-hoc analysis in order to identify evidence to help to enrich the understanding of users' interactions with the game. This paper details the methodological design of both published and unpublished studies, as well as reflecting upon some of the potential pitfalls of classroom-based evaluations in order to illustrate successful and unsuccessful approaches for evaluating game-based learning.

Keywords: game-based learning, evaluation, experimental design, learning outcomes, motivation

The School at Play: Repositioning Students Through the Educational use of Digital Games and Game Dynamics

Thorkild Hanghøj
University of Aalborg, Copenhagen, Denmark

Abstract: The aim of this paper is to present findings from a pilot study that relates to an on-going research project on the use of digital games and game-based pedagogies for supporting children in learning difficulties. The research project is entitled "The School at Play: Learning and Inclusion through Games and Game Dynamics" (2015-2017) and has been funded by the Egmont Foundation to be implemented in eight math and Danish classes (grades 3-6) distributed across four different Danish schools. The methods involve the use of digital games for creating meaningful contexts for learning and a number of visual tools and pedagogical approaches for clarifying and reflecting on students' progression in relation to social, curricular and game-related aims. Based on the theoretical framework of scenario-based education (Hanghøj *et al.*, 2014), the findings from the pilot study shows how a teacher and a student position themselves in relation to the shifting frames of the game-based teaching method. The preliminary findings suggest a number of possibilities and challenges involved in using the method for providing students with new learning opportunities, which emphasizes the important role of the teacher in adapting and facilitating the method.

Keywords: game-based teaching, games and inclusion, teacher roles, scenario-based education, framing, positioning

Amplifying Applied Game Development and Uptake

Paul Hollins[1], Wim Westera[2] and Borja Manero Iglesias[3]
[1]The University of Bolton UK
[2]The Open University of the Netherlands, Netherlands
[3]Universidad Complutense de Madrid, Spain

Abstract: The leisure game industry is one dominated by large international hardware vendors (e.g. Sony, Microsoft and Nintendo), major publishers and supported by a network of development studios, distributors and retailers. New modes of digital distribution and practice are challenging this model and the games industry landscape is one undergoing rapid change. The established industry appears reluctant to participate actively in the applied games sector (Stewart et al., 2013). This could be because of the concentration on consolidation of their platforms, content, protected brand and credibility which could be weakened by association with the conflicting notion of purposefulness in applied games in market niches without established return on investment. In contrast, the applied industry exhibits the characteristics of emergence and immaturity ; weak interconnectedness, limited knowledge exchange, an absence of harmonising standards, limited specialisations, limited division of labour and arguably insufficient evidence of the products efficacies (Stewart et al., 2013; Garcia Sanchez, 2013) and characterised as a dysfunctional market. To test these assertions the Realising an Applied Gaming Ecosystem (RAGE) project will develop a number of self contained gaming assets to be actively employed in the creation of a number of applied games to be implemented and evaluated as regional pilots across a variety of European educational, training and vocational contexts. The project brings together twenty European partners from industry, research and education with the aim of developing, transforming and enriching advanced technologies into self-contained gaming assets that could support a variety of stakeholders most significantly, game studios interested in developing applied games. RAGE will provide these assets together with supplementary knowledge resources through a self-sustainable Ecosystem, a social space that connects research, industry, intermediaries, education providers, policy makers and end-users in order to stimulate the development and application of applied games. The authors identify barriers and opportunities in engaging, exploring new emergent business models .

Keywords: applied games, serious games, game assets, ecosystem, gamification

Playing Facilitators: Care and Tough Love in Games Based Learning Contexts

Ellen Houmøller and Emanuela Marchetti
Department of Multimedia and IT, Lillebaelt Academy of Professional Higher Education, Odense, Denmark

Abstract: This paper presents reflections on the role of teachers as facilitators, in a context of role-play targeting learning of design thinking skills. Our study was conducted according to the method of visual ethnography. We acted as facilitators for 50 students through the yearly six-day competitive event called *InnoEvent*, addressed to students in the fields of multimedia and healthcare. Being interested in studying games and role-play as tools to support independent learning in the field of design thinking and team-building, following Dewey's (1938) theory of learning experience, we ran two workshops based on two classic role-play games: *The Silent Game* (Brandt, 2006) and *The Six Thinking Hats* (de Bono, 1985). These games were created to support students in learning design thinking in groups and are assigned positive values in literature, hence we expected a smooth process. However, our experience was rather characterized by conflictual negotiations with the students. Data from our observations and from interviews with group representatives show that the students took a discontinuous learning path, characterised by a false start, failure, and a thorough reconsideration of their work, succeeding in the end to produced original concepts. At the same time our role as facilitators shifted from instructional carers to challenging, and to group leaders. Based on our evidence we propose a new perspective, in which conflicts are an integral part of games based learning and can deepen the dialogue between students and facilitators, setting the conditions for independent forms of learning.

Keywords: role-play games, design thinking, facilitation, learning experience

---

The Application of a Content Independent Game Framework in Higher Education

Janine Jäger, Safak Korkut, Darjan Hil and Rolf Dornberger
University of Applied Sciences and Arts Northwestern Switzerland FHNW, Basel, Switzerland

Abstract: Gamification is a current trend in the business as well as the educational sector and is increasingly being applied in various disciplines and learning settings, especially in the context of e-learning. In order to take the various needs and re-

quirements of learners from different disciplines into account, a concept called Content Independent Game Framework (CIGF) (Korkut et al., 2014) and a corresponding online learning web platform called Tourney (http://www.tourney.ch) have been developed for the application in the context of higher education. According to the concept, teachers on the one hand, are content experts and mentors for the learning process. The students, on the other hand, are explorers, achievers and individual learners. For this reason, according to the CIGF, teachers act as game designers, creating playful challenges based on their subjects and geared to their students' needs. How difficult the game level is designed and what knowledge is to be imparted in which way depends on the teacher's evaluation, expertise and imagination. The application of the CIGF aims at engaging students in online learning environments as well as motivating instructors to rethink their content and design it in a new, attractive way to comply with the prerequisites of the digital age. The paper introduces the concept of the Content Independent Game Framework and the respective online learning platform Tourney and describes different use cases in the context of higher education. Furthermore, the different types of user data collected with Tourney as well as game stages designs are presented. Gained experiences from these game stage designs with regard to the underlying learning strategies as well as learning outcomes from user observations are reported and discussed and a future outlook is given.

Keywords: game framework, gamification, game-based learning, game design, e-learning

Making Games With Game Maker: A Computational Thinking Curriculum Case Study

Jennifer Jenson and Milena Droumeva
York University, Toronto, Canada

Abstract: While advances in game-based learning are already transforming educative practices globally, with tech giants like Microsoft, Apple and Google taking notice and investing in educational game initiatives, there is a concurrent and critically important development that focuses on ‘game construction’ pedagogy as a vehicle for enhancing computational literacy in middle and high school students. Essentially, game construction-based curriculum takes the central question “do children learn from playing games” to the next stage by asking “(what) can children learn from constructing games?” Founded on Seymour Papert’s constructionist learning model, and developed over nearly 2 decades, there is compelling evidence that game construction can increase confidence and build capacity towards ongoing computing

science involvement and other STEM subjects. Situated at the intersection of 'maker' pedagogies and inquiry-based learning on one hand and game-based learning on the other, this field of educational research is just now more thoroughly being theorized and implemented. There is still debate as to the utility of different software tools for game construction, models of scaffolding knowledge, and evaluation of learning outcomes and knowledge transfer. In this paper, we present a study we conducted in a classroom environment with three groups of grade 6 students (60+ students) using Game Maker to construct their own games. Our study adds to the growing body of literature on school-based game construction through comprehensive empirical methodology and evidence-based guidelines for curriculum design. We also discuss preliminary results related to computational literacy, in addition to a theorization of game construction as an educational tool that directly engages foundational literacy and numeracy and connects to wider STEM-oriented learning objectives.

Keywords: game construction, STEM, computational thinking, technology education, Game Maker, coding

Computerized Simulations of the Israeli-Palestinian Conflict, Knowledge Acquisition and Attitude Change

Ronit Kampf
Tel-Aviv University, Tel-Aviv, Israel

Abstract: This paper presents two cross-cultural experimental studies comparing the effects of PeaceMaker (PM) and Global Conflicts (GC) on knowledge acquisition and attitude change regarding the Israeli-Palestinian conflict. PM and GC are role-playing computerized simulations of this conflict, but there are a few key differences between them which may impact their learning outcomes. First, GC provides a more personal and human perspective on the conflict than PM. Second, GC is a more immersive game environment than PM. Finally, PM is an interactive and multimodal game environment compared to GC. 248 undergraduate students from Turkey, Israel, Palestine and the US participated in the two studies. They were required to fill in questionnaires measuring knowledge on the Israeli-Palestinian situation and attitudes regarding the conflict before and after playing the game. Results suggested that participants playing PM acquired more knowledge about the conflict than those playing GC. Second, participants playing GC became more impartial toward the Gaza operation in 2012, unlike those playing PM. Finally, participants playing GC became more impartial regarding long lasting historical issues in the conflict (i.e., Jerusalem, settlements, refugees, water, borders and security), unlike those playing PM. The results show that computerized simulations are useful as part of peace education

training, but the game characteristics may be crucial in determining whether the players gain the perspective of both sides or not.

Keywords: PeaceMaker, global conflicts, Israeli-Palestinian conflict, peace education, computerized simulations, serious games

Towards an Efficient Mobile Learning Games Design Model

Aous Karoui, Iza Marfisi-Schottman and Sébastien George
LUNAM Université, Université du Maine, Le Mans, France

Abstract: Classrooms are increasingly equipped with information and communication technology and especially interactive mobile devices. However, the latest studies show that their use by teachers is still very limited because of a lack of resources and applications adapted to an educational use. Indeed, there seems to be a shortage of mobile learning practitioners due to the time required for these tools' apprehension. Likewise, studies show real needs to expand the variety of applications, resources and activities available on these mobile devices, in order to make them more suited to the teachers' pedagogic objectives. Concurrently, new ways of using mobile devices for education are arising. Among those directions of use, research conducted on Mobile Learning Games (MLGs) seems particularly promising. In this paper, we propose to identify several MLGs, from the most referenced scientific assessments, that have been carried out in educational context, in order to determine their common features and impact on learners, and to identify challenges in terms of design, storyboarding and student monitoring. Thus, we can discuss how far research on MLGs has gone in terms of pedagogical effectiveness and whether there are still challenges that teachers will be facing regarding the design and execution of MLGs. At this level, we try to define the main characteristics of the analysed MLGs, and identify the recurring problems that occur when teachers use them. First, this will allow us to establish several guidelines for designing MLGs. Secondly, in order to diminish the constraints of use, we discuss new ways of implementing MLGs. Furthermore, we propose a global MLGs model, capable of capitalizing the identified main characteristics and overcoming the recurring problems at the same time. Finally, we discuss the possibility of implementing this model through an authoring environment.

Keywords: game-based learning, mobility, location-based learning, teacher, pedagogic objective

Seriously, Electricity is no Game: Play Safe

Aphrodite Ktena[1], Enea Mele[2], Eugenia Tsalkitzi[2], Christos Manasis[1], Charalambos Elias[1], Elias Constantos[2], Yannis Koutsoubis[1], Christos Tatsiopoulos[3] and Anna Tatsiopoulou[3]

[1]Department of Electrical Engineering, TEI of Sterea Ellada, Psachna, Evia, Greece

[2] SAIKON, Athens, Greece

[3] EPIS, Athens, Greece

Abstract: Over the last two decades we are witnessing an accelerating paradigm shift in electricity grids and markets. The power grid, enabled by technologies such as renewable energy sources (RES), microgeneration, telemetering and telecontrol, is moving towards demand side management, under the pressure for energy saving and low carbon economy on the one hand and electricity market deregulation on the other. Demand side management requires the user to be an active agent interacting in real time with the grid and the markets rather than a passive consumer whose only interaction with the gird is paying the bill and reporting faults. Under this light, the majority of electricity users could be considered as technologically illiterate, lacking fundamental knowledge and skills, which hinders the uptake of technologies and distorts related policies. *Smartege* has been designed and developed as a gamified application to educate electricity users, regardless of their profile, and modify the way they perceive their relationship with the electricity grid. To that end, persuasive modeling, gamification and cognitive learning have been used in a synergistic way. The expected learning outcomes of the user are to know, understand, apply basics of electricity use and generation towards efficient energy management as well as to analyse, evaluate and create energy efficient scenarios. Existing applications, such as Electric Box, Energy Quest, Ollie's World, Electrocity, Power Matrix, Energy Ville, et. al., focus mostly on children's and teenagers' conditioning towards a more overall 'green' attitude; address only one type of user's interaction with the electricity grid; or, are designed to promote commercial products and processes. *Smartege* on the other hand is a game of roles, simulation, strategy, quizzes and learning. The game uses an engaging graphical user interface that emulates the basic daily functions and activities of an electricity user in a house and an office building, in real time. Using gamification mechanics, the user is guided to understand the energy profile of appliances and equipment operating in the virtual buildings with respect to user-defined set points, to evaluate the effect of his/her actions and habits on them, to analyse the costs and benefits associated with energy upgrading or saving tactics. The user is gradually allowed to 'produce' electricity in the quest for net Zero Energy Buildings.

The user's knowledge base is improving through various content forms, such as tips, information, reading material, quizzes, exercises. The user is triggered at appropriate times with engaging messages and is motivated by counters, reputation points, leaderboards and badges. Special emphasis is given in the game's social dimension, employing social media, promoting user's interaction and information exchange for gaining points. Finally, at advanced levels, by purchasing appropriate hardware, the user can emulate, monitor and control the electricity use and production of a real installation.

Keywords: Smartege, energy behaviour modification, gamification, education

April 9th 1940, the Nazis are Coming: A Correlational Study of History Game's Mixed Effects on Knowledge, Attitudes and Thinking Skills

Andreas Lieberoth
Aarhus University, Denmark

Abstract: Thinking historically requires more than knowing what happened in the past. Building historical competences is a transformative process which trains a suite of cognitive and psychological skills including historical empathy, imagining counterfactual scenarios, and reflecting on the uses of history. This set of "second-order" competences is in essence what allows us to infer potential routes for the future by comprehending the past. Based cross-disciplinary empirical collaboration between history, didactics, game design and psychology, this paper explores data from "The Dilemma Game 9. April 1940": A design that illustrates the potential for bringing counterfactual historical scenarios to life though scaffolding at both the substantive first-order level and the more procedural cognitive/abstract second-order level. The challenge for researchers interested in the psychological processes that underlie 21st century historical thinking skills, then, is how to assess the transformative powers of games and other pedagogies in terms of domain-invigorated, but not content-bound, cognitive skills and attitudes, rather than regurgitation of facts that any child can Google in a heartbeat. Per usual, significant learning gains were observed at the level of substantial, or "first-order", knowledge and related increases in confidence, but a shift was also observed in the second-order concept of historical empathy. Sadly but perhaps predictably, the largest gains in substantial knowledge were associated with text-reading rather than enjoyment, counterfactual exploration, or perceived usefulness. Different play styles, from reading text to looking for maximal carnage was, however, related to a wide spread of attitudes and self-reported thinking habits, including historical empathy, using historical knowledge to form opinions and the un-

derstanding that history is sometimes about imagining what could realistically have happened instead of the few things that did turn out to shape our histories.
Keywords: history, systems thinking, counterfactual thinking, 21st century skills, play styles, game effects, correlation

Haunted: Intercultural Communication Training via Information Gaps in a Cooperative Virtual Reality

Gerrit Lochmann, Liesa Reitz, Jochen Hunz, Aline Sohny and Guido Schmidt
University of Koblenz-Landau, Koblenz, Germany

Abstract: In our paper, we present a novel way of oral language training, as well as vocabulary training for students and teachers of English as a Foreign Language (EFL) by embedding the language learning process into a generic 3D Cooperative Virtual Reality (VR) Game. The game is designed for students of different countries, training their Intercultural Communicative Competence (ICC) as well as helping them to overcome their insecurity in speaking without losing their faces. It is therefore necessary to create a most comfortable atmosphere to interact in a second language. Especially when the circumstances only allow conferences via video or phone, the learners are rarely induced to use words and phrases intrinsically. Our approach follows current research's demand for integrating creative tasks and alternative language learning schemes. It evokes communication between two players by implementing information gaps in a VR game, which makes information exchange necessary to complete the tasks and win the game. We therefore propose a game design template that is focused on creating a high density of information gaps by giving the players mutually exclusive abilities and different perception of the environment. From the template, we derive a game in which two players take the roles of a human and a ghost within an everyday environment. Their aim is to chase away Non-Player-Characters (NPCs), guarding items. It is our generic concept to arrange individual "atmospheres of fear" for the NPCs, who are each afraid of different everyday objects. Hence, the game can be extended by adding further subjects of learning in form of items and objects, depending on the need of learners and teachers. We analyzed the possibility to incorporate a given curriculum into our VR game. Therefore, we created a game content based on the curriculum obtained by the Graded Examination in Spoken English (GESE) Trinity Exam, a widely recognized test in international schools and universities. The empirical analysis of the communication among 26 test persons of different mother tongues shows that our game evokes a high amount of speech and a qualitative linguistic outcome that covers the requirements of the curriculum. In course of

the game, the students train their listening, speaking and reading skills, as well as ICC. Thereby, they become more confident in using English as Lingua Franca.

Keywords: second language training, virtual reality, English as Lingua Franca, cooperative learning, information gaps, generic gameplay

Enhancing Situational Awareness in Integrated Planning Tasks Using a Microgaming Approach

Heide Lukosch[1], Daan Groen[2], Shalini Kurapati[1], Roland Klemke[3] and Alexander Verbraeck[1]
[1]Faculty of Technology, Policy and Management, Delft University of Technology, Delft, The Netherlands,
[2]InThere, The Hague, The Netherlands
[3]Open Universiteit, Heerlen, The Netherlands

Abstract: A lot of working environments today are very complex, and tasks are interdependent. This requires well-trained and skilled personnel. One example of such complex, interdependent system is a container terminal. A container terminal represents an important node in the multimodal transportation of goods. It connects the global sea transportation of goods with the more regional hinterland transportation, including the storage of goods within the terminal. In such a node, many operations have to be planned in order to ensure a high performance of the whole system. Planners of these operations need a good understanding of the situation, described as Situational Awareness (SA). To develop situational awareness, training activities that fit in the work processes, and relate closely to reality, are needed. In our paper, we introduce the concept of microgames as an approach to foster situational awareness and situated learning of integrated planning tasks within container terminals. The microgame used in this study is known as Yard Crane Scheduler (YCS), which was developed by a novel design approach known as game-storm, grounded in the triadic game design philosophy. Our experimental set-up includes YCS game play, a survey to measure SA, a survey to collect demographics and a post-game evaluation survey. The sessions include briefing and debriefing lectures. Test sessions were conducted with 142 participants consisting of game design students, supply chain and transportation students from Netherlands, Germany and the United States. Based on these sessions, we were able to evaluate the role of situation awareness in integrated planning activities, and the playability and usefulness of the microgame. In conclusion, based on our quantitative analysis conducted on the data from the test sessions we can state that SA is very conducive to integrated planning tasks in container ter-

minal operations. Our qualitative results reflect that the microgame allows for an enjoyable game activity, while providing a meaningful situated learning experience.

Keywords: microgames, situational awareness, planning tasks, transportation

Integration of Game Based Learning Into a TEL Platform: Application to MOOCs

Wiem Maalejl[1], Philippe Pernelle[2], Jean-Charles Marty[1] and Thibault Carron[3]
[1]LIRIS, University of Lyon 1, Villeurbanne, France
[2]DISP, University of Lyon 1, Villeurbanne, France
[3]LIP6, UPMC, Paris, France

Abstract: Some pedagogical activities proposed in the frame of TEL (Technology Enhanced Learning) are not motivating enough, even if the proposed activities are pedagogically effective. Indeed, the principle of following very linear learning paths with little flexibility is not motivating enough for the learner. The current example of MOOCs is quite significant of these phenomena according to the high dropout by learners. In this work, we propose a dual approach that characterizes both the playful and adaptive aspects for MOOCs. The gamification consists of introducing playful activities. Adaptation allows to define personalized learning paths for a student, according to his/her profile, representing the current skills, the preferences, the habits of this student. In our work, we are thus interested in playful and adaptive paths based on the skills of a learner/player in the game-based learning environment all along a learning session. We illustrate the feasibility of our approach with a case study on the "Claroline Connect" platform.

Keywords: game-based learning, MOOCs, adaptation, motivation, learner's profile

Cities at Play: Children's Redesign of Deprived Neighbourhoods in Minecraft

Rikke Magnussen[1], and Anna Lindenhoff Elming[2]
[1]ResearchLab: ICT and Design for Learning, Department of Communication, Aalborg University, Copenhagen, Denmark
[2]Social Services Department, Copenhagen City Council, Copenhagen Denmark

Abstract: This paper presents a community-driven science gaming project where students in collaboration with urban planners and youth project workers in the City of Copenhagen used *Minecreaft* to redesign their neighbourhood to generate solutions to problems in their local area. The project involved 25 children from a school located in an exposed area in southern Copenhagen ages 13–15. The redesign process was conducted as part of science education in eighth grade. The specific area in southern Copenhagen has problems with organized crime and gangs and is defined as a focus area for various projects administrated by the City of Copenhagen. Resources were allocated for one of these projects to recondition the subsidized housing for this area. A community-driven science gaming process was designed in which overall challenges for redesign, defined by urban planners, were given to the students to highlight their local knowledge about living conditions and solutions for the problems identified. As part of the process students were introduced to central concepts in urban planning defined by leading Danish architects. Over four days, the students defined problems and potentials of the area, constructing models for redesigning the neighbourhood in *Minecraft* and LEGO. These were presented to City of Copenhagen architects and urban planners as well as the head of the Department of Transport, Technology and Environment. Overall the study showed that tasks focused on solving local living problems through neighbourhood redesign were strongly motivational for students. During the process students constructed models focused on the various needs of different types of residents and argued the models' redesign, in terms of their local knowledge area and in terms of fulfilling the mixture of needs of different groups of residents. This paper presents the *Cities at Play* research concept and explores the potentials and pitfalls of introducing user involvement in community-driven science gaming environments for integrating exposed groups.

Keywords: community-driven science games, urban planning, science education, citizen science

How to Build an Ineffective Serious Game: Worst Practices in Serious Game Design

Christos Malliarakis[1], Florica Tomos[2], Olga Shabalina[3], Peter Mozelius[4] and Oana Cristina Balan[5]
[1]University of Macedonia, Thessaloniki, Greece
[2]South Wales University, UK
[3]Volgograd Technical University, Russia
[4]Stockholm University, Sweden
[5]Cardiff University, UK

Abstract: Learning and teaching through immersive technologies has been an essential research topic in the last decades. Educators are trying to combine difficult topics that usually discourage students from learning with engaging tasks or technologies that will seem more attractive and thus supporting students' participation in learning. On the other hand, the students of the 21st century have been raised in a digital world, and therefore they learn and react differently. Computer games have become an active part of their everyday lives from a very early age, resulting in young people's familiarization with such technologies and their features. Furthermore, computer machines have greatly increased their capacities and capabilities, allowing the installation of game platforms with impressive graphics and special effects. This novelty fosters the usage of such games by users, where they are free to use all of the game's functionalities and immerse themselves in an interactive and attractive environment. These aforementioned benefits pose a significant challenge that is to investigate which elements constitute a successful serious game, what are the ways in which such games can be effectively embedded in the learning process and which are the factors that determine the success components in a game. However, it is essential also, to find out which are the elements that lead to the development of a game with no educational interest or benefits and with no facilitating features for both the teachers and the students. More specifically, this paper includes an analysis of learning principles, mistakes that lead to the non acquisition of long-term memories, and the lack of motivation of learners to keep playing and learning. Further, the paper elaborates on what is the mixture of learning and entertaining elements and features that produce either an unsuccessful or a successful serious game. Moreover, the research study will emphasize on the role of laughter and will highlight the implications of humor and comics for student successful learning. Furthermore, elements of humor such as humor creator and humor receiver will also be approached and discussed. Finally, it is stated how important it is to set achievable and measurable

learning objectives and align these to clear learning pathways as well as how to take appropriate feedback regarding learners' performance. The paper also describes all the concepts that are related to the development of an unsuccessful serious game, including the main mistakes that should be avoided. This proposed model will elaborate on the factors that hinder effective serious games development and will highlight that serious games can only support education when they properly link the "fun" elements of computer games with the essential educational elements required for in-depth learning.

Keywords: digital game-based learning, unsuccessful educational games, effective teaching, humor

A Tangible Digital Installation in the Classroom: Role Play and Autistic Children

Emanuela Marchetti [1] and Andrea Valente[2]
[1]Department of Multimedia and IT, Lillebaelt Academy of Professional Higher Education, Odense, Denmark
[2]Maersk Mc-Kinney Moller Institute, University of Southern Denmark, Odense, Denmark

Abstract: This paper describes a three weeks study involving 15 children affected by autism spectrum disorders (9-12 years old) in a primary Danish school. The aim of the study was to support the class teachers in assessing the benefits of game-based learning with respect to their main two challenges: facilitating the emergence of imagination and conceptual thinking, and managing the interplay between cooperation and competition. This cooperation originates from one of the teachers' interest in MicroCulture, a digital and tangible installation earlier created by the authors and aimed at bridging history learning across museums and schools. The design of MicroCulture focused on urban development seen as a social process; in order to cover children's multiple play modalities and support their interaction with guides and teachers, MicroCulture offers exploratory gameplay, with no predefined final goal and no score. At Aadal school the teachers introduced MicroCulture to the children and used it to discuss specific aspects of the life of the Vikings, and allowing them to play in small groups. The data were gathered through ethnographic observations, interaction analysis of video recordings and interviews with some of the school's teachers. We found that through mediated play and teacher's facilitation, children occasionally engaged in interactions leading to conceptual thinking, cooperation, and forms of role play. According to the teachers such occurrences represent-

ed a valuable achievement in the development of her classes, offering opportunities to discuss and explore with the children different forms of social interaction. Difficulties were encountered as the teachers had to find ways of supporting the children, strategically shifting between guidance and responsibility transfer, moderate children interaction towards cooperation while it often could resulted in conflicts. These results are contrasted against early findings concerning MicroCulture and museum-going pupils without autism. Our findings also show that MicroCulture will require further redesign, to better accommodate teachers and autistic children's needs.

Keywords: digital games based learning, facilitation, autism, role play, history

Manuskills: A DGBL Toolkit to Raise Young People's Awareness About Manufacturing

Maria Margoudi and Dimitris Kiritsis
School of Engineering, Institute of Mechanical Engineering, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

Abstract: Manuskills is a EU funded project (FP7 609147) that aims at studying the use of enhanced ICT-based technologies and training methodologies to facilitate an increase of young talents' interest in manufacturing and to support their training of new manufacturing skills (http://www.manuskills.org/). The conceptual framework of the project describes in detail Manuskills' learning objectives and the process through which they are achieved. In detail, Manuskills aims at the realization of three different levels of conceptual understanding: awareness, knowledge and application. The three abovementioned levels are also mapped with Bloom's Taxonomy of Learning Objectives. Nevertheless, identified as the main goal of the project is to raise awareness about manufacturing. In order to achieve this goal, a number of cutting-edge ICT educational tools and corresponding methods are employed, in the form of serious games and teaching factory. According to Rebolledo-Mendez et al. (2009), "the term serious game is used for game-based situations used for non-leisure purposes or serious applications such as learning and training". The approach followed by Manuskills for the integration of serious games into the learning process complies with the third approach described by Van Eck (2006). In more detail, the employed serious games constitute the result of the collaboration between educators and developers. Moreover, an important aspect that was taken into account during the design and the development of the games was the integration of pedagogical principles, so that the awareness-raising, leading to behavioural change, could be integrated into the game. The literature shows that it is only until recently that serious games

are used in order to develop awareness concerning several social issues. Furthermore, previously conducted research indicate a link between game-based learning and behavioural change (de Freitas, 2009, in Rebolledo-Mendez et al 2009). The current paper aims at presenting the DGBL (Digital Game-Based Learning) approach followed by Manuskills project, primarily in order to raise young talents' awareness and secondarily in order to attract their interest about concepts around manufacturing. The six different Manuskills' delivery mechanisms are designed around different manufacturing related concepts. We are going to present our route so far in the project and our vision towards the creation of awareness around manufacturing-related concepts on young people through the use of serious games.**Keywords:** Manuskills, serious games, awareness, manufacturing, DGBL

Teachers' Many Roles in Game-Based Learning Projects

Björn Berg Marklund and Anna-Sofia Alklind Taylor
University of Skövde, Skövde, Sweden

Abstract: This paper examines what roles teachers need to take on when attempting to integrate and use computer games in their educational environments. The task of integrating games into an educational setting is a demanding one, and integrating games as a harmonious part of a bigger ecosystem of learning requires teachers to orchestrate a myriad of complex organizational resources. Historically, the field of digital game-based learning research has had a tendency to focus heavily on the coupling between game designs, previously established learning principles, student engagement, and learning outcomes much to the expense of understanding how games impact the working processes of teachers. Given the significant investments of time and resources teachers need to make in order to conduct game-based learning activities, this research gap is problematic. Teachers needs to have a certain amount of gaming literacy in order to actively supervise, support, and guide their students before, during, and after the play sessions. The teacher also needs to be proficient in setting up play sessions in a limited amount of preparation time and tackle eventual technical difficulties. Beyond these demands, teachers also need to serve as a conduit between the learning context and the play context, and need to know how to continuously contextualize game activities and the content that students experience in the subject matter being taught. This paper describes the outcomes of two five month long studies where Swedish K-12 teachers were introduced to using MinecraftEdu as a classroom activity. The study identifies the different roles that a teacher takes on throughout game-based learning processes, such as technical administrator, game administrator, game tutor, subject matter expert, lecturer, debriefer, and classroom supervisor. Ultimately, the paper highlights the importance of understand-

ing the constraints under which teachers work, and argues that a better understanding of the contexts in which games are to be used, and the roles teachers play during game-based learning scenarios, is a necessary foundation for improving games' viability as educational tools.

Keywords: teacher-led gaming, teacher roles, practical implications of classroom gaming

Assessing an Authoring Tool for Meta-Design of Serious Games

Bertrand Marne
Sorbonne Universités, UPMC Univ Paris 06, Paris, France

Abstract: In order to help teachers to adopt serious games, we explore the problem of applying the meta-design principles to this context. The goal of meta-design is to enable end-users to act as designers as well as at design stage than at use time. We focused our work on helping teachers adapt educational aspects of serious game scenarios to their pedagogical needs. Our research leads us to design an authoring tool named APPLiq based on a generic model for serious games scenarios named MoPPLiq. In this paper, we first describe the three main aspects of the model MoPPLiq. First, we introduce the concept of meta design. Second, we introduce MoPPLiq and how it models scenarios by sequences of discrete black boxes named "activities". Then, we describe the "output states" that allow model the critical choices of the serious-players that can modify the course of the scenario. At last, we describe "input states" that aim to model the dynamic adaptation to serious-players, i.e. when an activity changes its behavior depending on the serious-player's model. After detailing MoPPLiq, we introduce APPLiq and its main features. APPliq is meant to design and adapt educational and recreational serious game scenarios. Therefore, we describe the main features of APPLiq: On one hand it depicts with a graphical representation the scenarios modeled with MoPPLiq. On the other hand, it provides a graphical user interface to change connection between output and input states of activities. APPLiq also provides a checking system that is able to check a serious game scenario for inconsistencies in the pedagogical scenario or in the game design. This system is also able to compensate automatically the non-pedagogical inconsistencies thanks to "buffer activities". Finally, we describe the protocol and the results of a qualitative assessment that we conducted with about 20 teachers for several weeks on APPLiq and MoPPLiq. The discussion of the results shows that the graphical representation of MoPPLiq helps teachers to understand the ins and outs of the serious game they had to use during the experimentation. On the other hand, despite some

ergonomics problems on the prototype of APPLiq tested, the results show that the authoring tool allowed teachers to create and to modify serious game scenarios that they declare relevant for their use.

Keywords: serious games, meta-design, authoring tools, scenario, game-design

What is a Game for Geometry Teaching: Creative, Embodied and Immersive Aspects

Morten Misfeldt and Lisa Gjedde

Aalborg University Copenhagen, Department of Learning and philosophy, Copenhagen, Denmark

Abstract: Game based Learning (GBL) has been promoted as a way to enhance science, technology, engineering and mathematics education, in several aspects. In this paper we aim at conceptualizing the creative, embodied and immersive potentials in the context of teaching geometry in primary school. We review two cases where the concept of "game" is related to the development of pupils' creativity and innovation skills. One intervention is inviting pupils to become designers at a "game factory", by using the digital mathematics tool GeoGebra. The second intervention uses mobile technology to have students participate in a collaborative game requiring them to take part in an embodied activity outside the classroom. In the paper we develop a model that view game based creative learning in as a combination of constructive, immersive, and reflective aspects. We do that by considering different meanings of the word "game" in a mathematics education context. That is game as a medium, game as a framing of educational processes, and games as an object. Considering games as media highlights the similarities with texts and any other means of delivering content. We can ask what message a specific game conveys, and discuss how well suited the game is compared to other mediations of the same content. Games can be described a as "semiotic domains" that allow players to interact with knowledge and make sense of the world (Gee, 2003). Games can act as a framing used to govern and plan educational processes, either as direct motivational driver, aiming at engaging more students in certain planned activities (Hamari, Koivisto, & Sarsa, 2014), or as an established form of process control in which complex situations can be played out. In a game the player act according to rules and the process has a natural direction towards finishing or advancing in the game. Furthermore games can frame educational processes by challenge the learners perspective through narratives and role-playing (Shaffer, 2006). Pupils creative design competencies and motivation to create and develop games have been documented as unusually relevant and high (Kafai, 1995; Tekinbas, Gresalfi, Peppler, & Santo, 2014). Mathematical thinking s can be used to

think game scenarios through, to govern the competitive aspects of a game and ensure that the gameplay is fair and balanced in terms of the involved struggle. Game literacy, both in terms of playing, producing and discussing games, does thus relate to mathematical literacy and knowledge.

Keywords: serious games, embodiment, epistemic games

Implicit and Explicit Information Mediation in a Virtual Reality Museum Installation and its Effects on Retention and Learning Outcomes

Tomas Moesgaard, Mass Witt, Jonathan Fiss, Cecilie Warming, Jonathan Klubien and Henrik Schoenau-Fog
Aalborg University Copenhagen, Sydhavn, Denmark

Abstract: Much research is currently being done in the area of Virtual Reality. This is due to the imminent release of several new pieces of gaming hardware that promises to bring the Virtual Reality (VR) experience into the homes and public spaces of ordinary people. This study attempts to build on the established literature to create a new form of game-technology based museum learning experience which uses VR to give the user a chance to visit the past. Greve Museum has been looking for a new way to visualize historical places like Mosede Fort, an old World War I battery south of Copenhagen in Denmark and the application developed for this study is a game-based Virtual Reality experience, which places the user at this Fort during World War I using the Oculus Rift Head Mounted Display. The application development was based on theories from other works concerned with education theory in games as well as engagement theory. The experiment explored the amount of knowledge retained, depending on how the information was mediated through the game. One version of the game had all the information given by a narrator and the other worked entirely through dialogue and other diegetic sources. The findings indicate that the implicit procedure only was a tad better suited for information retention overall, but that the explicit procedure gave the user a chance to gain better understanding of the situation. The study furthermore leads to several areas of discussion; partly how the setup affected people positively but also possible future aspects for the implementation.

Keywords: mediation, VR, museum, engagement, HMD, learning, game technology

The Predator Game: A web Based Resource and a Digital Board Game for Lower Grade School, Focusing on the Four Biggest Predators in Norway.

Robin Munkvold[1], Greg Curda[1] and Helga Sigurdardottir[2]
[1]Faculty of Business, Social and Environmental Sciences, HiNT - Nord-Trøndelag University College, Steinkjer, Norway
[2]Faculty of Business, Social and Environmental Sciences, HiNT - Nord-Trøndelag University College, Steinkjer, Norway and Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology, Trondheim, Norway

Abstract: The Predator game was developed by Nord-Trøndelag University College, The Mid-Norway Predator Center and the game company AbleMagic. The game is a multiplayer digital game, based on a classic boardgame model, where the players take on roles as one of Norway's four biggest predators, the bear, the wolf, the lynx, and the wolverine. The goal is to use the game as a part of grammar school children's preparations for visits to the Predator Center and the learning activities that they organize. This paper describes testing the game on a group of grammar school pupils. It focuses on how different game properties and the surrounding context effects the gameplay, looking into indicators like motivation, collaboration and competitiveness. It shows that The Predator game engages pupils and enhances collaboration and that the pupils genuinely appreciate many of its' features. At the same time it reveals some weaknesses in the game design as well as technical flaws. As digital games are a powerful medium for teaching and learning, proper testing during the design stage is essential. This paper lays out the strengths and the weaknesses of The Predator game, enabling improvements at the same time as sharing our findings with other game designers and scholars, in order to facilitate successful game design.

Keywords: digital, board, game, Predator

Non-Digital Game-Based Learning in Higher Education: A Teacher's Perspective

Nitin Naik
Defence School of Communications and Information Systems Ministry of Defence, UK

Abstract: Game-based learning (GBL) is a new educational paradigm. Digital game-based learning (DGBL) is a well established teaching pedagogy in higher education; commonly referred to as a GBL. However, there are many non-digital educational games available which do not require any technological assistance. Non-digital game-based learning (NDGBL) has also many advantages over digital game-based learning in education. Nonetheless, the teacher is the most important part of successful implementation of any DGBL or NDGBL approach. Teachers' perceptions are crucial towards this type of innovative learning because teachers are a bridge between students and games. Many studies were conducted that presents teachers' perceptions on the more popular form of GBL, DGBL approach. There are very few studies presenting teachers' perceptions on NDGBL. Therefore, in this paper, I present teachers' perceptions on my proposed NDGBL approach. This paper provides a critical analysis of teachers' feedback who played non-digital mathematical games to test the effectiveness of my proposed NDGBL for adults in higher education.

Keywords: non-digital game-based learning, NDGBL, GBL, maths game, mathematics, higher education, teacher's perspective

How can Teachers Develop Pervasive Games for Learning?

Hugo Nordseth[1] and Anders Nordby[2]
[1]Nord-Trøndelag University College, Steinkjer, Norway
[2]Hedmark University College, Hamar, Norway

Abstract: This project describes how teacher students and third year bachelor students in games and entertainment technology use a Concurrent Design Process (CCD) to develop a pervasive game to use in education. The case studies are based on projects carried out in Nord-Trøndelag University College (NTUC) and Hedmark University College (HUC). At NTUC the first part of the project took place in the fall of 2013 in a course on Game Based Learning (10 ECTS), where the teacher students developed different concepts for pervasive games for teaching in elementary school. The main competence of the students was pedagogy and practical teaching, so the pervasive game development had to be taught before the development process started. The

given assignment was simple; develop a concept for a pervasive game for use in the classroom. The teacher students made six different game concepts in total during this assignment. The second part took place in the fall of 2014, and this time third year bachelor student from the games and entertainment technology track was given one of the game concepts developed in the first part by the teacher students, and was asked to improve the game concept. This assignment was designed as a short CCD-process, where the students improved the pervasive games, and suggested new ICT-related ideas and digital support. Students were organized into four groups of six students, and the groups were put together as heterogeneous as possible. In each group, the students had different roles in order to maintain creativity throughout the development process. In HUC, students from the game development tracks did the first pervasive game development in 2012, and then later the idea was transferred to the teacher education program as a 30 ECTS course in the 4th year in 2014/15. The game development track and the teacher education program were separate development processes and not connected. We suggest a new model for the preproduction process using a concurrent design process. A CCD process can give a better structure using working sessions and collaborating tools for the work process. Further, a CCD process involves students with different background and competence, and the students get specific roles and perspectives like teacher/user, game designers, storyteller, programming expert, project leader and others. The goal of the work is to develop a game design document and a project plan for developing the game.

Keywords: gamification, games and learning, pervasive games, digital games, concurrent design

Teachers' Experiences Using KODU as a Teaching Tool

Ståle Nygård[1], Line Kolås[1] and Helga Sigurdardottir[1,2]
[1]Faculty of Business, Social and Environmental Sciences, HiNT - Nord-Trøndelag University College, Steinkjer, Norway
[2]Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology, Trondheim, Norway

Abstract: Digital games have become a part of the cultural and social reality in the Western world today, largely shaping the lives of those who have open access to them, children and young people in particular. In recent years digital games have been gathering acknowledgement as teaching facilitating tools and resources. This means that games are increasingly being applied in educational situations and within various educational contexts, which again requires that teachers not only understand both the potential and the limitations of digital game based learning – but also the

fundamental coding logic that is the bases for all digital gaming, as well as numerous other things in our daily lives. In February 2013, 3 University Colleges in Norway started a cooperation project, creating a new University college course, titled "Game-based learning" (n. "Spillbasert læring"). The goal was to prepare teachers at different levels of the education system to employ digital games in their various forms, as learning tools. Programming is an important part of game-based learning and in this project the Microsoft programming tool Kodu Game Lab was utilized. The course was first tested out at The Nord-Trøndelag University College (HiNT) in the autumn semester of 2013. This paper analyses the reflections of the teachers who participated in the first digital game-based learning course on how they experienced the employment of the Kodu coding tool in the classroom. Inspired by domestication theory and engagement theory, this paper presents the experiences of the teachers when they got to learn to teach basic coding skills to their pupils. We identify several themes that came up in their reflections, such as first impressions, reflections about digital natives and digital immigrants, the concepts of *learning to use* versus *using to learn*, the status of the teacher, prejudice, attitude change and IT-challenges.

Keywords: coding for children, game programming, games, Kodu, DGBL

Using Game Elements to Make Studying More Engaging

Daire O Broin[1], Neil Peirce[2], Tracey Cassells[1] and Ken Power[1]
[1]Institute of Technology, Carlow, Ireland
[2]Learnovate, Trinity College Dublin, Ireland

Abstract: A lot of potential exists for systems that enhance learner engagement using game elements. In particular, elements that support the activity of learning, that are designed around learning but that are distinct from the subject matter a learner is studying. This paper describes such a system, the particular support focussed on is goal setting - setting custom learning goals, independent of the course being undertaken, and tracking progress on these goals in a game like way. Students' approaches to study have been classified by a number of different inventories, perhaps the most popular is Biggs' Study Process Questionnaire (SPQ) which divides students into one of three categories - Utilising (studying no more than is necessary), Internalising (where studying is an intrinsically motivating activity), and Achieving (getting grades for their own sake). Is it possible to facilitate the state of flow, to enable more students to experience study as an intrinsically motivating activity more often? This work explores the design of a system with the goal of answering this question. This system has been trialled with a class of final year BSc computing students in order to

assist them with the activity of studying for exams. The aim of the trial was to determine the degree to which the game-like system succeeded in making studying for exams more engaging. This paper describes the design of the system, and the design and results of the trial. **Keywords:** game elements, studying, flow, intrinsic motivation

Using Gamification to Motivate Smoking Cessation

Trygve Pløhn[1] and Trond Aalberg[2]
[1]Nord-Trøndelag University College, Steinkjer, Norway
[2]Norwegian University of Science and Technology, Trondheim, Norway

Abstract: Smoking cessation represents the single most important step that smokers can take to enhance the length and quality of their lives. In this paper we present a case study of the commercial web-based *freeFromNicotine* course, which provides a game-based approach to smoking cessation. Participants follow a 50 day long program tailored to their individual situation. Gamification is used both as a control mechanism to measure how well the participants follow the course and to motivate the participants to complete according to plan. An important motivational element included in the design is the opportunity for participants to compete against themselves and others based on game points awarded for completing goals and assignments. Research within GBL has shown that in Pervasive Educational Games, competition has a positive impact on player participation. However, offering individually tailored courses while providing all users the opportunities to participate in the overall competition on equal terms is a challenge. This paper presents the gamification approach adapted in the course and how this affected and was perceived by the course participants. *freeFromNicotine* proved to be successful in getting people to quit smoking, but was not a commercial success due to marketing problems. However, participants who managed to quit smoking after completing the course mentioned competition as an important motivational factor and we can conclude that the gamification and design principles proved successful and can be deployed in other types of learning games.

Keywords: gamification, pervasive games, game based learning, health games

Teaching Business Intelligence With a Business Simulation Game

Waranya Poonnawat[1, 2], Peter Lehmann[1] and Thomas Connolly[2]
[1]Faculty of Information and Communication, Stuttgart Media University, Stuttgart, Germany
[2]Faculty of Engineering and Computing, University of the West of Scotland, Paisley, UK

Abstract: The term "*Business Intelligence*" (BI) has evolved from Management Information Systems to Decision Support Systems since the mid-1960s. Today, modern decision making methodologies and technologies are referred to under the term "Business Intelligence". The main purpose of this technology is to improve both the efficiency of users' decision making and the effectiveness of decisions. Decision support technology has been implemented and researched in industry and academia for more than half a century, however, challenges in teaching of this field still remain such as access to suitable data sets, finding interesting business cases, and providing realistic and meaningful experiences. Interestingly, the top rank of CIO global technological priorities is still *Business Intelligence and Business Analytics,* but the skills gap is significantly wide and negatively impacts on business. Moreover, it is not only the BI skills that are needed but also the 21st Century skills, such as, communication, social skills, creativity, critical thinking, problem solving, productivity, and risk taking – as suggested by the European Community to meet the requirements from the job market. This situation drives BI instructors to improve their teaching strategies or to have considered alternative methods to educate their students. *Business Simulation Games* are recognized as an effective educational method to enable students to learn how to make decisions and manage the business process in a modern enterprise, link abstract concepts to real world problems, and improve quantitative skills. Additionally, a *game* is a future technology trend that will be able to support developing new skills, because game characteristics can contribute and sustain 21st Century skills. Therefore, the "*BI Academy" (BIA)* project at the Stuttgart Media University in collaboration with the University of the West of Scotland has developed a business simulation game, called *BI game*. It is anticipated that using the BI game can help instructors to overcome the limitations and challenges in teaching BI, support students to improve their BI skills and 21st Century skills through the learning process, help students to get a better understanding of how to use BI tools to support decision making, and can leverage students' BI maturity level. This paper first presents the status of Business Intelligence in academia, the conceptual framework being used as the basis for game design, the technical framework supporting the game op-

eration, and the organisational format of the BI game which provides a closed-loop learning environment. The paper then describes the preliminary results of students' self-assessment, which shows that most of the students assessed themselves as having quite good 21st Century skills but quite low BI skills. Finally, the paper will provide directions for future research.

Keywords: business intelligence, decision support systems, business simulation games, decision making, 21st century skills, BI maturity

Approximating Balance in Collaborative Multiplayer Games

Christian Reuter, Stefan Göbel and Ralf Steinmetz
TU Darmstadt, Darmstadt, Germany

Abstract: Multiplayer games allow players to play together, allowing them to train their socials skills and enabling collaborative learning in educational settings. But while balancing a game's challenge is a well-researched topic, to the best of our knowledge there are no definitions and algorithms taking into account the individual contribution of each player in a collaborative setting. Unequal contributions however can lead to one player completing the game alone while the others are not playing at all in the worst case. In this paper we provide a novel definition for collaborative balancing suited for multiplayer games with fixed and free roles, including metrics for heuristically calculating effort, waiting times and options available for each player. These metrics have also been implemented in a graph-based analysis algorithm, which has been applied to an example game in order to show the feasibility of this approach.

Keywords: multiplayer, collaborative, cooperative, balancing

Serious Games Design as Collaborative Learning Activity in Teacher Education

Jože Rugelj
University of Ljubljana, Faculty of Education, Ljubljana, Slovenia

Abstract: Serious games design can be carried out as a collaborative, project based learning activity in the framework of a course on the use of ICT in education for future teachers. The main idea of the course is to combine all didactic and technical knowledge that students have acquired during their studies at the faculty of educa-

tion and to apply it in a relatively complex project. All activities in the project can help them to achieve competencies that are crucial for teachers in primary and secondary schools. We have considered issues that are associated with collaborative learning and with different aspects of work in a group in the paper. We analyzed project activities in the courses in the last five years to find out how groups form, how the members of a group organize their project activities, and how they communicate and coordinate their activities in a group. We also investigated how a group size and its heterogeneity, complexity of the project, and communication media influence interactions in a group and what are the characteristics of interactions of a group with other groups and with external resources.

Keywords: game based learning, project based learning, collaborative learning, constructivism

Games for Exciting and Effective Learning

Galina Saganenko[1], Elena Stepanova[2] and Anna Voronkova[3]
[1]Sociological Institute of Russian Academy of Sciences, St.-Petersburg, Russia
[2]Baltic State Technical University VOENMEH, St.-Petersburg, Russia
[3]School No 238 St.-Petersburg, Russia

Abstract: Nowadays as the world moves towards a knowledge-driven economy, education is becoming the one of the most significant economic topics. Russian education is falling substantially behind in this movement, as its education system does not adequately enough address humanistic tasks and missions. In this article we intend to identify, firstly, resources available to the education system and, secondly, we estimate its overall effectiveness. We will offer examples of strong dissatisfaction with the learning environment and its results by different categories of students and parents. We will identify the main reasons for the relatively low effectiveness of education in Russia. We will substantiate a set of new principles for creating a more comfortable and effective educational environment that balances opportunities for students with different educational backgrounds and delivers better results. We will present applied methods we have developed in order to raise student success rates: (a) a system of educational games that provide strong basic frameworks to solidify and add to new knowledge related to multiple social-cultural areas. In Russia game-based learning is used extremely rarely, and there has been very little research in this area; (b) a system of reflective survey methods for development of social thinking and raising student awareness of their opportunities and resources in the context of

the knowledge they gain; (c) "life for education" - different pieces of various materials related to students' social reality are used for manipulating and understanding.

Keywords: new learning principles; system of learning games; student as the starting point of education; spatial, time and social coordinates for knowing/learning; effective and comfortable educational environment; reflective research/learning technology

Gamifying the Museum: Teaching for Games Based 'Informal' Learning

Eric Sanchez[1] and Palmyre Pierroux [2]
[1]Institut français de l'éducation, ENS de Lyon, Lyon, France
[2]Department of Education, University of Oslo, Oslo, Norway

Abstract: In this paper we present a study of master students working with the concept of gamification (Deterding et al., 2011; Bonenfant & Genvo, 2014; Sanchez, 2014) to design an informal learning activity in a natural history museum. The teaching unit was a project-based course covering fundamental concepts related to the use of games for educational purposes, and is part of the Information Architecture program at ENS of Lyon. The winter 2015 semester included one week of project work at the *Museum of Nature* in Sion, Switzerland. We present the course organization and pedagogical approach for the teaching unit. Based on observations, recordings and documentation of the students' process and products, we analyze the core concepts that became relevant in the students' game design for this informal learning setting. Specifically, we identify the notion of 'games as metaphors of the subject to be learned' (simulation), and 'games as spaces for reflexivity,' where players are prompted to assess their modes of thinking and behaving (feedback). We also discuss the extent to which this project aligned with the museum director's objectives of integrating a game-based learning activity in the permanent exhibition, with its collection of material objects, unique physical spaces, and use of multimodal resources. The exhibition had the narrative aim of highlighting the concept of *anthropocene.* This is a rather complex theme dealing with environmental changes and humanity's influence on the emergence of a new geological epoch. We analyze the ways in which the students integrated perspectives on informal learning with principles of gamification to engage their target audience in understanding the concept of *anthropocene*: young people (12-15 years old) on school field trips. We conclude by discussing the implications of this study for teaching game based informal learning in higher education programs, and we reflect on potential tensions and values of inte-

grating games in learning activities in museums that became apparent from this study.

Keywords: museum learning, gamification, teaching gbl, design

Fabrication of Games and Learning: A Purposive Game Production

Henrik Schoenau-Fog, Lars Reng and Lise Busk Kofoed
Department of Architecture, Design and Media Technology, Aalborg University, Copenhagen, Denmark

Abstract: The concept of Game based learning has proven to have many possibilities for supporting better learning outcomes, when using educational or commercial games in the classroom. However, there is also a great potential in using game development as a motivator in several other kinds of learning scenarios. Using game development as an approach for including game based learning in various educations has become more accessible due to more user friendly game development tools and systems. This study will thus focus on an exploration on how game development motivates students and what they learn when creating games. We exemplify the potential of using game fabrication as a learning environment with the investigation of a game production, which involved over 25 students across semesters. In order to investigate students' experiences during this purposive game production, we set up an experiment where students were "hired" to work in a virtual game development company. Students then had to produce a game concerning global warming during their 2.5 months semester project. The main results indicated that students who worked on the purposive game production acquired several new technical and analytical skills, they increased their skills in production management, and they were more motivated to continue their studies after the production. The findings illustrate that there are great potentials in harnessing the power of game development in education. We conclude with a framework of best practice guidelines for other educators, who want to incorporate a purposive game production in their own activities.

Keywords: game based learning, game development, purposive game, problem based learning, production-oriented learning

Gender Differences in Perceiving Digital Game-Based Learning: Back to Square one?

Helga Sigurdardottir[1, 2], Trond Olav Skevik[1], Knut Ekker[1] and Beata Johanna Godejord[3]

[1]Faculty of Business, Social and Environmental Sciences, HiNT - Nord-Trøndelag University College, Steinkjer, Norway

[2]Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology, Trondheim, Norway

[3]Institute of ICT, Nesna University College, Mo i Rana, Norway

Abstract: Proponents of digital game-based learning, DGBL, often claim that since our children grow up with digital media, digital games are a medium they already know and have a positive relationship to. They say that this, along with several other reasons, such as the unique learning properties of digital games, are among the reasons DGBL is a relevant approach to educate current generations. Igniting children's interests in topics such as gaming and coding at an early age might thus spark their future interest in science and technology professions. At the same time, research indicates a difference in the gaming habits and preferences of girls and boys. In an ideal world, boys and girls would have the same opportunities. While the laws and regulations of most Western countries today support this ideal view, several things in our society indicate that gender equality is not yet accomplished. The different numbers of women vs men in science and technology is one of those indicators, as men still significantly outnumber women in such professions (Gansmo, 2011; Kafai, Heeter, Denner & Sun, 2008). We wondered why this is so - and how a balanced gender division in science and technology can be achieved. In this context, we set out to investigate the role of schools and other educational institutions and initiatives in Norway, in creating equally interested and skilled female and male scientists and technological professionals for the future. Furthermore, we turn the spotlight on to the experiences of young boys and girls who receive part of their education through DGBL. We wish to explore how they experience DGBL and whether there is a difference in this experience depending on the gender.

Keywords: gender differences, DGBL, equality

E-Learning Sudan, Formal Learning for Out-of-School Children

Hester Stubbé[1], Aiman Badri[2], Rebecca Telford[3] and Anja van der Hulst[1]
[1]Training and Performance Innovations, TNO, Soesterberg, The Netherlands
[2]Unesco, Khartoum, Sudan
[3]War Child Holland, Amsterdam, The Netherlands

Abstract: E-Learning Sudan (ELS) is a custom-built computer game that provides alternative learning opportunities to Sudanese children who are excluded from education. Unique in ELS is that children can learn mathematics, in their own remote village, without a teacher. This research study assessed the effectiveness of ELS through a pretest–posttest control group quasi-experimental design. Participants consisted of 67 children in three remote villages, aged between 7-11, that had never been to school before. The control group consisted of 19 children in a fourth remote village. The experimental group used the game for a period of six weeks, five days a week, 45 minutes a day. The results of the analysis on the pretest–posttest data revealed that ELS increased mathematics knowledge acquisition in numeracy and adding significantly and maintained student motivation to learn. The findings suggest that the implementation of ELS can greatly benefit learning for out-of-school children like in Sudan.

Keywords: game-based learning, autonomous learning, primary education, mathematics, developing countries

Building an Emotional IPA Through Empirical Design With High-School Students

Annalisa Terracina and Massimo Mecella
Università degli studi di Roma La Sapienza, Italy

Abstract: As suggested by Woolf, one of the Artificial Intelligence (AI) grand challenges in education is “mentors for every learner”. Mentors can be implemented as Intelligent Pedagogical Agents (IPAs) in order to motivate students: “The first way such systems [IPAs] must evolve is to directly address 21st century skills such as creativity, critical thinking, communication, collaboration, information literacy, and self-

direction." AI provides the tools to build computational models of student's skills and scaffold learning. Further, AI methods can act as catalyst in learning environments to provide knowledge about the domain, students, and teaching strategies through integration of cognitive and emotional modelling, knowledge representation, reasoning, natural language question answering, and machine learning methods. In this paper, we describe the design and development of an Intelligent Pedagogical Agent that will guide the students through the use of a Serious Game implemented to teach STEM subjects. The use of IPAs is proposed as a support during the game evolution because they act as learning facilitators and guide the learners in the virtual environment by explaining topics, answering questions, giving feedbacks, helping the learners to collaborate with others, providing personalized learning support. The IPA that we propose in this paper behaves along two paths: *emotional*, as the interaction depends on the feelings of the student, and *pedagogical*, i.e., by giving tips and advices related to the topics and to the tasks assigned. The emotional part of the IPA has been built conducting a study on emotions with high school students. On top of the results coming from the study, it has been built an Android application that uses the IPA as a standalone application to prove the efficacy of the IPA itself.

Keywords: intelligent pedagogical agent, emotional learning, serious game, empirical design

Developing an Epistemic Game: A Preliminary Examination of the Muscle Mania© Mobile Game

Anisa Vahed and Shalini Singh
Durban University of Technology (DUT), Durban, South Africa

Abstract: Several game scholars contend that the traditional understanding of vocational education in terms of curriculum content only is insufficient. Instead, they propose that lecturers need to develop a system in which students learn to think and work as reflective practitioners through an epistemic frame that mimics the real-world to allow students to have rich experiences of their domain-specific subjects. The Framework for the Rational Analysis of Mobile Education (FRAME) model offers some insight into the development of an epistemic frame within a mobile device In particular, it extensively links the hardware, software and connectivity options to meets with learner's cognitive, physical and psychological needs in the context of their learning environment. In this model, the mobile device is an active component and the mobile learning experiences are viewed as existing within the context of information that is mediated through technology. The aim of this paper is to explore the efficacy of using Muscle Mania© as a mobile platform. Arguments for implement-

ing mobile-learning within higher education have generated an increasing volume of research. The general focus of these studies, however, is based largely on empirically documented work with little theorisation on the design of mobile games. In the pursuit of using mobile technology to develop an epistemic or discipline-specific game that will facilitate the teaching and learning of the muscles of mastication and facial expression, this paper explores the FRAME model and how it can be used as a substantive theory for mobile-learning. A qualitative research design and a case study strategy were adopted. Data was collected by means of reflective reports on the mobile game prototype from the technical designer, lecturers and students. With its strong emphasis on educational software design, the Device Usability Aspect of the FRAME model guided the internal architecture needed to design the epistemic frame of a mobile game. Equally significant, the FRAME model foregrounds the concept of techno entrepreneurship as it demonstrates how lecturers use technology to move from delivery and supervision to the production of knowledge.

Keywords: android SDK; muscles; epistemology; debriefing; FRAME model

Analysing the Enjoyment of a Serious Game for Programming Learning With two Unrelated Higher Education Audiences

Adilson Vahldick, António José Mendes and Maria José Marcelino
CISUC, Department of Informatics Engineering, University of Coimbra, Coimbra, Portugal

Abstract: Serious games are generally considered a good alternative to improve motivation to learn. A game should have meaningful mechanics and elements to involve the players and to keep their attention. Each person has his own motivation to play games. This leads to different types of players and consequently to the need of different types of elements to keep them engaged. Understanding the player's behaviour is an important issue to improve support in the game. While the designer of a serious game focus mainly on its educational value, it is also important to incorporate fun elements in the game. We are developing a serious game aimed to help the development of basic computer programming skills. Our challenge is to create a game that provides effective self-learning support while keeping the student engaged in the game's missions. This paper deals with the game features and their evaluation. The game has missions covering basic concepts of computer programming: sequence of actions, variable manipulation and conditionals. In this research, we are concerned with evaluating the game enjoyment. We conducted two experiments with groups of

students from completely distinct knowledge areas. First, we applied the game in a Portuguese Education Sciences class that included essentially female students. Next, we performed a play test in a Brazilian first semester of Software Engineering undergraduate class composed essentially by male students. We believed that we would identify a larger set of needs if we diversified the types of players that tried the game. Consequently, if the game satisfies their needs, we would reduce the possibility of failure of the game. The EGameFlow instrument was used to measure the enjoyment. Findings show that the game entertains the players even if the programming tasks are hard. However, some improvements are necessary to foster self-learning. Finally, the paper presents future work that aims to include new challenges and missions in the game and to improve the enjoyment.

Keywords: computer programming, serious game, educational game, enjoyment, programming learning

Using Games to Raise Awareness. How to Co-Design Serious Mini-Games?

Klara Van Geit, Verolien Cauberghe, Liselot Hudders and Marijke De Veirman

Department of Communication Sciences, Ghent University, Ghent, Belgium

Abstract: This study explores the usability of informant design as a framework to involve multiple stakeholders in designing serious games. First, it evaluates serious mini-games as a tool for social marketing campaigns. The study suggests that serious mini-games can provide an efficient alternative to more complex serious games, since mini-games are short games focused on a single concept or learning goal. Similar to more complex serious games, serious mini-games motivate and enhance players' interest in a particular topic but require only a small time-investment from players. Research suggests that the use of mini-games is even more promising if a set of different games is used to study a topic from different angles (Frazer, Argles and Wills, 2007). Furthermore, if each mini-game incorporates different gameplay mechanics, the games will appeal to more players. Thus, serious mini-games are the perfect tool for creating awareness of different aspects of a social topic in a fast, interactive and engaging manner. However, the question arises how to develop a platform for serious mini-games. Organizations responsible for developing awareness campaigns focused on societal issues must deal with many different stakeholders. Thus, in the development of serious mini-games each stakeholder should be heard.

This study suggests the use of informant design as a framework for serious mini-games to increase the support of every stakeholder. Informant design provides an excellent design methodology for games since it offers great flexibility at whatever time and place co-design activities with each stakeholder occur. In the second part of the study, the phases of informant design and how they can be successfully applied in game design by creating our own set of serious mini-games to increase advertising literacy among adolescents are explored further.

Keywords: serious mini-games, co-design, learning game design, awareness, adolescents

Wait and see? Studying the Teacher's Role During In-Class Educational Gaming

Ellen Vanderhoven[1,2], Bart Willems[2], Stephanie Van Hove[1], Anissa All[1] and Tammy Schellens[2]
[1]iMinds-MICT - Ghent University, Ghent, Belgium
[2]Department of Educational Studies - Ghent University, Ghent, Belgium

Abstract: The increasing use of social network sites (SNSs) entails several privacy risks. Therefore, a multitude of educational interventions have been developed to raise risk awareness amongst teenagers and to change unsafe behavior. However, most of these interventions are developed from a formal educational perspective. We hypothesized that traditional courses to teach about risks on SNSs are less effective to increase awareness and to change unsafe behavior, as they are further away from real life SNSs, which are mostly used as entertainment during leisure time. Moreover, an important added value of teacher involvement during educational game play in class was hypothesized. A quasi-experimental study was set up in 11 secondary classes, involving 80 pupils divided over 4 conditions. In these conditions, 4 different interventions were compared, in which pupils: (1) played a serious game on a tablet computer without teacher involvement, (2) played a serious game on a tablet computer while the teacher summarized the learned content every five minutes, (3) received a traditional course on privacy risks and (4) received a course on a different topic (control condition). In a pretest-posttest survey, we measured risk awareness, pupils' attitudes towards risky behavior, and their behavior. Moreover, qualitative data from open questions in the survey established whether pupils were aware of the topic of the game and the course, and what they had actually

learned. The results revealed that all interventions caused an increase in awareness compared to the control conditions. Moreover, a better attitude towards safe behavior was found, but this increase was equal over conditions. No impact could be found on pupils' behavior. Finally, qualitative results showed that pupils in the condition with teacher involvement were more aware of the topic of the game than those who played the game without teacher involvement. This research clearly shows that more efforts should be put in the evaluation of educational games in a real-life classroom setting, not only to find out whether these games are effective, but also to find out how they should be implemented and what the role of the teacher should be.
Keywords: online safety, secondary education, teacher, privacy, game-based learning, evaluation

How to Evaluate Educational Games: Lessons Learned From the Evaluation Study of Master F.I.N.D.

Ellen Vanderhoven[1,2], Bart Willems[2], Stephanie Van Hove[1], Anissa All[1] and Tammy Schellens[2]
[1]iMinds-MICT - Ghent University, Ghent, Belgium
[2]Department of Educational Studies - Ghent University, Ghent, Belgium

Abstract: Increasingly more researchers are emphasizing the importance of evaluating educational games in real life classroom settings, as most of these are developed without any theoretical consideration and without any evaluation afterwards. This causes uncertainty about the effectiveness of these games. Based on the reflections we made during a quasi-experimental evaluation study of MasterF.I.N.D., an educational game that aims to raise awareness about risks on social network sites, we want to put forth a few pitfalls that need to be taken into account when evaluating educational games. While we support the decision to evaluate such games using quasi-experimental designs in authentic classroom settings, we point towards the risks of evaluating games that were not developed based on theoretical considerations and practical requirements. We argue that including academic research only after development, might result in wasted effort and useless results. We illustrate this argument based on the case of the evaluation study of Master F.I.N.D., which was developed by industry without much theoretical consideration. Because of this lack of academic input during the development phase, we stumbled upon several problems that guided our research decisions and thereby jeopardized the validity of the research results. Based on this research example, we put forth some guidelines to take into account when starting an evaluation study. Furthermore, we propose another ap-

proach known in educational sciences as design-based research. This research approach involves the final users (i.e., pupils and teachers) during the full design process, and iteratively evaluates the impact of the game, resulting in both an evidence-based effective game and theoretical guidelines to develop such a game. We claim that this approach is necessary to establish both useful academic results and guidelines for practice. **Keywords:** assessment, methodology, design-based research, theory, design, user involvement

Concealing Education Into Games

Nikolas Vidakis [1], Efthymios Syntychakis [1], Konstantinos Kalafatis [1], Petros Varhalamas [1] and Georgios Triantafyllidis [2]

[1]Technological Educational Institute of Crete, Dep. Informatics Engineering, Heraklion, Crete

[2]Aalborg University, Medialogy Section, AD:MT, Copenhagen, Denmark

Abstract: Although educational games become an upcoming trend, their effectiveness, reusability and entertainment factor remain a challenge. Merging entertainment with education is a major issue as the game must not get in the zone of homework or else it will lose its enjoyable nature. Consequently, the user/student must not engage consciously into the learning process but through an indirect captivating course which will contain the educational elements that are required for his/her learning experience. These elements consist of educational material that an instructor wants to furnish the students, as well as techniques which the instructor will use in order to teach the subject. More accurately, educational techniques are based on pedagogical patterns described by pedagogues, child psychologists etc. In light of the above, the present work distinguishes four main roles in the creation of an educational game (a) the educational expert (pedagogue, psychologist etc.) who will provide the educational theories and instructional patterns,(b) the game designer or more generally the game industry (consisting of game artists, scenarists, audio editors etc.) who will provide games that follow the mindset of the given educational theories/patterns and render a customizable game prototype while maintaining its ludic and exciting manner, (c) the instructor who, in most cases with no game development experience, will integrate the educational content and customize the game to suit the class profile and (d) the learner who will use the games to enhance his learning experience. In this paper, we present the challenges of creating ludic and serious educational games, by means of cooperation between different domains such as game designers and educational experts. Based on the state of the art for

educational game authoring tools we propose a collaborative authoring tool in which each role has a dedicated purpose and a suite of tools under a common information space.

Keywords: educational game, open authorable framework, ludic game design

Exploring Group Cohesion in Massively Multiplayer Online Games

Iro Voulgari[1] and Vasilis Komis[2]
[1]University of Athens, Athens, Greece, [2]University of Patras, Patras, Greece

Abstract: In this study we focused on the identification of factors involved in the cohesion of Massively Multiplayer Online Games (MMOGs) groups. We operationalised cohesion as the forces that keep the group together and the links between group and members. We explored the perceptions of players through a mixed methods research approach, combining qualitative data from interviews and quantitative data from a survey. Our main findings involve the identification of social and achievement oriented factors relevant to the cohesion of the group. Social factors were relevant to the social and interpersonal relations among members, and the identification with the ideology and interests of the other members. Achievement oriented factors involved the benefits of the group for the achievement of the players' own individual goals and progress in the game, the accomplishment of group tasks, the help and support from the group, the quality of collaboration, participation in decision-making processes, justice, and fair distribution of the rewards. We further compared group cohesion with the satisfaction of the players by their groups. Our findings suggest that group cohesion and satisfaction are strongly related. Group cohesion is particularly critical for the development of a common knowledge space and the emergence of effective collaborative learning processes. The implications of this study involve the design elements that could promote cohesion in virtual environments, or the indications to be monitored by educators or coordinators employing game-based learning, for further timely interventions, so that a learning and gaming experience can be supported and enhanced.

Keywords: massively multiplayer online games (MMOGs), group cohesion, collaborative learning, games, virtual teams

Multi-Devices Territoriality to Manage Collaborative Activities in a Learning Game

David Wayntal[1], Audrey Serna[1], Philippe Pernelle[2] and Jean-Charles Marty[1]
[1]LIRIS, University of Lyon 1, Villeurbanne, France
[2]DISP, University of Lyon 1, Villeurbanne, France

Abstract: Game Based Learning (GBL) has positive effect on learners' engagement. Students feel more concerned and invested when the learning scenario and gamified elements are motivating. Usually, GBL environments can improve individual activities, particularly by adapting them to the learners' current knowledge or can support collaborative learning in multi-player environments. In our research, we consider complex scenarios where both individual and collaborative learning are addressed. In order to support these scenarios, we take advantage of various devices, allowing new features. Personal devices (tablets, mobile phones) co-exist with shared devices (collaborative tabletops). New learning usages emerge in these multi-device environments where learners can swap from virtual to real activities. In this context, new problems appear when one wants to design new GBL activities. One major issue refers to the combination of personal and collective workspaces. This notion also known as "territoriality" has been addressed in the literature, particularly in Collaborative Tabletop Workspaces. However, we need to extend and reconsider this notion when designing multi-device activities. For instance, providing users with both private and shared devices raises confidentiality issues. In this work, we thus present three facets to consider for the design of GBL activities in this context. The first facet concerns the devices topology: the adjacency map, the notion of personal workspace on a collaborative device, and the representation of the area allowing information exchange between two devices. The second facet concerns the new actions to define: how to allow the users to provide others participants with information, to present partial information on objects to others, how to move an object from the collaborative workspace to personal workspaces and how to control shared workspaces through individual actions. The third facet concerns the contextual visualisation of the objects involved in the learning tasks. This contextual visualisation can for instance allow the privacy of several characteristics of an object. The object can be totally visible on the user's tablet, but may be hidden to the others in the collaborative workspace (e.g. one can see his/her game cards face-up on the tablet view while the same cards are face-down on the tabletop view). These three facets are then used to design the scenario of a collaborative game to learn French grammar. The scenario takes place in a newspaper office, where learners should edit short features

about their university news. This writing exercise is prepared individually and then a collaborative edition happens. In this activity, personal and collaborative workspaces are used with different devices supporting the activities. The proposed approach is therefore particularly adapted to the context.

Keywords: collaborative learning, personal workspace, collaborative workspace, tablet, tabletop, multi-device environment

Learning and Motivational Processes When Students Design Curriculum-Based Digital Learning Games

Charlotte Lærke Weitze[1,2]
[1]**ResearchLab: IT and Learning Design, Aalborg University, Denmark**
[2]**VUC Storstrøm, Denmark**

Abstract: This design-based research (DBR) project has developed an overall gamified learning design (big Game) to facilitate the learning process for adult students by inviting them to be their own learning designers through designing digital learning games (small games) in cross-disciplinary subject matters. The DBR project has investigated and experimented with which elements, methods, and processes are important when aiming at creating a cognitive complex (Anderson and Krathwohl, 2001) and motivating learning process within a reusable game-based learning design. This project took place in a co-design process with teachers and students. The learning approach was founded in problem-based learning (PBL) and constructionist pedagogical methodology, building on the thesis that there is a strong connection between designing and learning. The belief is that activities that involve making, building, or programming provide a rich context for learning, since the construction of artefacts, in this case learning games, enables reflection and new ways of thinking. The students learned from reflection and interaction with the tools alone as well as in collaboration with peers. After analysing the students' learning trajectories within this method of learning, this study describes seven areas of the iterative learning and game design process. The analysis also shows that the current learning design is constructed as a hierarchy supported through different roles as learning designers contained within one another. The study found that the students benefitted from this way of learning as a valid variation to more conventional teaching approaches, and teachers found that the students learned at least the same amount or more compared to traditional teaching processes. The students were able to think outside the box and experienced *hard fun* (Papert, 2002) - the phenomena that everyone likes challenging things to do, as long as they are the right things matched to the individu-

al. They were motivated by hands-on work and succeeded in developing four very different and meaningful learning games and game concepts, which contributed to achieving their learning goals.

Keywords: students as learning game designers, learning game design, game design models, constructionism, pbl, students as learning designers

Traces: A Pervasive app for Changing Behavioural Patterns

Thomas Wernbacher[1], Alexander Pfeiffer[1], Mario Platzer[2], Martin Berger[2], Daniela Krautsack[3]
[1]Danube University Krems, Austria
[2]Verkehrplus, Graz, Austria
[3]Cows in Jackets, Vienna, Austria

Abstract: The ability to travel long and short distances at any time enables a high degree of individual flexibility on the one hand, but it also results in a number of adverse effects, including massive impacts on traffic flow and a constantly growing lack of space. Increasing emission levels (CO_2, NO_2) and the associated fine dust pollution are to be considered serious barriers for meeting internationally agreed targets on environmental preservation; they will also negatively affect the health of city residents. As a result these factors will increase community and state expenditure (through accidents, parking tickets and so on) as a direct result of insufficient sustainable and future-oriented individual traffic behaviour. In course of the state funded project "Traces" we aim to tackle these challenges by promoting sustainable mobility in the urban area using a contextual gamification framework. During the past year behavioural theories have been combined with state-of-the-art ICT technologies in order to create an immersive playing experience. During the game players will be motivated to choose from a variety of inter- and multimodal mobility options. The gamification framework uses a pervasive gaming approach with location-based elements for changing behavioural patterns surrounding individual mobility choices. The main goal is to achieve a change in long established behavioural patterns, demonstrate feasible alternatives and establish an authentic gaming experience, creating an incentive to use inter- and multimodal mobility forms (persuasive design). Through the integration of modern ICT technologies target groups will be addressed in real life conditions. The bi-directional transfer between the virtual and real game world will be additionally enhanced by offline-campaigns in urban space (pervasive design). In order to achieve our objectives, the game concept as well as the mobile application demo will be developed within living laboratories (labs) in order to stay as close as possible to the end-users' needs. The basic game mechanics, functionality and usabil-

ity of the game framework are optimized following an iterative design process. Additionally, experts will be involved in dedicated workshops for enabling a professional integration of best-practice experiences. The project results are constantly evaluated and will lead to an action plan for promoting and enhancing inter- and multimodal mobility as well as an impact analysis of the behavioural and cognitive effects.

Keywords: gamification, pervasive games, behaviour change, sustainable mobility

System Design Requirements for Formal Education Based on COTS Entertainment Computer Games

Thomas Westin, Göran Lange, Mats Wiklund, Lena Norberg and Peter Mozelius
Stockholm University, Stockholm, Sweden

Abstract: Computer games can be designed as tools for school, but formal education can also be game-oriented based on dialogue enabling the use of commercial-off-the-shelf (COTS) entertainment games. The latter design was applied in two upper-secondary school trial educations, called the Digital Room. A problem is that teachers have to grade pupils based on assessment of the learning process through playing COTS games together with the pupils, while retaining compliance with the school regulations which can also change over time. The question is: what are the requirements for designing a system supporting teachers in bridging this gap? This paper describes and compares two trials of the Digital Room, enabling a long-term study between 2003-2013 with secondary school pupils and teachers. To answer the question in this paper, teachers from both trials were interviewed and situations were analysed based on a critical realist approach. Lack of time to manage and reflect on the documentation for assessment was a critical part of the results, and a teacher support system was explicitly asked for. Knowing what to document was crucial as games have many modes of expression, and understanding how to assess what has been documented was the hardest part. Conclusions are that a knowledge management system (KMS) could aid teachers in supporting each pupil to fulfil their goals and the requirements of the existing school system. Due to the expressed lack of time for management and assessment of documentation, the KMS should compile the data of each pupil's actions in the game as basis for grading. Further, this KMS could be used for further learning by combining explicated knowledge from the socialisation process. Pupils could also add explicit information to the KMS about findings on the Internet and from oral dialogue with peers and teachers. Thus, the KMS must enable multimodal expressions to be as accessible as possible, including pupils

with impairments. Information must be searchable and sortable which can be a challenge to achieve with other modes of expression than text. Further, the KMS design has to include both pupils and teachers in evaluations, and be easy to adapt when new regulations create new conditions. Future research includes implementing and evaluating the system in a similar game-oriented formal education context outside of traditional school.

Keywords: game-based learning, teaching with computer games, assessment, knowledge management, system design, COTS

Evaluating Educational Games Using Facial Expression Recognition Software: Measurement of Gaming Emotion

Mats Wiklund, William Rudenmalm, Lena Norberg, Thomas Westin and Peter Mozelius
Stockholm University, Stockholm, Sweden

Abstract: The issue of using educational games versus entertainment games as the base for learning environments is complex, and various data to base the decision on is needed. While participants' verbal accounts of their situation is important, also other modes of expression would be meaningful as data sources. The availability of valid and reliable methods for evaluating games is central to building ones that are successful, and should preferably include outside measurements that are less affected by the participants' choice of what to share. The present study considers a method using software for analysing facial expressions during gameplay, testing its ability to reveal inherent differences between educational and entertainment games. Participants (N=11) played two games, an entertainment game and an educational game, while facial expressions were measured continuously. The main finding was significantly higher degrees of expressions associated with negative emotions (anger [$p < 0.001$], fear [$p < 0.001$] and disgust [$p < 0.001$]) while playing the educational game, indicating that participants were more negative towards this game type. The combination of cognitive load inherent in learning and negative emotions found in the educational game may explain why educational games sometimes have been less successful. The results suggest that the method used in the present study might be useful as part of the evaluation of educational games.

Keywords: facial expressions, emotions, games, educational games, evaluation methods

The Role of Surprising Events in a Math-Game on Proportional Reasoning

Pieter Wouters[1], Herre van Oostendorp[1], Judith ter Vrugte[2], Ton de Jong[2], Sylke vanderCruysse[3] and Jan Elen[3]
[1]Utrecht University, Utrecht, The Netherlands
[2]University of Twente, Twente, The Netherlands
[3]KU Leuven, Leuven, Belgium

Abstract: Reviews regarding serious games show that the effect on learning can be qualified as moderately positive. Despite the active involvement of players it seems that they sometimes refrain from relevant cognitive processes during game play. This study addresses a technique involving the generation of manageable cognitive conflicts to stimulate these cognitive processes. Surprise comprises events that undermine an expectation which trigger players to evaluate the new situation more extensively. Participants (N = 94) played a game in which they practiced proportional reasoning skills. The pretest-posttest design involved two factors: *Surprise* (surprise vs. no surprise) and *Expectancy* (strong vs. weak). Surprise was implemented as an appearing game character that modified some parameters of a problem while the player was solving that problem. We expected that this would prompt players to evaluate their solution strategy and decide whether another strategy was more appropriate. Expectancy pertains to the type of problems that players expect. In the strong expectancy version players received a series of problems with the same structure as before. In the weak expectancy version problems with different structures are randomly presented to the players and each problem may involve a different solution strategy. We hypothesized an interaction between Surprise and Expectancy, next to a main effect of Surprise. The results show that participants learned from the game. We also did find a weak positive effect of Surprise, but no effect of Expectancy nor interaction effect on learning. The facilitating effect of Surprise was stronger when existing proportional reasoning skill was included as factor. These results indicate that surprise as implemented in the game has effect on learning regardless whether expectancy was weak or strong. We discuss some suggestions for finding stronger effects of surprise such as the fact that the repetitive nature may have weakened the 'surprisingness' of the surprises and the observation that our sample may not have possessed a sufficient level of metacognitive skills to interpret the changes caused by the surprises.

Keywords: serious games, mathematics, surprise, learning, motivation

PHD Research Papers

Pre-Test Session Impact on the Effectiveness Assessment of a Fire Safety Game

Anissa All[1], Barbara Plovie[2], Elena Patricia Nuñez Castellar[1,3] and Jan Van Looy[1]

[1]iMinds, MICT, Ghent University, Ghent, Belgium

[2]Hogeschool West-Vlaanderen

[3]Department of Data Analysis, Ghent University, Belgium

Abstract: In recent years, critiques have been formulated regarding current evaluation methods of DGBL (digital game-based learning) effectiveness, putting the validity of certain results in doubt. An important point of discussion in DGBL effectiveness studies is whether or not a pre-test should be administered, as it can lead to practice effects and pre-test sensitization, threatening internal validity of the results. The present study aims at testing if the administration of a pre-test has a direct influence on post-test scores and/or makes participants more receptive to the intervention. For this purpose, an effectiveness study of a fire safety training in a hospital was conducted using a Solomon four-group design. The experimental groups received a game-based intervention (n= 65) of which 34 participants received a pre-test and 31 did not. The control groups received traditional classroom instruction (n=68), of which 39 participants received a pre-test and 29 did not. A 2x2 ANOVA was used to explore the practice effect and the interaction between the pre-test and the intervention. An interaction effect between pre-test and intervention is detected. More specifically, this interaction takes place in the traditional classroom group, indicating pre-test sensitization. In the traditional classroom context, the pre-test makes the participants more sensitive to the content treated in the intervention while administration of a pre-test does not influence outcomes of the DGBL treatment. When the administration of a pre-test influences the control group's receptivity to the treatment, but not the experimental group, results of an effectiveness study may be biased. This is especially relevant in the DGBL field as often, non-significant differences between DGBL and more traditional methods are reported. Therefore, further research should take this into account and look for possible solutions to solve this discrepancy.

Keywords: DGBL, pre-test sensitization, practice effect, Solomon 4-group design, fire safety

Learning Between Rules and Narrative: Player's Meaning Negotiations Analyzed, Designed and Assessed

Sanna-Mari Äyrämö
University of Jyväskylä, Jyväskylä, Finland

Abstract: It has been recently noted that there is a special need for research on the particulars of learning and serious game design. The aim of this study is to examine how mutually different learning objectives, game narrative design, and game rules can be combined by various ways. There can be multiple roles for the player in narrative serious and learning games, including the roles of the game player, learner, narrator, or story character. Depending on design decisions of a game at issue, the player may be moving between different roles during the game playing and as an intentional actor s/he has to conduct multiple meaning negotiations between different types of game rules and narrative elements perceived during the game playing. The player's role and the abovementioned operations are discussed in this article as *co-storyliner's meaning negotiations*. It is assumed that, in narratively rich games, the design decisions governing the co-storyliner's meaning negotiations play a central role regarding what is finally to be learned through the game playing. The author proposes an analysis and design framework called *the Design Space for Instructional Game Narrative* (DSIGN), which helps researchers specify and hermeneutically analyze the design space between various types of game rules and semiotic-cognitive areas of narrative design. Thereby, the mechanisms by which various games create meanings can be understood more closely and compared to the explicitly stated learning objectives of the games. The utilization of the framework is demonstrated by presenting brief learning game analyses using a hermeneutic approach, which highlights player's interpretations, or *readings*, of game and narrative-related representations and situations. The presented analyses illustrate how the applied framework can aid to specify the potential-based design by which the player-learner's cognitive processes are aimed to be steered through the crossroads of game narrative and rules. For conclusions, it is discussed how the DSIGN model could be applied as a guiding tool for serious and learning game design and assessment.

Keywords: narrative, game rules, learning, serious game design

Word Towers: Assessing Domain Knowledge With Non-Traditional Genres

Tyler Baron and Ashish Amresh
Arizona State University, Mesa, USA

Abstract: This paper presents the design, development and the results of a pilot study for Word Towers (WT), an educational game that combines gameplay mechanics from board-style word building and arcade style tower defense games. To our knowledge, this is the first ever attempt to merge these game genres into a functional educational game. Our efforts open the possibility for other learning games to be reworked into new genres, increasing novelty and player engagement. Expanding the range of genres also allows for learning games to reach a wider audience. The goal of the WT is to provide a natural method for measuring domain expertise and knowledge by hiding the complexity within the level progression. In the prototype developed for showcasing our design, the domain is chosen to be the English language and the entire English dictionary is available to the player. While a design goal is to have WT eventually measure several different constructs of the English language, spelling was the only construct used for this pilot study. Each level is designed to not last longer than two minutes to promote reinforcement of the learned concepts by repetitive gameplay. Methods for integrating pedagogical principals with the game mechanics of the word games and tower defense genres are discussed. Results of a study on non-native English speaking students by measuring their performance via level progression and comparing these to native English speaking students are presented. Participants in the pilot study also provide feedback on their enjoyment of the game. These responses were mostly positive and showed initial promise that learning games can be moved successfully into new genres and still result in an enjoyable playing experience. Finally we measure learning gains in WT and prove that the gains are not compromised by the shifting of genres.

Keywords: language games, tower defense, game mechanics for assessment, word games, The LM-GM model

Designing a Serious Game to Enhance Orthographic Projection Learning in Higher Education

Ming-Hung Chu[1], Tay-Sheng Jeng[2], and Chien-Hsu Chen[3]
[1]Institute of Creative Industries design, National Cheng Kung University, Taiwan, ROC
[2]Department of Architecture, National Cheng Kung University, Taiwan, ROC
[3]Department of Industrial Design, National Cheng Kung University, Taiwan, ROC

Abstract: Nowadays, most university or college students are Digital Natives (Prensky, 2001). Their learning style and learning culture is quite different from their parents and teachers, who are Digital Immigrants (Prensky, 2001). Many previous research studies have shown that games are a powerful and effective tool (Michael & Chen, 2006) in many educational domains, such as military training (Lim & Jung, 2013; Yildirim, 2010), marketing (Devitt et al., 2015), management (Mayer 2006), healthcare (Ribaupierre et al., 2014; Lynch-Sauer et al., 2011), foreign language learning (Johnson, 2010; Ludwig et al., 2009), computer programming (Xu, 2009), computer graphics (Mustaro, 2009), job-specific skills, politics (Bogost, 2010), etc. However, there is no specific research discussing how to use serious games to improve orthographic projection learning in a higher education setting. Technical graphics are an essential and fundamental basis of a technologist or designer education. The core of technical graphics is orthographic projection. Technical graphics communication skill is a critical and significant asset for students majoring in engineering, production design, industrial design, interior design, architecture, etc. Therefore, the main objective of this research is to develop a serious game, called ITouYing, for helping university students from the Net generation (Tapscott, 1998) or the Games generation (Prensky, 2003) to master orthographic projection in novel fashion. The ITouYing game is composed of nine sub-units, including 1) Orthographic projection concept, 2) Orthographic projection knowledge quiz, 3) Plane type judge, 4) Stain in plane, 5) Front view selection, 6) Top view selection, 7) Right side view selection, 8) Three view match, and 9) Proper 3-D model selection. The effectiveness of the ITouYing game towards learning was examined by surveys in the department of mechanical engineering, aeronautics and astronautics at the National Cheng Kung University and the department of industrial education at National Changhua University of Education. The evaluation results indicated that most of the university students(54%) favor using the ITouYing game, because it can enhance orthographic projection learning effectiveness interactively (84.9%) and also promote visualization skill between a 3-D

model and it's multi-views (79.9%). Moreover, the participants perceive the stain in plane unit (unit 4) is the most satisfying unit (24.5%), and the proper 3-D model selection unit (unit 9) is the most helpful unit (22.3%) for learning orthographic projection. Furthermore, for more completeness, the IToYing game should broaden the scope of the survey by including participants from more different departments, and from more different universities. The valuable feedback collected from participants will be useful to refine the ITouYing game.

Keywords: serious game, higher education, orthographic projection, ITouYing, multi-view, 3-D model

Game Design for Transforming and Assessing Undergraduates' Understanding of Molecular Emergence (Pilot)

Andrea Gauthier and Jodie Jenkinson
Institute of Medical Sciences, University of Toronto, Toronto, Canada

Abstract. Undergraduate biology students lack an understanding of the emergent nature of molecular processes and systems and often think about molecular interactions in a teleological manner. A game has potential to transform students' misconceptions through immersion in an interactive environment and through challenges that encourage cycles of productive negativity. The purpose of this pilot study was to test the pedagogical effectiveness of the current game prototype, *MolWolds*, in facilitating conceptual change about molecular emergent systems and to document changes to be made to its design before further trials. Twenty-four first- (n=8), second- (n=9), and third- (n=7) year undergraduate biology students answered two short answer questions about vesicular formation before and after playing *MolWorlds* for 20 minutes. Answers were coded for emergent-themed statements on randomness, concentration, rate/probability, specificity, and crowdedness. It was found that second- and third-year players generated significantly more emergent statements (p=0.011; p=0.018) on the post-test, and first-years (novices to molecular biology) also generated more statements, though the result is only trending (p=0.111). This improvement may be due to engagement in cycles of productive negativity during gameplay: a significant proportion of players (20 out of 24; p=0.001) engaged in one or more cycles, though our small sample did not allow us to make comparisons between groups that did and did not experience this. Generated post-test statements were significantly correlated with gameplay efficiency ratios (p=0.039, r=0.424) and had a trending correlation with total game score (p=0.142, r=0.309), suggesting that gameplay performance might be used to predict conceptual

understanding. This study was limited by our small sample size, rendering us unable to perform more robust analyses, such as multivariate regression models. Overall feedback for the game was positive and provided us with several leads for further development and improvement of the game mechanics. Future research will explore how learning through *MolWorlds* differs from learning through a similar non-game control application, how patterns of interactions and demographic characteristics are related to these learning outcomes, and how long-term concept retention is affected by gameplay.

Keywords: molecular emergence, game-based learning, conceptual change, productive negativity

Novices Vs. Experts; Game-Based Learning and the Heterogeneous Classroom Audience

Björn Berg Marklund
University of Skövde, Skövde, Sweden

Abstract: This paper examines how the heterogeneity of K-12 students, as game audiences, affect the way games can be used as educational tools in formal education. When discussing the application of games in educational contexts, the realities of the formal educational environment are seldom brought to the fore. There has been a lot of discourse and studies surrounding the theoretical viability of games as engaging educational tools and their properties as learning environments, but the practicalities of inserting games into classroom environments are comparatively rarely the subject of game-based learning research. This paper presents two five month long studies using participatory observation that details the process of putting a commercial off-the-shelf game to use in two different types of formal educational K-12 environments: a computer lab and a classroom. More specifically, this paper focuses on examining how students receive and work with a well-known commercial off-the-shelf game when it is introduced as a tool in their ordinary curriculum work. The study revealed several challenges that put many of the axiomatic assumptions practitioners and scholars frequently make regarding games' virtues as educational tools into question. The challenges relate to students' perceptions of games and gaming, variations in students' efficacy while playing, and of exclusionary behaviour during collaborations. Commercial of-the-shelf games, while they might be more equipped than educational titles when it comes to living up to player expectations as far as production values are concerned, can instil a certain set of faulty expectations of how the game will actually be used. If the used game is widely recognisable by the classroom audience, the important distinction between gameplay intended for active directed

learning rather than unguided leisure activity can be difficult to establish, which can make it difficult for teachers to keep students in a reflexive and analytic mode of play. The classroom as a game audience also puts the educator in a tricky position due to the wide variation of preferences and gaming literacy among students, and creating engaging play-sessions that are inclusive to everyone in classroom environments can be an immense undertaking for teachers. While the study reveals several issues produced by the tension between games and the heterogeneous nature of the classroom as an audience, it also highlights the importance of managing students' expectations, framing the play activity correctly, and fostering collaborative work where subject matter knowledge and gaming literacy are intertwined.

Keywords: classroom gaming, alpha gaming, audience heterogeneity, gaming literacy

Gamification for Data Gathering in Emergency Response Exercises

Kenny Meesters[1], Aaron Ruhe[2] and Marvin Soetanto[2]
[1]Tilburg University, The Netherlands
[2]University of Amsterdam, The Netherlands

Abstract: Our paper describes how gamification can be implemented in an emergency response exercise. In particular, we focus on the potential of gamification to support self-evaluation processes through the automated gathering of data about the participants' performance. Disaster-exercises are typically constructed around a scenario posing more or less known challenges to the participants, with the performance often determined only by observation. While these observations certainly have a value in their own right, since participants are deeply engaged and immersed in such exercises (e.g. detailed descriptions of events, immediate interpretation of data, and placing results in context) they also have their limitations. Especially in regards to learning in emergency response exercises we encounter limitations due to the observer's cognitive limitations and the (limited) type of data that is being gathered. While external observations may be sufficient for evaluation the execution of tasks according to pre-determined standards, less well defined and complex processes, such as decision making processes, are more difficult to evaluate. Such processes are for example influenced by cognitive biases, group dynamics and even political motives. Finally, on a more practical level, the dependence on external observers adds an additional requirement to already resource-intense disaster exercises, especially considering the required expertise. We aim to demonstrate the potential of gamification in disaster exercises to support the structured collection of data regarding the performance of the participants. This data would support self-evaluation, in

turn reducing the dependence on external observers and provide additional insights. First we derive different constructs from the various learning objectives associated with complex tasks such as group decision making, coordination and building situational awareness. Next we translate these constructs in quantifiable measurements enabling data collection. Finally, we implement these measurements in gamification elements in a disaster exercise game. The resulting data is presented to the participants enabling them to reflect on their own performance as a team reducing the dependence on external observers. This concept has been explored, developed and studied in an experimental setting. Ten volunteers were involved in the study, participating in a simulated emergency response exercise at the University of Amsterdam. In this test the focus of the exercise and the implemented gamifications elements were the decision making process, information management and coordination efforts. For validation purposes, the participants were divided over three different groups each given the same tasks and challenges. Additional several experts in disaster exercises and decision making were present to compare the outcome of the groups' self-evaluations with their notes as 'traditional' observers. Our results indicate that gamification can be a strong tool to gather quantitative data concerning the learning goals of the exercise that in turn helps participants to evaluate their own performance for complex tasks during disaster responses. Participants were to a large extend able to indicate the same lessons as the observers. Demonstrating that the collected data supported the participants to reflect on their performance and identify improvements themselves. Moreover, participants also indicated additional lessons learned which were not noted by the observers.

Keywords: gamification, quantitative measurement, data gathering, decision making, disaster exercises

BrainPlay: Serious Game, Serious Learning?

Gillian Morrison
Swinburne University of Technology, Melbourne, Australia

Abstract: Games are increasingly being used in educational contexts. The view of some game educationists is that games are able to effectively fulfil the requirements of a constructivist learning pedagogy. It is suggested, for example, that games are useful at representing complexity and often possess mechanisms that make learning more effective through mimicking behaviours required for study. This includes such elements as a call to focus, increasing levels of difficulty of skill, repetition and the need for players to regularly remember elements such as rules or previous moves. But while there has been much recent progress in this area, one aspect of learning

that has not been adequately incorporated into game pedagogy is metacognition or the ability to reflect on one's own thinking process. Thus, whilst many games are effective at teaching specific subjects, facts or skill, and some games support metacognitive processes, no games to date appear to focus on the ability for students to understand the inter-relationship of neuroscience and the behavioural techniques of how humans learn. This paper will outline my research plan to support the creation of a game to teach this inter-relationship. In this paper I will report on the theoretical background to game-based learning, considerations of how to conduct the game design and outline a methodological approach to test the capacity of the game. BrainPlay is a PhD by artefact and dissertation. The artefact is the Board Game designed to teach primary school students from 10 – 12 years old current neuroscientific models and practices of learning or how the human brain acquires, retains and processes facts and knowledge (explicit memory) effectively. The dissertation examines the results from testing the artefact on 3 populations of students to determine whether by playing the game within a class-room setting over a 10 week period the students alter the way they behave in class-room study as observed by their teachers or if they increase their academic scores over time.

Keywords: game-based learning, neuroscience, how to learn, primary school

Training Emotionally Intelligent Leaders: The Case of Massively Multiplayer Online Games

Sofia Mysirlaki and Fotini Paraskeva
University of Piraeus, Greece

Abstract: Over the last decades, digital games have evolved to complex, social environments like Massively Multiplayer Online Games (MMOGs) which are a practice arena for 21st century skills, such as leadership. This paper outlines the conceptual framework behind a doctoral project currently in progress, which examines emotional intelligence (EI) as a leadership skill that can be developed in MMOGs. The main statement of this PhD is that the skills learned in the game settings can help people to become more emotionally intelligent in real life and workplace. The hypotheses of this study that leaders in MMOGs with high emotional intelligence can become transformational leaders, inspiring team members and enhancing team cohesion which can lead to team effectiveness. In order to address this issue, a preliminary study using qualitative and quantitative data from interviews and a survey, will examine the elements of perceived emotional intelligence, transformational leadership, team cohesion and team viability acquired by MMOGs players and their perceived transfer of these skills in their workplace settings. The conceptual framework of this study is

based on the Input-Process-Output (IPO) team effectiveness model, which is used widely in organizational researches. Moreover, players' perceptions of the game elements that foster emotional intelligence will also be identified during the preliminary study. These findings will contribute to the final stage of this project, including the design principles for the development of an emotional intelligence training course with real, on-the-job content to teach leadership using essential gamification elements.

Keywords: MMOGs, emotional intelligence, leadership, team cohesion, team effectiveness, team viability

An Investigation of Digital Games Features That Appeal to Young Females and Males

Joseph Osunde, Gill Windall, Liz Bacon and Lachlan Mackinnon
University of Greenwich, London, UK

Abstract: This research is part of an attempt to address the well-known problem of female underrepresentation in computer science education and industry. This problem starts between ages 11 to 14 and gets progressively worse in what is often referred to as the "shrinking pipeline effect". There has been considerable research into the causes of the shrinking pipeline and attempts to halt or reverse it. In spite of this, the causes remain unclear and there is evidence that the problem may be worsening. Digital games are increasingly used in education because of their ability to engage and motivate young learners. Unfortunately, digital games used in the teaching of IT and computer science have been found to appeal less to females than males. This is in spite of the fact that digital games intended for entertainment, as opposed to education, are now very popular with girls. There has been some research into this issue, however more is needed, especially into what game features do and do not appeal to girls at the age that the pipeline starts to shrink. The study reported here aims to identify what characteristics of digital entertainment games appeal to young females and males. The results can be used to guide educators, researchers and game developers and provide criteria for evaluating the suitability of digital educational games for use with specific age groups and genders. We used open card sort with participants aged 11 to 14 to explore their attitude to a range of digital entertainment games. Open card sort allows participants to categorise items in ways that are meaningful to them. There were 32 participants (24 females and 8 males) from four schools in south-east England. They were shown video clips of ten popular games. The participants were then given ten cards, each representing one of

the games and asked to sort them into categories based on shared characteristics. This process elicited 131 features (95 from the females and 36 from the males). The data was analysed to identify the features that were a) most significant and b) most appealing to the participants. The findings indicate that there are some gender differences in which game features are perceived as most significant. Some features, such as game action, are significant to the males whereas others, such as game levels, are significant to the females. Interestingly, some features that both genders find significant have different degrees of appeal for example "fun" and "violence". We are currently using the findings in an experiment with 480 young people. Two digital educational games have been created: one includes features found to appeal to young females and the other includes the opposite or neutral features. The results of this experiment will be used to validate the findings of the initial investigation and form the basis for a framework to facilitate the inclusion of characteristics that appeal to specific groups in educational games and other software.

Keywords: computing education; card sort; gaming features; game appeal; gender differences

Computer Games for Promoting Global Awareness: Methods and Modes

Kristine Oygardslia

Department of Education, Norwegian University of Science and Technology, Trondheim, Norway

Abstract: Computer games have come a long way not only as a form of entertainment, but also as a means for changing the world for the better. An increasing number of researchers, educators and even politicians now emphasize the value of using computer games with a purpose beyond entertainment, such as education, health and social change. This article is a study into one segment of these serious games: Social impact games. The aim is to answer the following questions: What methods do these computer games use to promote global awareness to their players? And how might the chosen modes, such as images, video, narrative and procedures, contribute to the games reaching their goal? In this study, seven computer games with a goal of promoting global awareness were analyzed. The method for analysis was inspired by Consalvo and Dutton's (2006) framework for analyzing computer games qualitatively, having a theoretical and methodological foundation within game studies, and inspired by multimodal analysis. Selected findings are presented in this article, centered on the following principles which emerged from the analysis: 1) Learning on the player's terms, 2) Meaningful choices, 3) Using real-world images and vid-

eo, 4) Social mechanics. Based on this, the paper will then argue that research on computer games for global awareness should not necessarily pay attention mainly to game mechanics, as some of the main methods these games use are based on images, video and more linear narrative. Lastly, the paper briefly discusses the importance of leading players from awareness to action, as a facilitator for social change. The findings in this article aim at being helpful not only to researchers within the domain of social impact games, but also to serve as a resource for designers and developers of games with the aim of creating awareness and changes in the society.

Keywords: social impact games, serious games, global awareness, empathy, multimodality, game analysis

From Strategy (Play) to Knowledge (Learning): A Case Study

Taima Pérez
École Normale Supérieure de Lyon, France

Abstract: Games are considered relevant tools for implementing learner-centred approaches and teaching complex issues, particularly when the knowledge that enables play is also the knowledge targeting for learning (Sanchez, 2014). As a case study, we analyse the game *Mets-toi à Table!* (MTAT) This game addresses nutrition education for high-school students (Monod-Ansaldi *et al*. 2013). The most recent version of the game (adapted for touch-screen tablets) consists of a contest between two teams of players who attempt to conceal and unmask characters according to their dietary choices. The analysis of the game, carried out in the context of a 2nd year PhD thesis in Educational Science, allows us to identify indicators corresponding to the *strategy-building* phase of an appropriation model based on three stages (exploration, strategy-building and mastering) The model analyses student appropriation of the educational game MTAT, using criteria from a theoretical model in which appropriation is viewed as the student's response to the teacher handing them the responsibility of solving a problem (Pérez, 2014). This research is based on the theory of didactic situations (Brousseau, 1998) and game theory (Neumann and Morgenstern, 1944). It aims to identify the strategies enabled by MTAT from a game modelling perspective. It also aims to identify indicators of *strategy-building* by students. These indicators are required to analyse game appropriation in the classroom. As a result, the research identifies winning strategies involved in the MTAT game and, using an *a priori analysis* confirms whether or not they offer access to the *targeted knowledge*. **Keywords:** didactic situation, strategy, intrinsic game, a priori analysis, nutritional education game

Towards Social Network Support for an Applied Gaming Ecosystem

Munir Salman[1], Dominic Heutelbeck[2] and Matthias Hemmje[1]
[1]Distance University in Hagen, Germany
[2]Forschungsinstitut für Telekommunikation und Kooperation e.V. (FTK), Dortmund, Germany

Abstract: The EU-based industry for non-leisure games (applied games) is an emerging business. As such it is still fragmented and needs to achieve critical mass to compete globally. Nevertheless its growth potential is widely recognized and even suggested to exceed the growth potential of the leisure games market. The European project Realizing an Applied Gaming Ecosystem (RAGE) is aiming at supporting this challenge. RAGE will help to seize these opportunities by making available an interoperable set of advanced technology assets, tuned to applied gaming, as well as proven practices of using asset-based applied games in various real-world contexts, and finally a centralized access to a wide range of applied gaming software modules, services and related document, media, and educational resources within an online community portal called the RAGE Ecosystem. Besides this, an integration between the RAGE Ecosystem and relevant social network interaction spaces that arranges and facilitates collaboration that underlie research and development (R&D) as well as market-oriented innovation and exploitation will be created in order to support community building as well as collaborative asset exploitation of the contents of the Ecosystem. In this paper we will outline a conceptual approach exploring methods to first of all integrate content management and community collaboration support portal technologies based on Digital Library (DL), Media Archive (MA), and Learning Management System (LMS) infrastructures with social network support technologies. This will allow for a seamless integration of social network advantages within community portal operation. On the other hand it will support information, content, and knowledge sharing, as well as persistency of social interaction threads within Social Networking Sites (SNSs) that are connected to the RAGE Ecosystem. The paper reviews possible alternative architectural integration concepts as well as related authentication, access, and information integration challenges. In this way on the one hand a qualitative evaluation regarding an optimal technical integration approach is facilitated while on the other hand design approaches towards support features of resulting user interfaces are initiated. **Keywords**: applied games, social network environments, digital ecosystem, data sharing, access and information integration, integration architectures

Learning Object-Oriented Programming With Computer Games: A Game-Based Learning Approach

Yoke Seng Wong[1], Maizatul Hayati binti Mohammad Yatim[2] and Wee Hoe Tan[3]

[1]School of Computing and Creative Media, KDU University College, Petaling Jaya, Malaysia

[2,3]Falcuty of Art, Computing & Creative Industry, Sultan Idris Education University, Tanjong Malim, Perak, Malaysia

Abstract: Using traditional ways to learn object-oriented programming in tertiary education is insufficient due to the new teaching and learning pedagogy. The major purpose of this study is to propose a game-based learning conceptual framework which is suitable for creating games for learning object-oriented programming in the tertiary level. This study presents the outcome from an extensive field study at university level, where computer science degree students learn object-oriented programming with computer games that emphasize game level design, gameplay, and player experience. The proposed game in this study only focuses on the player experience where the player is able to learn object-oriented programming while playing the game without using any coding exercises. Games made for coding practice can be very tedious, making it difficult to motivate students and providing a negative perception for learning programming. In this paper, it describes a game-based learning approach framework which focuses on gameplay and player experience to achieve the learning purpose and retain student motivations.

Keywords: game-based learning, object oriented programming, learning and motivation, gameplay, player experience

Non Academic Papers

Gamification in Higher Education: How we Changed Roles

Natasha Boskic and, Sharon Hu
The University of British Columbia, Vancouver, Canada

Abstract: Squire claims that a good game encourages good learning that "enables us to become knowledge producers [which] gives us robust ideas to think with, and propels us toward participation in social practices" (2013). Inspired and intrigued by the possibilities of using game environments as learning spaces, which can lead to social changes (McGonigal, 2011), the instructional designers at the University of British Columbia ventured into the "unknown" and transformed a "traditional" online course on adult education into a role-playing game. This paper explores the notion of gamification in a higher education setting, what it means in terms of instructors' teaching practice, and how it changes student experience. The paper describes how game elements were incorporated into a course. The goals were to 1) engage students by creating a responsive feedback system, and 2) empower students by allowing them to customize the game experience based on their learning style and interest in the topics. The game space designed for the students enabled them to explore and try different things, and also realize that their work mattered. The paper focuses on the process and challenges of "gamifying" academic content and outlines the elements that make the game successful and sustainable. The designers purposefully avoided creating a virtual world or environment similar to an MMORPG, or investing a significant amount of funding and time into creating a space where only experienced gamers would feel comfortable. The new gamified version of the course needed to be low-tech, but enable high-social learning. The goal was to increase student engagement in the course, especially their interaction with one another, without technology getting in the way of their learning. The course was therefore taken out of the structured and formal LMS and transferred into the more flexible and social WordPress environment. The students took on two roles: 1) the role of reporters who were required to write about adult education issues and respond to different tasks set out by their Editor in Chief, and 2) the role of readers who responded to the written articles. Together, they were contributing and building the newspaper "Adult Educator Weekly". The design of the course enabled students to receive timely feedback from their peers, which made the students feel their writing was relevant and purposeful. Based on the students' feedback, the gamification of the course contributed to their increased interest in the topics, engagement with the course, and understanding of the issues from different perspectives.

Keywords: gamification, higher education, role-playing, engagement, empowering

Learning From Mistakes: A Quiz to Drill Climate Experts

Benedict O'Donnell and Pierre Jouy
Heliocentric Solutions, Berlin, Germany

Abstract: In the context of the Prometeruse project, we are developing a serious game to complement the courses on environmental sustainability that we are delivering in secondary schools across Europe. The project invites academics into classrooms to introduce 14-17 year-old students to the climate sciences and the energy sector. Because the duration of these lectures is limited to a few hours a year, we are coding a web-based Prometeruse Quiz to allow students to gain familiarity with the complexities of these ongoing areas of research in their own time. The game is designed to break scientific facts down into bite-sized trivia questions so that students can learn to juggle the figures and vocabulary of the field in a playful environment. Questions are phrased informally to help students draw relations between their personal experience and the geo-economic data that they are assimilating. However, all answers returned by the quiz include quantitative and technical specifications to sensitise students to the importance of substantiating arguments in factual debates. The game also offers references to primary source material to encourage players to research topics further at leisure. Gamification is enhanced by the opportunity to team up with classmates and compete with peers in schools abroad that are also participating in the project. The quiz cannot substitute for conventional, classroom education. Rather, it takes on the less creative aspects of teaching in order to better prepare students for their classes. The teacher directs students towards information and explains its value. At present, environmental studies sit awkwardly with conventional forms of education given their cross-disciplinary nature and the high degree of complexity at their entry level. However climate change is a topic that resonates with both students and teachers. Exploited well, it could offer a bridge between serious games and more traditional schooling mechanisms, and set a precedent for hybrid forms of education.

Keywords: climate change, environmental sustainability, STEM, serious game, quiz learning

Are Game Mechanics Mappable to Learning Taxonomies?

Andy Sandham
NHTV Breda University of Applied Science, North Brabant, Netherlands

Abstract: Can the game mechanics which promote learning be catalogued? To address this question, a framework is designed to investigate both the learning aspect whilst integrating the ludic dimension. In an effort to validate the hypotheses, Bloom's revised taxonomy provides the learning criteria, whilst the game mechanics are provided through the filter of commercial games and gamification systems. Finally, for the purposes of testing, a playable prototype game example is designed and created specifically for the task, containing specific measurable learning objectives, and tested with students, aiming at recording how they perceive the connection between the game mechanics of the prototype and the provided learning elements.

Keywords: game design, game mechanics, learning, learning taxonomies, blooms taxonomy, education, edutainment, serious games, serious gaming, gamification, playful interaction, e-learning, games for health

---

Gamification and Lifestyle Technologies for Personal Health Management

David Wortley
GAETSS – Gamification and Enabling Technologies Strategic Solutions, Alderton, UK

Abstract: This paper presents a practical case study on the use of Gamification strategies and wearable lifestyle technologies for personal health management. It describes the results of a two year project in which the author explores the potential of various lifestyle tracking and health monitoring equipment and the impact that had on his health parameters and well-being. The paper will describe the lessons learned from project and the techniques used to effect simple but long-lasting changes in exercise and eating patterns that significantly improve personal health management. The data captured and visualized by the mobile applications linked to these lifestyle technologies illustrates how gamification and enabling technologies have evolved in support of pervasive personal health management. The paper will also suggest how these technologies and practices are likely to evolve over the next few years and the

potential benefits for society in tackling global lifestyle related conditions such as obesity and diabetes.

Keywords: gamification, health, lifestyle technologies

Work In Progress Papers

Towards in Situ Measurement of Affective Variables During Playing Educational LARPs: A Pilot Study

Cyril Brom[1], Viktor Dobrovolný[2] and Edita Bromová[1,3]
[1]Faculty of Mathematics and Physics, Charles University in Prague, Czech Republic
[2]Faculty of Arts, Charles University in Prague, Czech Republic
[3]Film and TV School, Academy of Performing Arts in Prague, Czech Republic

Abstract: Live action role playing games can be used for educational purposes (edu-LARPs), but information about their learning effectiveness is limited. To our knowledge, even quantitative instruments for in situ measuring (i.e. during playing the game) of affective constructs, for instance flow or generalized positive and negative affect in edu-LARPs, are lacking. Existing instruments cannot be applied straightforwardly due to several reasons; most notably, because they are not gamified. Administering a non-gamified inventory in the game can influence/interrupt the states it is supposed to measure. The research aim of our new project is to investigate acquisition of mental models of mechanical devices learnt within an edu-LARP and correlate the quality of the acquired mental model with in situ flow and generalized positive/negative affect (planned N ~ 10 groups x 10 participants). So far, we have conducted three pilots (N = 10, 12, 13) for which we developed a new method for assessing these constructs by in-game questionnaires (and tested the LARP's plot, a sci-fi space opera). The results so far are promising in that we are able to administer the respective questionnaires in situ without adverse effects of the measurement process on these states; as reported by participants in post hoc focus groups. Our method can be probably used in other edu-LARPs provided certain requirements on the LARP's plot are met. Another result is that some components of flow (such as fluency/sense of control) seem to be influenced by role playing but others (such as absorption or time alteration) not so. This indicates that the notion of flow as a unitary construct may not be applicable in LARP contexts.

Keywords: educational life action role playing, edu-LARP, mental model, flow; positive affect, learning

Increasing Student Engagement With Gamification

Tracey Cassells, Daire O Broin and Ken Power
Institute of Technology Carlow, Carlow, Ireland

Abstract: Educators are currently facing the problem of students not fully engaging with the curriculum in educational institutions. Gamification is the application of game elements to real life tasks, which can help change behaviour, improve motivation and enhance engagement. By gamifying the students' learning experience we can improve student engagement, increase their motivation to learn and help further their involvement in their own education. For this reason we are setting out to answer two questions: How much does gamification influence student engagement? , Which game elements are most effective? This paper will look at the use of a specially constructed online learning platform to monitor the engagement of a third level computing course through the students' interaction with the platform. By adding different game elements to various versions of the learning platform, we aim to gauge the success of each element and measure the effect of game elements on student engagement. The platform as a whole will provide students with the ability to set their own learning outcomes and view the progression of their goals. By incorporating game elements into the platform we can give users more frequent and enticing feedback to achieve flow, and use progression loops to help students with onboarding and mastering. By increasing the students' engagement using these game elements, it is hoped that they will feel a greater intrinsic and extrinsic motivation and in turn will spend more time learning. The students' engagement will be measured through their interaction with the platform and feedback from the students' on the felt motivational effect of different game elements. By analysing the data gained from this project, we hope to determine to what effect and degree different game elements engage students.

Keywords: gamification, engagement, motivation, game based learning

Board Games to Learn Complex Scientific Concepts and the "Photonics Games" Competition

Fabio Chiarello
IFN-CNR (Institute for Photonics and Nanotechnologies of the Italian National Research Council), Rome, Italy

Abstract: Board games can be useful supports for the exposition and explanation of complex scientific concepts. In the past years we realized and tested three different

board games of this kind, presented on the occasion of three different editions of the "Festival della Scienza di Genova" (and of other minor events) in the form of giant live-version board games: "Quantum Race", for the introduction of Quantum Mechanical principles such as wave functions, delocalization, collapse and tunnel effect (2011), "Lab on a chip", for an introduction to the immune system and to Nan biotechnologies (2012), "Time Race", for the introduction to Special Relativity and to the concept of time dilation (2014). Each game has been played by about 1000 participants, mainly students, with excellent results concerning growth of interest and comprehension on the themes. In the ambit of the European Project Photonics4All and of the UNESCO International Year of Light 2015 we are now trying a step forward with a competition for high school Italian students concerning the creation of didactic board games on the themes of light and photonics to be held in the 2015-2016 autumn-winter period. We present in detail these activities with obtained and expected results and issues.

Keywords: board games, science dissemination, quantum mechanics, relativity

Film Education for Primary-School Pupils: Gamification and Interactive Storytelling as an Educational Approach to Raise Awareness of Design Structures in Feature Films

Regina Friess, Anke Blessing, Johannes Winter and Meike Zöckler
University of Furtwangen, Furtwangen, Germany

Abstract: Theoretical Considerations: As the pervasiveness of media usage in the everyday lives of primary school pupils is constantly increasing, supporting the development of media literacy within pupils should be considered as an important educational goal. However, in the real world, the strategy in primary schools seems to be to lock out media usage altogether in order to avoid trouble. The educational techniques behind media literacy, especially in respect to feature films, are very often reduced to providing an interpretational understanding of the story or knowledge about the production process. We argue that even for younger pupils, the reflection of design components and aesthetical structures is also relevant. In a more and more media driven society, processes of identity formation are increasingly attached to individual´s media consumption and his or her social embedding. As Mikos (2000) points out, this process creates the phenomenon that the social relationships of younger generations depend to a high degree on aesthetic criteria. Therefore, aesthetic competence is an important requirement for one's ability to reflect on individual lifestyles. Gamification and Interactive Storytelling as a Pedagogical Concept: s

aesthetic reflection is a highly subjective matter, the pedagogical methodology has to focus on creating individual experiences. In order to foster the perception of formal structures and raise awareness of different design qualities, we consider a pragmatic approach for the general structure, which encourages experimental exploration and creative activities (Joas 1988, Kerres/Witt 2002). Additionally, we pursue a gamification concept in the sense of meaningful gamification, as described by Nicholson. He focuses on an understanding of gamification which enables playful participation and is based on the freedom of exploration. This creates the possibility of making meaningful decisions enabled by an informational context, which engages people through social interactions. It is assumed that a playful activity involving film design components as variable structures can enhance an aesthetic and therefore more abstract perception of the presented film plots (see Sutton-Smith 1972, Ohler 1994, Friess 2011). Conceptual Approach for an Interactive Media Environment: The core concept behind the educational application is built upon an interactive storytelling tool, which allows the creation of different variations of the same story. In order to set up a situational context that confronts the pupils with a design problem, we introduce a narrative framework with two children arguing about the way they can design a short film. The narrative context is used to give the pupils the necessary information on design possibilities, allowing them to make decisions in the later experimental part. The application should be embedded in a blended learning situation. This means that a teacher introduces the informational portion, and more importantly, that the pupils can show and discuss their final versions of the short film within the class community. The project is realised at Furtwangen University and supported by the Institute for Media and Communication of Baden-Württemberg. The prototype will be evaluated with primary-school pupils in summer 2015.

Keywords: gamification, interactive storytelling, pragmatic didactics, aesthetic education, film design

A Teacher Survey to Identify Solutions That Facilitate GBL Design for Engagement

Azita Iliya Abdul Jabbar and Patrick Felicia
Waterford Institute of Technology, Waterford, Ireland

Abstract: Game-based learning (GBL) remains important for engagement and learning. It is about much more than simply learning with games. GBL involves several steps, approaches, elements and features in gaming that lead to and enhance engagement and leaning. The accelerating pace of gaming and digital technology, along with increasing pressure on teachers to improve pupils' performance and achieve-

ment, means there is a need to search for innovative approaches to GBL that will engage pupils with learning. By "engagement" we mean the capacity to create and sustain a momentum of continuous learning so that pupils become self-directed learners. However, only a few surveys explore the connections between approaches, strategies, resources, teaching and learning in the context of designing and using GBL to increase engagement. These connections may be understood as "learning experiences" and "conditions" in classroom learning environments. Therefore, the attempt to harness and maximise teaching and learning approaches, strategies and resources is at the centre of GBL research and initiatives. Thus, we designed and administered a teacher questionnaire as part of design-based research (DBR). The purpose of the questionnaire was to gain insight into teachers' instructional practices, give teachers the opportunity to share their teaching experiences, and keep a broad and open understanding of teachers' experiences, including their positive and negative feelings and thoughts. The findings presented in this paper evaluate increasingly varied materials, resources and solutions for enhancing learning within primary and post-primary schools. This survey also aimed to gauge teachers' enthusiasm for using a game-based approach to designing classroom activities and for extended learning, towards our effort to introduce and enhance GBL approaches. The survey results may improve our understanding of teachers' concerns, requirements and GBL suitability in relation to introducing and using games as a teaching and learning method in the classroom and for independent and extended learning.

Keywords: engagement, school, learning, design, performance support

Applying Memory Theory in Game Design (Case Study)

Trude Løvskar[1], Jon Hoem[1] and Jordi Linares-Pellicer[2]
[1]Bergen University College, Norway
[2]Instituto Tecnológico de Informática. Universitat Politècnica de València, Spain

Abstract: This article reflects upon the design process of the game Tella, an application for tablet computers, designed for children with special needs in the lowest grades at school. The game facilitates learning of mathematics through playing and exploring. The tablet allows the visual and interaction design to work together with sound and movement, in ways that differs from traditional learning material and classroom practices, supplementing both these arenas of learning. Several different pedagogical principles are applied in the game. This article will focus on the concept of *implicit memory / priming*: Elements (e.g. the number line) are introduced visually

at an early stage, but not put into practical use until later in the game. Priming is a concept from the field of memory research, not a pedagogical principle or a learning theory as such, but in connection with designing games this concept is applicable and very helpful. Further on this article reflects upon the balance between game logic and learning logic, when designing serious games. There are contradictions that need to be negotiated if an application should serve as an e-learning resource as well as an enjoyable game. The article suggests a way of developing educational games. The design of the game started by having experienced teachers sit down and work with designers and game programmers. The result incorporate theories and principles of learning, memory, game design and instructional design.

Keywords: serious games, learning, priming, design

MMORPGs in the Educational Process: Using a CSCL Script to Assess Learning

Anthony Melissourgos, Fotini Paraskeva and Sofia Mysirlaki

University of Piraeus, Piraeus, Greece

Abstract: Since the research in video gaming has given the first long-term results, new research fields emerged to exploit video games in the educational process. With a considerable fan crowd and the game industry spending more and more every year in Massive Multiplayer Online Role Playing Games (MMORPGs) development, the exploitation of MMORPGs in the educational process became a promising prospect. This study is an attempt to bridge MMOPRGs and the educational process, taking into account social, emotional and cognitional aspects. Based on a composite educational model combining collaborative learning, role-playing and problem solving, a Computer-Supported Collaborative Learning (CSCL) script was designed, converting an educational curriculum from the 6th grade of elementary school, into a Problem Based Learning (PBL) scenario embedded in a quest in a MMORPG called "Neverwinter". In order to embed the scenario in the game, the activities were designed and implemented in a customized and secure environment created in Neverwinter for the needs of the study. Using the quest creating system that the game provides, three independent quests were created, one for every cognitive field, for the students to complete in groups of four members. During the educational scenario, a role was assigned to each student based on the multiple intelligence theory and the person's dynamic. The main goal of the scenario was for the students to acquire psychomotor, social and meta-cognitive skills, and enhance knowledge and emotional attachment to the cognitive fields of history, physics and social & civic studies. For the purposes of the scenario, the players first had to study interactive educational content that was designed and provided by a learning management sys-

tem, and then had to use the game to complete educational activities based on problem based learning techniques. During the educational activities the students, depending on their roles, had to solve mysteries, find clues and answer questions while interacting with non-playable characters (NPCs). The results of the study showed an increased performance on every tested cognitive field, increased engagement and a considerable decrease of violent behaviour between members. These results suggest the need of longitudinal studies in the field of educational games and especially in the use of MMORPGs in the educational process and the development of educational MMORPGs that would be based on modern pedagogies that would be accessible even by students with disabilities or in remote locations.

Keywords: MMORPG, role-playing game, problem solving, collaborative learning, PBL, CSCL Script, multiple intelligences, educational psychology, Bloom taxonomy, game based learning

Edmodo as a Gamification Platform: Review and Plans

Peter Murar
University of Ss. Cyril and Methodius, Department of Mass Media Communication, Trnava, Slovakia

Abstract: Educational services based on web 2.0 showed clearly that new media in education are not just online courses and quizzes. Faculty of Mass Media Communication, University of Ss. Cyril and Methodius started to experiment with Edmodo within few subjects in academic year 2014/2015. During the year, we found this tool is much handier than we expected. Not only for K12 but in university education as well. Survey at the end of academic year has shown that the best features for students are the clear way to turn in the assignments and clever overview of all results. Gained experience and up to now idled features encourage us to go further. In keeping up with current trends, we decided to utilize Edmodo as a gamification platform. This paper is a review of experiences with utilizing the Edmodo in gamification. It describes basic parts of game mechanics and it compares their accessibility in the Edmodo and few other online services. It is a fact that Edmodo had not been developed as a gamification tool. Up to now, several other commercial services have been developed. On the other hand, user's experiences have indicated the Edmodo is utilizable for this purpose. We solve the range of its applicability and think about available alternatives. Finally, based on the findings we present a plan of gamification featured subjects for the academic year 2015/2016.

Keywords: gamification, social media, Edmodo, examination

Abstracts Only

Let Them Craft Their World in a new Future

Ana Almeida[1] and Ricardo Sousa[2]
[1]Universidade de Coimbra, Coimbra, Portugal
[2]Cáritas Diocesana de Coimbra, Portugal

Abstract: This work in progress emerged from a renewed approach of supporting children and youngsters, academically and in social inclusion, in a particular institutional context of social solidarity. This Centre of support for young people, with a study room, has the target public a vulnerable population located in a residential area stigmatized because it allocates families and people from ethnic minorities, socio-economic and culturally disadvantaged, with high illiteracy rates , long-term unemployment and the prevalence of dependencies (functional, drugs, alcohol), and history of judicial penalties. The Centre has been using informal approaches with "liberating" playful accent. More recently, the yearning for the use of technological tools, web access, gaming operations in computer interface and tendency to release stress into a "protected" and pleasurable environment, turned to an alternative to structured and formalized schemes of intervention suggesting the inevitable introduction of information and communication technologies in the educational environment frequented by children and young people in non-academic periods. The use of equipment, most of the time, is reported to leisure time and catharsis, and the authorization conform, or to a reward or an incentive for attending the Centre. At some point, it was intended to integrate those competitive tools in a game-based learning model. Minecraft was one of the introduced topics of the menu to explore. Interestingly, soon the challenge of building and survival proved to be a significant experience for a small group of four boys who, since then, have developed a set of skills from the activities and their gameplay. We've tried to analyse what players do with the game, in a single-player mode and a mode in which players have access to multiplayer, shared Minecraft servers, and in this mode what are the interactions. Following Duncan (2011), «what makes Minecraft "work" is a fascinating mix of the game's aesthetic sensibility, its mechanics, its development history, and the creative activities of its players». This study takes into account the game playing and the novel uses players are putting toward the gaming platform, on which the players overtly can afford by game's design. This study pretends to turn explicit how the experimenting Minecraft can advise instructional goals, namely, at a behavioural and cognitive level.

Keywords: Minecraft, disadvantaged students, social inclusion, skill development, learning

To Game or not to Game – a pilot study on the use of gamification for team allocation in entrepreneurship education

Rajiv Vaid Basaiawmoit, Eszter Somos, Ervin Szalai, Kata Szabo, Taru Deva

Aarhus University, Aarhus, Denmark

Abstract: A need for a well-balanced team" is a well-known adage, be it in sports, organizations or startups. There are numerous studies that suggest which type of teams perform better than others for a certain task, but the process of that team formation itself is rather unexplored and next to non-existent in the educational literature. Furthermore, educators burdened by course loads and schedules tend to opt for the easiest method of team formation – a random allocation or self-selection by the participants. Taking into account well known benefits of diversity in teams, we have tried to explore team allocation by educators and the use of gamification to try and answer the question - Is it possible to make team allocation easier for the educators as well as more fun for the students? We compare a serious gaming solution with an intensive instructor-selection method for team allocation. This pilot study finds that the game-allocated teams performed equally as the instructor-selection method, but the former saved time for the educator while being fun for the students. While there were some hints that the game-allocated teams performed marginally better than the instructor-selection-allocated teams, further studies need to be done to confirm our hypothesis.

Development of Educational Bacterial Battle app to Educate School Pupils on Antibiotic Resistance and Bacterial Competition

Carla Brown

University of Glasgow, UK

Abstract: Due to the rapid misuse and overuse of antibiotics, antibiotic resistance is now a major health concern worldwide. Poor understanding on bacteria and antibiotics by the public is a contributing factor to this problem. This was demonstrated clearly in classrooms in greater Glasgow when pupils (aged 8-13) were asked to summarise 'bacteria' in one sentence. Responses included "aliens", "germs" "disgusting" "ill" "yuk" "bugs" "dirt" "virus". In order to teach pupils about bacteria and antibiotic resistance, we sought to develop an educational game. This game was first

designed as a card game titled Bacteria Combat and is described as an effective and sustainable teaching tool by teachers. All feedback shows that the game alone is sufficient to teach pupils about bacteria and antibiotic resistance and also motivates students to learn about science. Furthermore recent evaluation from S1-S2 classrooms shows that 95% of pupils would play Bacteria combat again and 87% stated that the game changed their views on bacteria and antibiotics. Evaluation from all workshops has shown that pupils prefer learning through digital materials and also would prefer Bacteria combat as a digital app. Due to this a collaboration between University of Glasgow and Dundee based company Future Fossil Studios was organised in order to develop Bacteria combat into an interactive app using all existing artwork and materials. Pilot testing shows that the app alone has the ability to change pupil's views on antibiotic resistance. Furthermore, using in-game learning quizzes we show that players learn about key microbiology concepts such as gut bacteria, immune tolerance and bacteria virulence through game play alone. Overall our work suggests that microbiology can be taught in all classrooms without the requirement of practical equipment.

Keywords: antibiotic resistance, bacteria, app, game-based learning, microbiota, microbiology

Games to Promote Soft Skills and Project Management Techniques

John Denholm[1] and Ian Stewart[2]
[1]Manchester University, UK
[2]School of Mechanical, Aerospace and Civil Engineering, University of Manchester, UK

Abstract: Project management has become an increasingly important discipline over recent years, not least in view of the number of major infrastructure projects which have been completed either late or over budget. There is also an increase in the number of educational establishments offering related courses in project management, mainly at Masters level. This article/poster addresses the need for simulation-based training in the form of a serious game for project management and sets out a proposed game design. It is based around defined Learning Objectives (LOs) as for a module or course of training, and considers the three cornerstones of Time, Cost and Quality, plus the fourth dimension of Risk. As projects are generally managed by teams rather than individuals, the game allows for a number of competing teams to participate, team-play with social interaction leading to periodic decision-making. Aspects considered are: motivation, team collaboration, competition, winning crite-

ria and tutor feedback. The simulation is designed around Group Decision Support System (GDSS) methodology, focussing on multi-activity projects of a complex nature and takes account of a number of recognised project management techniques. These include a Work Breakdown Schedule (WBS) to identify project activities, a Critical Path Network and Analysis (CPA) in which the relationship between these activities is established, and the Earned Value (EV) method of monitoring time and cost against the original baseline plan. Based on the provision of a "Generator for a Tidal Barrier" and provisionally named TACT (Time and Cost Targeting) the simulation involves two phases, project planning and implementation, both equally important for a successful outcome. In the planning phase the participating teams must arrange a set of major activities (given along with associated cost and resource information) in an appropriate sequence, to determine the budget and shortest time. The implementation then progresses over a number of "months" during which teams make decisions relating to each activity, e.g. on suppliers, resources, lead times and perceived levels of risk, in order to complete the project on time and within budget. The team decisions taken in each period are entered into the computer which then displays team-by-team information on progress. This is mainly in the form of graphs, for example value of the work done against budget and actual cost against the value of work done, with inter-team comparisons. In this way the competitive element generates motivation to succeed against other teams and with respect to the winning criteria of completion within cost and time. The primary goal in developing the game is not the use of advanced technology as such, but to use it to maximize the benefit to the learner. To this end the game is computer-assisted rather than computer-driven and is aimed at improving soft skills, e.g. effective team cooperation, and the application of project management techniques.

Keywords: project management, serious games, simulation, teamwork, experiential learning

Ludic Elements in Student-Generated Material for Peers and Impact on Learning Outcomes

Valerie Priscilla Goby, Catherine Nickerson and Chrysi Rapanta
Zayed University, Dubai, United Arab Emirates

Abstract: Cut and paste or type your abstract in the space below. :: Our university in Dubai is a well-funded government institution in a country that registers high levels of IT adoption and the government is committed to developing comprehensive IT literacy among all students as part of its drive to become a knowledge economy. Its education system is dedicated to exploiting IT-enhanced teaching and learning via a

diverse range of devices and applications. At our university, where we teach organizational communication, many applications are currently in use across all disciplines and students display considerable IT mastery. Our classes are gender-segregated and there is no interaction permitted between male and female students at undergraduate level. In an attempt to exploit the applications available and to generate a ludic factor that would engage students more fully in a course module, we developed an assignment in which students were required to develop an iBook incorporating material specifically relevant to their cultural context. They were asked to include links to videos of an entertaining nature that they had made themselves and other interactive material, including quizzes that generated a score. Chapters of the book were based on different modules of their communication course. Students used the Apple Creative Book Builder application for this purpose. We had one section of our course (a male section) prepare the chapters and then instructors presented these to another section (a female section) and administered a survey to gauge their degree of interest and involvement with the material prepared. The video components and quizzes created by the students themselves had a high entertainment value for the other section. Considerable creativity was displayed in the production of both of these and the section assessing the material indicated a keen appreciation of this in the subsequent survey. The game-based learning elements of the intervention included: a) the fact that students of one section had to become teachers who prepare humorous materials for the students of another section without having any interaction with them; and b) the freedom of connecting the student-generated materials to personal and cultural experiences always with the aim of transforming these into learning objects. Currently we are in the process of measuring achievement in the sections exposed to this type of creative input delivered via such apps compared to sections exposed to more traditional means of instruction. We have devised MCQs and mini-cases and have uploaded these to Blackboard to facilitate assessment. The mini-cases provide a set of responses from which the student will select, and feedback on each response is provided together with a score. In this way we hope to provide some measure of if, and to what degree, the incorporation of an entertainment component related to a module will impact on learning. The design of the Blackboard assessment will facilitate ongoing assessment and provide feedback on student achievement and inform future course design modification.

Keywords: student-generated material; student attitudes to ludic materials; creative book builder; comparison of traditional versus mobile learning outcomes

Outnumb3r3d: Intrinsically Motivating Mathematics for the PlayStation 4

Jacob Habgood[1], Carl Jones[1] and Daniel Mallinson[2]
[1]Sheffield Hallam University, Sheffield, UK
[2]Sumo-Digital Limited, Sheffield, UK

Abstract: This paper and accompanying poster describes the design of an *intrinsically integrated* educational game to improvechildren's competencies in mental mathematics. A number of researchers have suggested that educational games aremore effective when they are closely integrated with theirlearning content. Specifically work by the lead author has showed that a closer integration between an educational game's core-mechanics and its learning content can be both more appealing (in terms of time spent on-task) and more educationally effective (in terms of learning outcomes) than a less integrated "edutainment" approach. However, cursory approaches to integrating learning content remain common in contemporary educational software, and the literature lacks an exemplar of what can be achieved using an integrated approach. The Outnumb3r3d game was conceived to provide a commercialand theoretical exemplar of intrinsic integration for the Nintendo Wii, but was never completed.This project is now porting the original Wii prototype onto the PlayStation 4 in order to revive Outnumb3r3d as a research project. This paper details the design of Outnumb3r3d with reference to the key theoretical constructs that underlie its pedagogical design. In doing so it provides an example of a game design created to integrate mathematical learning content seamlessly into the game's core mechanics, ensuring that the mathematics is what makes the game intrinsically motivating to play rather than trying to hide or "sugar coat" its learning content.At the time of writing the game's implementation is still a "work in progress", but is expected to be the subject of future empirical evaluations into its effectiveness as a teaching tool.

Keywords: game-based learning, intrinsic integration, intrinsic fantasy, endogenous fantasy, mathematical learning

The Theraworld Project: From Theragames to Theracomics and Beyond

Robyn Hromek
The University of Sydney, Australia

Abstract: The Theraworld Project aims to bring psychology to children and young people in an engaging and experiential way. Young people are often referred to psychologists or counsellors for social and emotional difficulties and engaging them in therapy can be challenging, especially if they are reluctant to be there. By using experiential tools like games, comics and interactive stories children are more likely to participate, especially if they are with a group of friends. Soon they are discussing the issues presented in the games and learning about psychological tools like cognitive behaviour therapy, or relaxation, or managing their emotions. So far the Theraworld Project has created 15 developmentally progressive boardgames to teach about the things kids deal with and think about, like friendships, resilience, bullying, anger management, anxiety, success at school, happiness and character development. The next phase of the project is creating Theracomics to go with each game. Theracomics use the many advantages of comics to teach social and emotional skills to kids. Being both visual and verbal they quickly present social situations from several points of view, inviting readers to develop perspective and understanding. Kids get to 'try out' different responses through the characters while making connections with their own challenges. When read with a therapists, teachers or parents they allow guided discussion and reflection to take place. The first comic has been created and is called 'The Tuesday Club'. It uses the everyday school playground and an imaginary world to explore the issues of friendship. The Theraworld Project will expand by using the comics to create 'choose your own adventure' stories for iPads. This interactive format provides readers with the opportunity to explore different responses to the social and emotional dilemmas presented in the stories, both prosocial and antisocial along with their consequences. And who knows, perhaps one day there will be Theracartoons! The Theraworld Project is being created by an Australian educational psychologist (Robyn Hromek) and Blue Monkey Studio, an Italian firm with writing, illustration and graphic design expertise (Corrado Sesselego and Emilliano Civiletti).

Keywords: therapeutic games, comics, iPad stories

Game-Based Career Decision Support: Drafting the Youth@Work Game

Hans Hummel
Open University of the Netherlands, Heerlen, The Nederland

Abstract: This topical round table session contains four presentations (20 minutes each) intertwined with discussions (5 minutes after first three, 20 minutes after last presentation). Two presentations (1 and 4) are more theory-inspired, two presentations (2 and 3) are more practice-inspired: 1. Acceptability and user requirements analysis (presenter: Janet Moffet / Graham Allan, UWS) Focus groups with experts in career planning questioned what they perceived as main influences, resources and constraints on their own and young people's career decision making. Experts were also asked for their ideas about desirable features in making a successful game in this area. To establish that these preliminary ideas were relevant across a broader range of potential players of the game, questionnaires were administered to young people in different European countries. In this presentation we will describe the results of these acceptability and user requirements analyses and explain how they fed into the design of the game. 2. Counseling and education in Iceland (presenter: Arnar Thorsteinsson, HI) The Icelandic context is characterised by a lack of comprehensive information about occupations, and rather scattered careers education and counselling. An acceptability analysis of using a game for career counselling was conducted among young people and their career counsellors. Focus groups, interviews and surveys were used to determine views on useful resources for exploration, decision making and development of career related competencies. This presentation will focus on features that were found to best motivate exploration and the acquisition of learning career management skills, and how this approach should be integrated in context. 3. Future = Now: Game on career orientation (presenter: Wijnand Kieft, SPL) This game provides a challenging learning environment from the Dutch context in which future professions have to be explored, experienced and compared. Players start describing how they envisage themselves and their profession in 15 years time and then follow a path with assignments that will help time reflect and align their self-image to their professional image. The presentation will describe this game, first experiences, and future work. For instance, navigation and monitoring decisions appeared to need further improvement. 4. Review of resources (with demo of game prototype) (presenter: Liz Boyle, UWS / Hamid Oudi, UR) Since the youth@work game is developed against a background of existing resources, we reviewed existing careers materials and literature. This presentation argues that our approach is highly consistent with materials and theories of learning found that view effective career learning as highly constructivist, active, experiential, situated, personalised, self-

regulated and frequently collaborative. Related to personal development, considerations about self and identity, interests and values, as well as sociological theories, have guided the design of a first prototype of the game that will be demonstrated. Why is your paper of interest to the conference participants? Use this space to persuade the reviewers why they should select this abstract for the conference :: Submitting a 'workshop' about the youth@work project (*) to ECGBL2015 was previously discussed with the organisation of ECGBL and listed in the project plan as one of its multiplier events. Liz Boyle (project coordinator) and Sue Nugus (ECGBL Chair) have recently agreed that the best option would now be to submit an abstract for a round table session. (*) The Erasmus+ project "youth@work" currently designs, develops and evaluates a serious game to support young people (between the ages of 13-19 years) in their career planning and decision making. Career management for this group appears highly problematic. Such a game provides potential for more engaging and active approaches to decision-making, taking into account both the state-of-the-art knowledge in career counselling as well as innovative game concepts and mechanics. It is a societal issue with high impact and fits well in the scope of the conference.

Keywords: game design, career decision and development, user requirements, review of resources, career counseling contexts

Game-Based Learning in Nanotechnologies for Adolescences: Could it be Real?

Andrey Melnikov[1], Evgeny Akintiev[2], Oleg Sidorov[3] and Tatyana Krupa[4]

[1]Fund for Infrastructure and Educational Progams (Rusnano), Moscow, Russian Federation

[2]ANO eNano, Russian Federation

[3]Innovations Laboratory Ltd, Russian Federation

[4]Global Lab Ltd,Russian Federation

Abstract: Fund for Infrastructure and Educational Programs (RUSNANO), Russia launched a project in order to create an educational computer game for adolescents within a STEM-area with a special scope on nanotechnologies. Fund primarily focuses its activity in formation of infrastructure for nanotechnology, development of human resources for the nanoindustry and popularization of nanotechnology and nano-enabled products. There is a growing demand on high-caliber professionals for developing robustly rising hi-tech market, including nanotechnologies. For successful

development nanoindustry will need in a closest future a considerable amount of highly qualified specialists, each thoroughly knowledgeable in his or her field and possessing a multidisciplinary perspective. Unfortunately the amount of students who are aiming to become such a professional is coming down. Besides the quality of school education in STEM area is not appropriate. Moreover we have to raise the awareness of high technologies among people to upgrade living standards and to decrease the level of undue fear. On that path we endeavor to create new ways of delivering information about nanoscience, nanotechnologies and nanoindustry (including school curricula updating). Our target group are future consumers of nano-enabled products and new generation of engineers. The aim of the project is to develop the computer (video) game with the following goals: to raise the awareness of nanotechnologies among teenagers; to motivate them or to strengthen their motivation on the path of acquiring STEM content in "in-school" and "out-of-school" activities; to deliver the modern knowledge in the STEM area and particularly in nanoscience to teenagers in the most appropriate and effective way; to enhance our own capacity in the educational domain in terms of designing/obtaining/leverage the most effective and cutting-edge pedagogical techniques and methodology in teaching and learning of STEM subjects. By now the stage of creating a concept of the game is passed, developers made a synopsis of the plot, basic elements of game world and characters. The genre is the quest from the first person. Fighting and racing will be added to the gameplay in some levels, in other words such game will also have elements more characteristic of the genre "action-adventure". This should have a twofold effect: to help a player to cope with stress and to increase the motivation for further learning and achieving results. Web-based application with connected apps on mobile platforms (iOS and Android) was chosen for the projects.

Keywords: nanotechnology, educational game, adolescences, STEM

Working With Students to Address Attrition Through Gaming

Darren Nixon and Natalia Gerodetti
Leeds Beckett University, UK

Abstract: The first year of university life is well known to present a series of challenges and opportunities for both students and staff. For students, issues such as being away from home, managing finances, maintaining old and developing new friendships, as well as generally maintaining a balance between social life and studies are key concerns. For universities and course teams these issues can manifest in high levels of attrition. In this poster we present an internally funded ongoing collabora-

tive project of staff and students at Leeds Beckett University, UK, that aims to tackle these problems through the development of a games and learning resource that could be used to help support students transitioning into and succeeding during their first year of study at university. Further developing the students as producers epistemology that we have successfully applied in producing useful games material for the classroom (see Gerodetti and Nixon, 2014) we put students' experiences and their tacit knowledge at the centre of the project. The principles of students as producers is particularly relevant to this project because students themselves have the most recent experience of transitioning into higher education and know what kind of game would appeal to their peers. A mixture of students from two social science courses and across all years of study were therefore brought together to identify issues central to students' experiences of adapting to higher education and its challenges in their first year of study. The project is unfolding over a series of workshops the first of which has resulted in the identification of key themes and concerns for students and a concept for a new traditional game. The board game will be developed further in subsequent workshops over spring and summer 2015. Whilst the precise game mechanics are yet to be finalised some of the principles of the game for students is around knowledge transmission of local support services and common pitfalls for first year students. From the course team's perspective the playing of the game should help foster collective awareness of problems and solution finding, and, in doing so, help create social cohesion within the cohort. Research findings on attrition issues suggest that simply making friends early is a key factor for students' wellbeing in their first year. The poster highlights the benefits of collaboration in the design and production of game resources, and in particular, the potential for harnessing students' experiences and applying them to curriculum development. The poster also considers the value of non-traditional teaching and learning formats for increasing student engagement and addressing attrition issues. Finally, the poster underlines the benefits for the students of staff-student and inter-year collaboration which have already emerged in the evaluation of the first workshop.

Keywords: gamification, attrition, student as producers, collaboration

Games Abstracts

ME2: Model for Entrepreneurship Education Game

Rajiv Vaid Basaiawmoit
Aarhus University, Denmark

BACKGROUND: Entrepreneurship is a process and one that can be and should be learnt. Not only to create start-ups or companies but to solve problems and to adopt an entrepreneurial mindset that views the world around us from a different perspective where we realize and respond to a call-for-action. The ME2 game tries to capture this essence based on a theoretical model of problem solving that Aarhus University has developed and implemented over the last few years known as the Aarhus University model for Entrepreneurship Education. The ME2 name uses a double play on words to capture both what the model is (Model for Entrepreneurship Education) and convey the meaning "I too" can be an entrepreneur if I learn and adopt this process. However, the game and the model refrains from selling itself as a model for success.

CONTEXT:The game introduces the concept of handling uncertainty which is a large segment of what an entrepreneur is always engrossed in. The game also distinguishes between risk and uncertainty as your level of risk appetite will determine your uncertainty outcome (or level in the game). The board game is designed to supplement entrepreneurial education in the classroom and is targeted towards both bachelor level and early Masters level students.

GAMEPLAY:The game has a traditional board game setup and is a mix of role-play, story-telling, randomness (dices) and strategy play. However, this is a collaborative game where you play "against the environment" i.e. the concept of uncertainty as a team. The game is meant to be played in two rounds (what we call playthroughs of about 75 minutes each) - where you play the 1st iteration - when you first enter the classroom and are only curious about entrepreneurship (it is mostly an optional choice of study for students at AU) and 9 out of 10 times do not know what Entrepreneurship is or if it is something you can do. The first playthrough introduces the concepts and the model behind the education and you play with a fictive set of characters whose mission is to reduce uncertainty. The second playthrough (played at roughly close to the course end) replaces the fictive team with active role-play where you now insert yourself and your project that you would have developed in the classroom thus far - with the same goal but tougher choices. During the game you are taken very quickly through the ME2 model and the process that it entails together with a set of choice cards. The gameplay itself is very simple: Pick a card

corresponding to the phase you are at - do the action and make a choice (you always have 3 options to choose from) and there is no right or wrong answer. Your answers give you a die roll that based on your cards and strategy will move your uncertainty meter. The only competitive element of the game is in the classroom setting where each team competes against another team for the lowest uncertainty score.
https://www.behance.net/gallery/27163265/ME2-game-The-entrepreneurship-board-game

APEX: The Board Room Board Game

John Bourke
The Business Excellence Institute, Ireland

APEX's audience is people with responsibility for running organizations, especially business leaders, senior middle-managers, and people preparing for these roles.

Its objective is to enable players to learn how to (i) be strategic, (ii) make decisions in the face of uncertainty, and (iii) manage an organization to achieve outstanding results for all stakeholders. It also brings out teamwork, communication, and resource management learnings.

People play APEX as a management team that have been appointed to run a business that is not doing as well as necessary. Every turn involves deciding between taking an opportunity, taking an action, or implementing a project. This requires trade-offs to be made when improving things such as leadership, strategy, communications, processes, product, and people management. Event cards add uncertainty, requiring risk to be managed as you play.

Similar to real business, there are multiple paths to success and players have great flexibility in the decisions they can make. There is no victory condition – a team plays against its own potential to do better – but there are "defeat conditions".

The core game is collaborative. However, when multiple teams are playing they can compete with each other and the team performing the best can be considered the "winner".

Occasionally, when triggered by events, a facilitator engages in discussion and at a few predefined stages, game play is paused for group discussion. After playing, performance is assessed (good performance results from achieving some degree of

mastery of the learning APEX is designed to deliver), followed by group discussion and analysis with the players to help learning emerge from the experience.

APEX's learnings are partly integrated into the game's stated objective ("lead your business to excellence") and partly allowed to emerge from game play. The game is mainly a vehicle to get players thinking about (i) what they are doing, (ii) the consequences of their decisions, (iii) how they are making decisions, and (iv) how they might do better. These "constructivist" learnings are the most important ones.

The Innovation: As APEX replaces a "lecturer" with a "facilitator", the emphasis shifts from "being taught" to "learning", which is helpful when the student is an experienced manager. Rather than merely discussing topics with an instructor, participants engage in a scenario that enables them to quickly see - and feel - the consequences of their actions. This enables them to realize things as they play, facilitating both new learning and the transformation of old knowledge into new knowledge. In addition, it couples learning with emotion which, as Plato reminds us, is the basis of all learning.

Inspired by psychologist Urs Bucher, APEX was developed without funding by 3 people for the newly established Business Excellence Institute. Prototypes were tested by diverse individuals (men and women of various ages, cultures, and professional backgrounds) and went through numerous iterations. Each time the game was played, formal feedback was collected and play was observed and analysed, resulting in hundreds of improvements to the board, the mechanics, backstory "framing", and more.

You can find a video of game play, a video of comments by a (final prototype) game tester, and a short video on development of APEX here:
https://drive.google.com/folderview?id=0Bz80vQqfwXCdfmktYldaS3ZQNEZKWWJSMzQwZjBTZjJnbWlidWhwR3hfcW5PRmtwTHN2alU&usp=sharing
(best to download as google seems to require audio to be manually turned on if played from the web.)
You can also find some information and testimonials about the game on the Institute's website here:
http://businessexcellence.org/apex-management-training-game/

Bacteria Combat: Interactive Bacterial Battle app to Educate School Pupils on Antibiotic Resistance and Bacterial Competition

Carla Louise Brown
University of Glasgow, United Kingdom

Bacteria Vs antibiotics? Germs Vs probiotics? Immune system vs EVERYTHING? Learn who the real winners are in a game of Bacteria Combat.

Bacteria Combat is an educational and exciting educational app played in the style of Pokemon and Top Trumps with a twist! This digital card battle game is comprised of two sets of card types; 1) Stat cards comprised of good and bad bacteria and 2) Joker cards. Joker set includes antibiotic jokers, immune cell jokers and bacteria stress jokers.

The game aims to teach players that bacteria are not simply germs or 'bugs', they possess unique and specialised properties which are extremely important in human health and disease. In order to portray this message the cards were designed to translate scientific fact to fun analogies school pupils will respond to and enjoy.

Stats are Strength (determined by bacteria outer membrane properties a); Speed (determined by flagella production); Generation time (doubling time of bacteria;); Resistance (determined by antibiotic resistance) and Special power (virulence factor or probiotic quality).

Through the addition of the joker cards players also learn about the problem of antibiotic resistance and also tolerance of immune system against good bacteria.

The game can be played in two formats: multiplayer using AI or multi-player with friends via school networks and social media.

Game play example: Player one has the E .coli 0157 card (bad) which causes food poisoning. This bacteria has a top speed score of 100 which the player selects. However, player two (or AI) has the immune cell joker card! This card automatically eliminates all bad bacteria in this round. Player 2 wins and obtains player one’s card. Joker card used only once.

N.B Antibiotic joker card only wins against bacteria with resistance score of 50 and lower.

The game was designed and created by Microbiology PhD student Carla Brown and Dundee game design company Future Fossil Studios.

Bacteria combat app production has been completed however game is currently out for testing via Testflight programme.

The game was produced initially as a card game for testing (2014) and the themes can be viewed here.
https://twitter.com/bacteriacombat
Future Fossil website:
http://futurefossilstudios.com/index.html

Game of Homes: A real estate simulation game

Sophie Callies
University of Québec at Montréal (UQAM), Canada

Game of Homes is a simulation serious game that teaches the basics of real estate transactions (how to evaluate the price of a property, which are the different steps of a sale process, how to compare several properties together etc.).

In the game, the player plays the role of a real estate broker whose goal is to become the best broker in a given city, represented in a city map format. To accomplish this goal, he needs to earn as much money as possible and keep a good reputation.

The game focuses on the selling part of real estate transactions. In the game, the player offers his services to support homeowners in selling their property. He negotiates with homeowners to get a brokerage contract, assesses the property value, and manages the sale by carrying out advertising, giving house tours to potential buyers, adjusting the selling price, and finally negotiating with buyers and recommending offers to the seller.

During each activity, the gameplay allows the player some flexibility: for example, he can choose to fix the selling price higher if he believes he can sell to a higher price.

Hence, the player can execute various strategies all along the game, and appreciate the outcomes of his actions.

The player is not the only real estate broker in the game. There are NPCs, which represent other brokers sharing the same goal as the player, and therefore act as direct competitors. In addition to competing against other brokers controlled by the game, the player needs to interact with other artificial agents. There are therefore three types of artificial agent in the game: sellers, buyers and brokers. The rules of each type of agent are inspired from observable behaviors from real-world expert brokers.

The game includes an architecture which automatically generate game scenarios adapted to player's level and knowledge.

Our architecture allows the game system to modify the evolution of the simulation and thus creates new situations that will change the way of playing. This dynamic evolution of the simulation world represents the automatic generation of game scenarios to teach and train the player.

To make the game more realistic and improve learning, the simulated environment is based on real data. The game takes place in real cities represented by maps that are imported from the OpenStreetMap project. The houses characteristics appearing in the game are derived from real public houses listings. We try to provide an environment close to reality as much as possible to allow the player to learn more about the selected city and its market reality (for example, which sectors cost more and which ones are cheaper). However, the virtual environment is not just a copy of a real city market. The environment evolves and each game is unique: for example, the features of properties are never the same, neither are the owner's requirements or the buyers' needs. This allows us to provide a large variety of scenarios, which correspond to in-game dynamic changing situations of this virtual environment.
http://gdac2.uqam.ca/goh/

Virtual Age

Meng-Tzu Cheng
National Changhua University of Education, Taiwan

Virtual Age was designed based on the science curriculum standards in Taiwan. The standards suggest that K-9 science education should cover the topic of the history of

life on Earth, the theory of evolution and evidence for biological evolution. The scientific concepts of evolution are realized, concretized, and gamified with several learning objectives. After playing Virtual Age, students are expected to be able to:

- Understand the birth of the Earth, the emergence and development of life on Earth, and the course of evolution.
- Realize the various environments of the Mesozoic and Cenozoic Eras and the morphology and characteristics of representative creatures of each era.
- Comprehend the mechanism of evolution.
- Know the relationships between creatures and the environment to which they have become adapted.

The learning objectives are embedded in the game format, with the Mesozoic Era and the Cenozoic Era as the setting for the game scenes and levels and with representative creatures from each era used as in-game characters. Virtual Age is a single-player game in which the player learns the mechanism of natural selection by manipulating a team of player characters (PCs) to compete with non-player characters (NPCs) controlled by the computer. Additionally, each level (era) has two more requirements for players to complete. Players have to generate an Ephippus and an Eomaia and keep them alive at the end of the Mesozoic Era, as both of them are representative species transitioning from the Mesozoic to the Cenozoic Era, and Australopithecus and Dryopithecus should be produced and kept alive at the end of Cenozoic Era because they are the ancestors of modern apes and humans.

Thirty-two in-game characters (avatars) are totally designed. According to the actual ecological characteristics and niches, each avatar is created to have its own attributes. These attributes include the biomass required (i.e., the biomass required for reproducing or summoning it), health points, attack power, defense power, speed, ecological role (i.e., carnivore, herbivore, or omnivore), and habitat (i.e., the environments to which the given avatar is adapted).

In the game, many resource areas (which are made up of representative plants of each era) are also set up in which players have to use their herbivorous avatars to occupy and produce biomass. Only when players produce enough biomass can they reproduce more offspring or summon new species to increase the character diversity of their team. Mutations resulting in different traits randomly occur during reproduction. A natural disaster system is randomly triggered at the beginning of each turn to determine which species and with what traits can survive. The concept of symbiosis is also integrated into the game mechanism. Once a symbiotic relationship has been established between the in-game character and its symbiont, the attributes of the character are enhanced. Moreover, the role that decomposers play in the environment is additionally introduced in Virtual Age by the design of

using decomposers to decompose the corpses of characters that have died as a result of competition.
1. Video of game play: https://goo.gl/joUjoZ
2. For more information regarding how to play the game and its related work, please see the reference:
Cheng, M.-T., Lin, Y.-W., & She, H.-C. (2015). Learning through playing Virtual Age: Exploring the interactions among student concept learning, gaming performance, in-game behaviors, and the use of in-game characters. Computers & Education, 86, 18-29.

Humunology

Meng-Tzu Cheng
National Changhua University of Education, Taiwan

The development of Humunology was initiated in 2011 and culminated in 2012. The project team included a biological education expert, middle school biology teachers, a graduate student whose major is biological education and information communication technology technicians from a game company. As battlefield metaphors are always used to describe the processes of immune cells combating invasive pathogens (Kelly et al, 2007), the team eventually decided to create Humunology as a tower defense game in which the game features could easily be combined with the concepts of human immunology, which were determined after lengthy discussion. The team members tested and met regularly to discuss the framework and content of Humunology and to debug and work out solutions regarding the challenges and problems encountered in its development process. During the final stage of development, 45 college students with backgrounds in biology were invited to be β-testers in order to investigate their gameplay experience, as well as the game usability. Humunology was then modified according to comments and feedback from these testers.
Learning objectives: After playing Humunology, students are expected to be able to:

- Remember the specialized functions and effects that each immune cell is in charge of.
- Understand the mechanisms of nonspecific and specific immune responses and identify the differences between the two responses.
- Comprehend the three different lines of defense and know how they work.
- Apply the learned concepts of human immune responses to solve the problems encountered in our daily lives.

Game design: We determined that attractive visual representations and clear explanations would make the complicated and confusing concepts of the immune system lucid to students. Hence, the design of Humunology includes two parts: gameplay and tutoring. The tutoring system has a main screen listing all the player characters that players can use. Each of the player characters that were created depicts a type of human immune cell. The representation of each character was constructed based on what the cell actually looks like. The gameplay of Humunology includes a main scene presented in a chessboard form with an oral cavity as the background, along with different types of immune cells responsible for human defense responses and a variety of invasive pathogens. The user learns about the human immune mechanism by deploying different immune cells on the main scene to fight against the invasive viruses and bacteria. Mitochondria, which serve as an energy producer and generate energy units regularly, are also introduced into the game. Players must collect enough energy so that the immune cells are able to be activated. Each of the immune cells has different energy, cooling, and auxiliary conditions. Only by satisfying the required conditions can they be dragged to the main scene to perform their respective functions. Humunology involves several additional game features in order to ensure its playability and playfulness. A time limit and scoring parameters are employed to provide players with feelings of excitement and competitiveness.
Video of game play: http://youtu.be/0PC7L4z5sEY

Interactive performance Art: Musical Sequence

Szu-Ming Chung
Digital Content Design, Ling Tung University, Taichung, Taiwan

This research proposes an experimental module for creating interactive music performance art. The artists and students will work collaboratively in this creation process as performers and audience. They will experience the cycle of listening, viewing, thinking, expressing until attaining skills of the improvising. The researchers develop this module by creating 5 interactive games (musical sequence, footsteps, conducting chords, and musical partner) to test first or second graders. This set of musical games is developed by Flash, Maya, Unity 2D/3D, Kinect, and Leap Motion.
The Musical Sequence is using motives of a musical piece "Rain" by a Taiwanese musician--Ma, Shui-long (2005) to create interactive objects. The musical motives are animated as movieClips in Flash, which represent improvisation referents for Musical Sequence. The player chooses animation combined with a pitch (chosen from 7 pitches in C Major) to arrange a sequence, then play it as a newly created musical

piece. This Musical Sequence is the first of a set of music games (Footsteps for rhythmic patterns, pentatonic bubbles for melodic improvisation, conducting chords for chord progression, and musical partner for 2 part writing/improvisation). There are 6 classical masterpieces are selected for Musical Sequence to comply with three stages of improvisation: exploration, process-oriented improvisation, product-oriented improvisation (Kratus, 1991.)

The Great Green Hipster Hotel

Darragh Coakley
Cork Institute of Technology, Ireland

The “Great Green Hipster Hotel” is a mobile game for iOS and Android smartphones and tablets created as part of the "Green Games Project" (www.greengamesproject.com).

The game is a tablet-based resource management game similar to games such as "Middle Manager of Justice", where the player must effectively run their business by hiring and training staff, managing and spending resources and building and upgrading their premises.

The game also aims to help players learn about effective sustainability in tourism and hospitality (as well as in their own homes) by having them build and manage their hotel while attempting to ensure that they minimize food, energy and water waste through smart decisions in terms of building and upgrading, staff training and spending of resources.

The game aims to provide players with a quirky, humorous learning experience, in which the task of the player is to create a successful, environmentally-sustainable, hotel for a variety of “hipster” guests. Players must build and upgrade a range of bedrooms, bathrooms, restaurants, etc. to meet guest requirements and must also hire staff to manage these facilities. By meeting guest demands and managing their available resources, players can grow their hotel effectively, constantly improving its size, capacity and reputation.

In addition to building the hotel, players must also ensure that they run their hotel in an efficient and sustainable way if they wish to be successful in the game. Players begin with a limited amount of water and energy (until the hotel as a whole can be upgraded). In order to keep expanding their hotel, players must therefore minimize

the amount of water & energy that rooms in the hotel use. This can be done through improving rooms with upgrades that reduce energy/ water waste, such as energy-efficient lights and tap aerators, or through training hotel staff on how to reduce waste and improve sustainability. Players must also upgrade their restaurant to serve all manner of hipster dishes – from veggie burgers to kimchi tacos and train staff in how to avoid food waste. Players must also order food without ordering too much – which results in waste, or too little – which results in unhappy guests.

For implementing teaching and learning, the game utilizes an approach similar to that taken in hugely successful freemium games such as “Hay Day”, “Clash of Clans”, etc., but subverts this model for pedagogical purposes. Whereas in standard freemium games, players pay microtransactions to access additional features, or to speed up aspects of the game (e.g.: construction times, character training, etc.), in the Great Green Hipster Hotel, players can speed up certain tasks - such as construction or equipment upgrades, staff training, or expanding their restaurant’s menu - by taking part in learning activities such as watching training videos and animations and answering related questions. In this way, there is a genuine, game-related incentive for players to engage in and demonstrate learning, as demonstrated by the success of game mechanics used by successful freemium games.

The game is available for Android devices at:
https://build.cloud.unity3d.com/distro/install?id=b16st8R2ex
To access the game on an iOS device, please email darragh.coakley@cit.ie to be added to a list of external beta testers
A video playthrough of the game's main features is available at:
http://youtu.be/OpwOQy3r9kI

Develop Your Drug

Mariam Dholkawala
Tata Consultancy Service Ltd., India

Develop Your Drug game is designed with the goal to give players an end-to-end understanding of the Clinical Research and drug development process.
Drug Development consists of 4 major steps.

- Identifying the disease and the molecular drug target
- Pre - clinical Studies
- 4 Phases of Clinical Trials on humans

- Regulatory Review and Drug Launch

The purpose of this game is to give players an overall understanding of the Drug Development Process and various methods and formalities that are required by the Clinical Research fraternity. A player working in any of the sub domains would get a complete picture which will help him/her to relate to his/her job better thereby increasing the quality of work, job satisfaction and low attrition. This would also help associates to connect themselves to the feeling of helping society by participating in a new drug development procedure.

Building the Game through a process
We first identify the training area –
TCS Life Sciences is involved with global players in pharmaceutical industry providing back end services during clinical trials involving huge volumes of data processing, validation, programming and hence involves various sub domains like Pharmacovigilance, Clinical Data Management, Biostatistics and Programming, Regulatory Affairs and Medical Writing.

While the associates specialize in a particular sub domain, they may not have a thorough understanding of the whole chain. Training the associates on all steps of Drug Development and giving them a bird's eye view through the clinical trial process becomes a crucial training area for us.

After a thorough understanding of the Drug Development Process from domain experts, the premise of the game is built. The player is made the CEO of a pharma company and given a budget of $1B to develop a new drug. Wrong decisions at any step during drug development could lead the player to losing money while progressing correctly could lead to spending money at persistent rate.

Throughout the game, the player has rich interactions with virtual characters, digital items and navigates through the game space. The game space consists of different environments –

- The Pharma CEO's office – This is where all official documents are prepared, decisions are taken and interactions with the regulatory authorities are conducted.
- The Laboratory – This is where the preclinical trials such as lab testing and animal testing of the new drug are conducted.
- Hospital – This is where Clinical Trials on human volunteers is conducted.

The players are guided throughout the game by a expert with a PhD in Pharmacological Sciences and Biochemistry. The expert provides the narrative, collaboration, navigation and content clues throughout the game.

Designing activities for improved learning and knowledge retention – Designing activities for improved learning is very important as the player should be able to recall and remember the information being shared throughout the game. For this reason, the DYD game has sub tasks (mini games) which aims at explaining the concept with an intention of retaining knowledge.

Play-testing– The game will first be shared with the leaders in Life Sciences at TCS in India and non - Life Sciences players to understand if the concepts that have been explained are simple and easily understood. Player metrics will be recorded using analytics to enhance future versions of the game.
Target Audience: The players will be associates who are working on assignments related to Clinical Research at TCS.

Link to the game:
https://drive.google.com/file/d/0B5PiO9JBEgVIOGx0aGZZLTY0c0k/view Preferably play the video in any web browser.

Mythos Unbound: Rescuing Prometheus from the Confines of Powerpoint

David Fredrick
University of Arkansas, United States

Our game aims to liberate teaching classical myth from the confines of the traditional lecture format, as Prometheus was freed from his mountain crag. Hence the name, Mythos Unbound. While attending a university powerpoint presentation is not exactly like having your liver eaten by vultures, this course is motivated by the recognition that in comparison with powerpoint, an immersive game environment can give classical myth a much deeper, more compelling relationship to its ancient cultural context.

To this end, Mythos Unbound presents classical myth from Homer through Ovid in the form of cybernarrative, a 3D world constructed in Unity in which the student-player has an immersive part. Beginning the semester as a newly acquired slave in a Roman house, students progress toward freedom through their understanding of classical myth, presented through nineteen game levels based on key texts.

Mythology lay at the core of education in antiquity, and as we learn from authors like Petronius and Horace, education was crucial for social mobility in ancient Rome.

The game play for each level typically consists of three parts: a prologue and epilogue set in the House of Octavius Quartio in Pompeii (played in first-person mode), and a mythological episode sandwiched between (played in a variety of third-person modes). On the "house" side, the player must negotiate the tricky waters between the wealthy freedman dominus (Quartio) and his aristocratic wife (Cornelia), and between this power couple and their partners in the wine and fish-sauce trade. The house itself is based closely on the surviving evidence, and the myth levels are "entered" through all the places and surfaces where myth was found in Pompeian houses: frescoes, sculptures, dishes, plants, even recipes. Our goal here is to communicate how deeply and widely infused myth (and "mythological" patterns of thinking) were in everyday lives in classical antiquity. These myths have religious meaning, political meaning, and meaning at the level of family structure, gender and class, and household roles.

Student players, of course, all have different imaginations, and these stories could be presented in very different ways. For this reason, course assignments ask students to comment critically on the layout and mechanics of the game world itself--how it compares to what they imagine when they read the texts, the themes our game world seem to emphasize, and what they would do to make Mythos Unbound better. As Raph Koster points out in A Theory of Fun, humans excel at pattern recognition and comparison, and so to be effective Mythos Unbound does not need to present the most "accurate" version of any myth, but rather versions that offer a rich ground for comparison to the ancient evidence, allowing students to think creatively and critically in the space between. In this respect, Mythos Unbound capitalizes on 'mesotelic' space as uniquely valuable for education, as the game is not designed strictly for the autotelic (intrinsic) goals of a commercial game, nor the allotelic (extrinsic) goals of a training simulation.

Link to Vimeo Trailer: https://vimeo.com/130903686
Link to game play levels:
https://drive.google.com/folderview?id=0B0IweIlmBGHYfmpfcm1GVWZad1Vzai0yS2RYRVJGTndpaF93c1NpUVNZZEFEb2x2bTBFaFU&usp=sharing
You will find two folders, for two game levels corresponding to Euripides' Bacchae. Click on the Episode folder (13 or 14), and then download the zip file appropriate for your operating system. On Windows, make sure to unzip all folder contents. You should then be able to play the executable.

In Your Eyes: Learning Perspective Taking

Laura Freina
CNR-ITD, Italy

According to the Disabled World website, between one and three percent of the world population has some kind of intellectual disability. More than 90% of this population is able to reach some level of independent life and can become socially engaged and active.

In order for them to achieve these objectives, the ability to move around town autonomously and safely is fundamental. Nevertheless, problems in spatial orientation make the acquisition of this ability is not straightforward. Learning new skills may be an issue and there are often problems in learning transfer, that is they lack the ability to apply the acquired knowledge or skills in different situations or environments. Moreover, people with intellectual disabilities tend to learn more slowly and need a lot of practice. The abilities for moving around in town are traditionally acquired after a long training with specialized tutors. The use of Virtual Reality would allow as much practice as needed, facilitate learning transfer and allow tutors to follow more people at the same time.

In Your Eyes is a game designed and developed with the aim of teaching spatial orientation abilities to teenagers with mild intellectual impairments. In particular, the game focuses on the training of two basic skills: perspective taking and mental rotation. Perspective taking refers to the ability of imagining how the world looks like from another person's point of view, while mental rotation refers to the ability to mentally represent and manipulate physical objects.

The game, which takes place in a virtual home environment, shows the player a scene with some objects on a table. The player has to choose, among the provided answers, how the scene would look like from one specific side of the table. The game was designed to be played by the target population with the help of a tutor, but it can be easily used independently.

Specifically tailored scaffolding is given to the player in order to make the game difficult enough to be challenging and motivating, but easy enough to be solved in order not to disappoint him and, at the same time, keep the error rate as low as possible. Keeping error rate down is, as suggested by the Errorless Learning approach, a way to make learning easier and quicker since there is no concurrent

stimuli by errors. If an error is not recognized as such, it can be encoded into memory, and result in wrong responses later or conflicts between the correct and the erroneous information.

When the correct answer is chosen, positive feedback is given and the player advances with his score and levels. When the answer is wrong, the game provides specific clues in order to help the player to understand his mistake. Furthermore, the presence of the tutor allows human intervention if needed.

The game includes data mining in order to have a detailed evaluation of the game itself, the possibility to have an insight on a player's performance and to study the advantages of the game on a wider population.

At the present moment (May the 29th) a first version of the game is available. It will be updated by June the 16th and a readme.doc will also be provided.
The game can be downloaded from:
https://drive.google.com/folderview?id=0B_NoZetseimSfl9uLS04eHRKZWhCWUNOSW5IRmxlVFUxSjgxS29Hc2doOE5sZjR3ZzJ6RDQ&usp=sharing
The game is designed to run on a PC with Microsoft Windows and with Oculus Rift. The runtime SDK is needed in order to use Oculus. It can be downloaded free from the Oculus Rift website: https://developer.oculus.com/downloads/#version=pc-0.5.0.1-beta choosing "Oculus SDK for Windows

JobStar: Create Your Star Job:

Toru Fujimoto
The University of Tokyo, Japan

We developed an original educational card game called 'JobStar: Create Your Star Job' to help youth plan a better career. The target users are high school students or older who are thinking about their future path. The game is easy to play in any classroom setting and playfully engages students in discussions regarding their future jobs.

The premise is that career development activity can be more casual and playful so that students are able to think about their future occupations more positively and more creatively. College students in Japan tend to experience high anxiety and depression during their job search period, with some even committing suicide every year. The present situation in career development is not emotionally healthy for

youth; hence, it is necessary to create more opportunities to help them build a positive attitude towards their career. While there have been a few attempts at utilizing simulation games for career guidance, Jobstar's approach of helping students imagine and discuss critically needed jobs of the future is unique in the career education field.

The game package comprises 20 'Job Cards', 20 'Events Cards' and 16 'Industry Cards'. Each Job Card contains a generic job type such as 'engineer' or 'designer' with a brief description of the major roles of the job. The Event Cards illustrate issues and incidents that are considered likely to occur in the near future; for example, 'smart city', 'national financial collapse' and 'robotization'. The Industry Cards describe major industries such as 'finance' and 'telecommunications'.

The game is designed to play with three to five players. During the game, players have to come up with a unique job name based on the Job Cards that are provided to them. Then, players present a job profile and how the job might be needed in a certain context in the future, as described on the Event Card and the Industry Card. The game requires participants to analyze social issues and invent and articulate future job needs.

The game is designed theoretically based on Bandura's social learning theory (Bandura 1997). Bandura emphasized the importance of surrounding oneself with other people when learning, as this brings another layer of meaning to the context. Peers learn from each other by observing one another's actions and collaborating to achieve a goal.

A survey of Jobstar players indicated that the game play offered an engaging opportunity that enhanced social interactions and facilitated participants' learning from each other. One participant stated that 'other than the jobs I preferred, I found we could create those that are needed in society by changing our views'. Participants gained a positive attitude regarding their future paths, and their experience with the game made them more confident about their competence in choosing their occupations.
The game creates a playful context for thinking about a serious topic that youth tend to be reluctant to consider and supports participants in practicing idea generation and verbally presenting their ideas by promoting interaction among players.

For further information, please check the link below:
http://www.slideshare.net/tfuji/jobstar-information

Vascular Invaders: A game for studying human vascular anatomy

Andrea Gauthier
University of Toronto, Canada

Abstract Vascular Invaders is a web-based game for medical students studying vascular anatomy. Its premise is that a rogue nanobot technology, called Bacterbots, has infected the University's population and are wreaking havoc on students' immune systems. With the help of an anatomically accurate 3D map, players guide a Bloodbot (a good nanobot developed to seek out these vascular invaders) through the circulatory system to various invasion sites to destroy the Bacterbots, thereby testing their knowledge of nomenclature, vessel supply, and anastomoses. Players have a limited amount of energy with which to reach the invasion site; going against the flow of blood or revealing structures on the anatomical model will use up energy, so they must be strategic about the path that they take and must exercise their knowledge of vascular pathways in order to reach their goal.

Vascular Invaders has a mirrored (control) study aid, which contains the same learning material, path-finding mechanic, and visual treatment as the game but lacks any game elements, (e.g energy limits, leaderboard, points system, storyline). Both study aids were created around the same evidence-centred design framework (1): A) Student Model: vasculature of the head and neck; B) Task Model: vascular-sequencing tasks; C) Evidence Model: tool-use and performance metrics. We hypothesized that the presence of game design would encourage greater engagement with the Task Model, resulting in higher measured study aid performance. In turn, higher study aid performance metrics would be predictive of greater learning of the Student Model in both treatments.

We were interested in the educational affordances of the additional game design in Vascular Invaders, particular to the evidence-centred design framework. Medical students at the University of Toronto were randomly divided into two groups; Vascular Invaders (n=24) and the control application (n=22). We digitally collected tool-use data (e.g. tasks completed, tasks attempted, breadth of material covered, usage sessions, interaction with various elements) over 35 days and tested their knowledge with pre-post anatomy tests.

Ultimately, the findings of this study suggest that adding game design to a vascular anatomy study aid may motivate increased voluntary use by medical students,

though only trending differences were observed (p=0.11). Perhaps the most pertinent finding was an unexpected one: study aid performance was a significant predictor of learning in the game group (β=0.41, p=0.05) but not in the control group (β=0.14, p=0.56). Our analyses suggest that game mechanics encouraged more specific problem-solving strategies than did the control study aid, leading to greater predictability of learning outcomes. Future educational games should be created with this in mind; game mechanics should enhance evidence-centred design by eliciting actions from the player that require him/her to reflect on the target concepts so that patterns of interactions can be related directly to the players' knowledge. This represents a unique contribution of game design to a digital application.

1-Mislevy, R. J., & Haertel, G. D. (2006). Implications of Evidence-Centered Design for Educational Testing. Educational Measurement: Issues and Practice, (Winter), 6–20.

Links Video of gameplay and screenshots of synopsis and control application (denoted as VASA):
http://bmc.med.utoronto.ca/sciencevis/?projects=vascular-invaders
scroll mid-way down page for video)

University Challenges: The Otley Run Edition:

Natalia Gerodetti
InstitutionLeeds Beckett University, UK

Abstract"University Challenges: The Otley Run Edition" is a new traditional game (Moseley and Whitton, 2014) that has been developed through a staff-student collaborative project involving a cohort of different level sociology students from a UK university. As academics we are well aware of the challenges new students face adjusting to university life, however, our students have even more direct and recent experience of transitioning to student life. The aim of the project was thus to pool our collective experience in order to generate a game that can be played during the first year to help smooth new students' transition into university life.

The board game is thus aimed at first year students entering a new institutional setting for the first time. Well known to present a series of challenges and opportunities for students, issues such as being away from home, managing finances, maintaining old and developing new friendships, as well as generally maintaining a balance between social life, the demand to work and studies are key concerns. For

universities and course teams these issues can manifest in high levels of attrition. One key learning objective is that through playing the game students develop an awareness of the challenges confronted by freshers and are provided with opportunities to develop skills and knowledge to solve such issues in collaboration with other students. This final objective shaped the decision to develop a new traditional game which could be played in groups. Collective knowledge generation and solution finding to problems is designed to develop a student community, shared values and shared knowledge.

The game's aim is to "pass and progress" by filling a cake with six "slices" which can be collected periodically upon reaching enough points within each category. The first team (each consisting of 2-4 players) to "fill their cake" wins the game. Upon throwing a dice the players will go around the path of the board game landing on different categories where they get random cards (a luck element), multiple-choice questions (knowledge skills) or open-ended scenarios (solution finding skills) which will award points. Once a group has accumulated 20 points in a category (aligned with the 20 credits of our modules) they can convert them into a "cake slice" upon landing on an "exam board" field. The six categories of the game are "Health & Safety", "Accommodation", "Personal", "Finance", "Social" and "Academic" which aligns with the six modules students have to complete. Thus, built into the game is also a mechanism by which students get more familiar with the modular structure and the requirements for passing the first year in a game based approach.

Presented here is the game accompanying our poster presentation at the ECGBL 2015 which is based on an internally funded project of non-traditional game-developers – mostly sociology staff and students. The project development is currently in a testing phase after a prototype has been developed during the four month project development period and it is being rolled out to first year students in the current semester.

Fujian Trader

Sari Gilbert
Savannah College of Art and Design, United States

Fujian Trader uses a recently discovered seventeenth-century Chinese trading map of East Asia to create a board game that brings history to life. The Selden Map of China had lain forgotten in the archives of Oxford University's Bodleian Library until 2008. It is believed to be the oldest Chinese maritime merchant map still in existence and

now considered one of Oxford's greatest treasures. Fujian Trader's co-designer, the historian Robert Batchelor explains, "After finding the map, I wanted to let people experience its uniqueness and its history. Fujian Trader does this by getting players to learn about the map and experience its meaning through play." Batchelor and co-designer Sari Gilbert are now running a Kickstarter campaign until March 18(http://kck.st/17geBzC) that will enable the production of the first thousand units of the game so that they can get it into classrooms, living rooms, libraries and museums.

The game, for players ages twelve and up, begins in the year 1620, with players taking on the role of Chinese merchant families. They must send their ships out to build up networks of ports, and sell their rice, silk and iron for silver, through this trying to gain influence in the Ming empire itself, all before the game reaches its climax with the Manchu invasion of 1644. Along the way, players must survive events (like rice famines and typhoons) as well as plot with and challenge other players using a deck of cards based on the classic Yijing or "Book of Changes." It is considered a "gateway strategy" game, sharing some similarities to popular games like Risk, Monopoly and Settlers of Catan. Fun, accessible, yet strategically challenging, the game plays differently every time. Fujian Trader's designers Sari Gilbert and Robert Batchelor are also currently testing the game in tandem with a curriculum for middle- and high-school classrooms, which allows students not only to play the board game but to experiment with modifying it based on their own historical research and readings.

http://kck.st/17geBzC

DRAGONS PARAGONS AND SHADOWS: A Game to Explore Character Strength and Cognitive Behavioural Therapy

Robyn Hromek
The University of Sydney, Australia

'Dragons Paragons and Shadows' explores character development and cognitive behavioural therapy (CBT) with students aged 10 – 16.

The first phase of game development involved analyzing gaps in the tool kit I use in my work as an educational psychologist in schools. I had developed 14 therapeutic boardgames to teach psychologically sound strategies to young people with social

and emotional deficits. I chose games as a teaching strategy because of their inherently engaging nature and the semi-naturalistic environment they create that allows players to talk, listen and learn from each other. I needed a game to engage older students in psychological counselling. I had attended a conference on positive psychology and it became clear that character development was important in achieving success in life (Gardiner 2008). I developed a list of character strengths based on the work of Peterson and Seligman (2004) and collected a list of negative thoughts and moral dilemmas reported to me by young people. I chose a simple format for the boardgame with four corner trees representing different cultures. A Dragon would deliver moral dilemmas and ghostly Shadows would deliver negative thoughts. A Paragon would collect character strengths. Karma Coins would be given by the game facilitator for random acts of kindness.

The game was trialed with groups of boys and girls aged 9-12. They enjoyed playing and wanted to return to finish it. Anomalies were identified and changes were made to the layout. A new rule improved the flow of the game and increased the chance of gaining Karma Coins. The game was run multiple times to ensure all elements worked. It became clear it could be played over several sessions.

The second phase involved creating a boardface that looked like a map with a Dragon, ghostly Shadows and path for the Paragons. The game was trialed with other educational psychologists. The feedback was positive. One psychologist said ‘we were able to touch on topics he has previously been unable or unwilling to talk about. Whilst we played, not only did I develop deep insight into my client, but I also believe he experienced significant therapeutic benefit. We can't wait to continue next week’. Her student said ‘he was afraid the game was going to be boring but that it was really fun and basically the best game ever’.

Teaching points of the game:

Paragon Cards.

1. Wisdom - Creativity, Curiosity, Open-mindedness, Love of learning, Perspective.
2. Courage - Bravery, Persistence, Honesty, Zest.
3. Humanity - Love, Kindness, Aware of others
4. Justice - Citizenship, Fairness, Leadership.
5. Temperance - Forgiveness, Humility, Prudence, Self-control.
6. Transcendence - Beauty, Gratitude, Hope, Fun, Purpose

Dragon’s Challenges

- Use your character strengths to meet challenges
- We are unlucky if we have no challenges in life

Shadow Whispers

- Negative thoughts can stop us from achieving

• We can turn negative, unhelpful thoughts into helpful thoughts
Karma Coins
• We meet challenges best when we have the support of others
• Collect Karma Coins when you help others

http://theragames.com/games/#
Dragons Paragons and Shadows is in the bottom right hand corner of the page - the other images are of the 14 other therapeutic games I have created.

BIO-CHASE: A board game where "forwards" and "backwards" are not as straightforward as they sound...

Amalia Kallergi
LUCAS/ Faculty of Humanities/ Leiden University, the Netherlands

BIO-CHASE is a roll-and-move board game about biotechnological progress. In a board with 2 ends ("heavens"), players encounter fictitious biotechnological developments, are asked to choose sides and to literally influence the direction of the game (indicated by a global arrow). Amidst a constant flipping of directions, BIO-CHASE subverts the notion of "forward" to challenge the notion of progress: What do we think of biotechnology as a means to progress, what do we consider a beneficial development and what is progress in the wider picture? The game promotes a playful and yet critical reflection on biotechnology's promises and on one's own opinions and attitudes regarding biotechnology and can be used as an introduction or ice-breaker in science and technology related courses. Pedagogically, the game corresponds with our views on an embodied, hands-on approach to learning and to obtaining critical thinking skills.

BIO-CHASE responds to a need to discuss and reflect upon the ambiguity and complexity of biotechnological solutions in a non-confronting manner. The game was developed by the coordinator of the Leiden University honours class "Who owns life" [1] for the "LIVING COUTURE" event [2], a series of activities (presentations, debates, art exhibits, workshops) about biotechnology as a means to a more sustainable textile industry [3, 4]. In this context, BIO-CHASE was developed as an exhibit that playfully confronts visitors with our hopes and fears regarding biotechnology and its promises for a better, greener and more prosperous future. Influential to the game's

concept was the notion of biotechnology as a technological fix [5, 6]. Many of the game's topics were derived from our experiences and expertise from several editions of "Who owns life". Desk research, especially on news archives, supported the writing of fictive text fragments. The game art was influenced by landmarks of both biotechnology (e.g. Herman, first transgenic bovine [7]) and bioart (e.g. GFP bunny [8]). By appropriating a known game concept, the game also relates to a practice of board games and mods for critical play [9].

BIO-CHASE has been played with visitors at two exhibition settings (LIVING COUTURE and Nacht van Kunst and Kennis [10]) and with students of the course "Entrepreneurship for society"[11], an interdisciplinary minor of Leiden University. Most players are quick to observe that the game forces upon them one-sided, over-the-top or oversimplified views that are hard to endorse. In response, they tend to articulate their personal opinions to better clarify a decision they do not fully support. Others quickly endorse the most beneficial (for their game position) option, which may raise objections from the rest. Players also regularly comment that the frequent flipping of directions makes both "heavens" feel unreachable and thus unrealistic, even utopian, and further contemplate about a middle ground. Overall, while much can be done to improve the gameplay and repertoire of topics, BIO-CHASE demonstrates a great potential in exposing the complexities of biotechnological debates and in stimulating conversation around opinions that are frequently implicit (i.e. based on "gut" feelings) or unarticulated.

Link to video
http://kallergia.com/media/biochase.mp4
References
1. Who Owns Life? Ethical, Juridical and Artistic Encounters with Biotechnology - Honours Classes - Education. 2014 June 2nd, 2015]; Available from: http://education.leiden.edu/honoursclasses/classes/who-owns-life-ethical-juridical-and-artistic-encounters-with-biotechnology-semester-2.html.
2. Living Couture or: How I learned to stop worrying and love bio-technology | Living Couture-event:. 2013 June 2nd, 2015]; Available from: http://livingcoutureevent.wordpress.com/.
3. Gübitz, G.M. and A. Cavaco-Paulo, Biotechnology in the textile industry—perspectives for the new millennium. Journal of Biotechnology, 2001. 89(2): p. 89-90.
4. Rowe, H.D., Biotechnology in the textile/clothing industry–a review. Journal of Consumer Studies & Home Economics, 1999. 23(1): p. 53-61.
5. Scott, D., The technological fix criticisms and the agricultural biotechnology debate. Journal of agricultural and environmental ethics, 2011. 24(3): p. 207-226.

6. Rosner, L., The technological fix: how people use technology to create and solve problems. 2013: Routledge.
7. Naturalis, N. Bull Herman - Naturalis Biodiversity Center:. June 2nd, 2015]; Available from: http://www.naturalis.nl/en/museum/top-pieces/bull-herman/.
8. Kac, E., GFP Bunny. 2000.
9. Flanagan, M., Critical play: radical game design. 2009: MIT press.
10. De nacht van kunst & kennis | De Nacht van Kunst & Kennis - Hét kunst- en wetenschapfestival:. June 2nd, 2015]; Available from: http://www.nachtvankunstenkennis.nl/.
11. Entrepreneurship for Society, 2014-2015 ~ e-StudieGids, Universiteit Leiden:. June 2nd, 2015];

Branko se brani

Luka Korošec
University of Ljubljana/Pedagogical faculty, Slovenia

Branko se brani (Branko defends himself) is an educational video game made in game development tool Unity. It is designed specifically for the third triad of elementary school. The main theme of this game is safety on the Internet. In it we simulate a simple operating system and its infection with a harmful program, that is how we present the dangers in a way that is very similar to reality. Its main purpose is to present various malicious programs and show an appropriate response in the event of detected infection. Throughout the game the player also gets a few tips on safer use of personal computers and the Internet.
Difficulty is adjusted to the target audience and it gives the player appropriate challenges that motivate him to achieve the learning objectives. During the game we often provide feedback about players actions and by extension their own learning process. He can use that information to pinpoint the areas where his knowledge is still inadequate and where there is room for improvement.

The player does not need any specific knowledge, because the whole game is based on simplicity and understandability, but it is expected that the player has some basic experience of using any kind of operating system.

tinyurl.com/brankosebrani

SMARTEGE: Seriously, electricity is no game: play safe

Aphrodite Ktena
TEI of Sterea Ellada, Greece

Over the last two decades we are witnessing an accelerating paradigm shift in electricity grids and markets. The power grid, enabled by technologies such as renewable energy sources (RES), microgeneration, telemetering and telecontrol, is required to move towards demand side management, under the pressure for energy saving and low carbon economy on one hand and electricity market deregulation on the other. Demand side management requires the user to be an active agent interacting in real time with the grid and the markets rather than a passive consumer whose interaction with the gird is exhausted in paying the bill and reporting faults. From this aspect, the majority of electricity users can be considered as technologically illiterate, lacking fundamental knowledge and skills, which hinders the uptake of technologies and distorts related policies.

In light of the above, we have designed and developed SMARTEGE, a gamified application in order to educate electricity users, regardless of age or background, and modify the way they perceive their relationship with the electricity grid. Persuasive modeling, gamification technologies and cognitive learning are used in a synergistic way in the application development. The expected learning outcomes of the user are to know, understand, apply basics of electricity use and generation towards efficient energy management and analyse, evaluate and create energy efficient scenaria.

Existing applications, such as Electric Box, Energy Quest, Ollie's World, Electrocity, Power Matrix, Energy Ville, et. al., are focusing mostly on children's and teenagers' conditioning towards a more overall 'green' attitude; address only one type of a user's interaction with the electricity grid; or, are designed to promote company products and processes. SMARTEGE on the other hand is a game of roles, simulation, strategy, quizzes and learning.The game uses an engaging graphic environment that emulates the basic daily functions and actions of an electricity user in a house and an office building, in real time. Using gamification mechanics, the user is led to understand the energy profile of appliances and equipment operating in the virtual buildings with respect to user-defined set points, to evaluate the effect of his/her actions and habits on them, to analyze the costs and benefits associated with energy upgrading or saving tactics. The user is gradually allowed to 'produce' electricity in the quest for net Zero Energy Buildings. The user's knowledge base is improving through various content forms, such as tips, reading material, quizzes, exercises. The

user is triggered at appropriate times with engaging messages and is motivated by counters, reputation points, leaderboards and badges. Special emphasis is given in the game's social dimension, employing social media, with the user being encouraged to interact with other users, exchange information and gain points. Finally, at advanced levels, with the purchase of appropriate hardware, the user can emulate, monitor and control the electricity use and production of a real installation.

The pilot application has been tested by students and preliminary survey results suggest that the application is engaging users' knowledge and motivation towards becoming active agents of the electricity market have increased.

https://www.youtube.com/watch?v=mY6S1RU4Omo&feature=youtu.be

Tella: Maths for Small Kids

Trude Løvskar
Bergen University College, Norway

TELLA - MATHS FOR SMALL KIDS
"Learn maths and have a good time when playing TELLA! The little yellow bird will help you along. Each of her eggs contains a bundle of activities. If you do well, you get to open colourful bonus games!"
Website: tella123.org

TELLA is an educational game for tablets that introduces children to basic maths through play. Created for 5-8 year olds, TELLA may also be enjoyed by younger or older kids. TELLA consists of several sets of games with tasks to be solved in a given order. The content can be easily customized by an adult – making tasks visible/invisible – providing the child with challenges that suit his or her skills. New tasks can be revealed as the child learns and masters each level.

TELLA is designed to be used at school or at home – in the classroom or on the sofa. The game is developed by educators and funded by the Norwegian Directorate for Education and Training.
Developed by
Bergen University College (Centre for New Media), Norway.
Statped (national service for special needs education), Norway.
Instituto Tecnológico de Informática. Universitat Politècnica de València. Spain

Our task: There is a need for learning resources designed for children with special needs, and the Norwegian Directorate for Education and Training offered funding to developers who would focus on mathemetics for first- and second graders. TELLA was funded, and this is what we want the game to do :

- 1.Teach mathematics, helping children build understanding of some basic consepts, connections and operations.
- 2.Facilitate basic digital competence.
- 3.Make maths fun and appealing for children with learning disablilities.
- 4.Make it possible for these children to feel mastery on a field where they usually have little success.
- 5.Facilitate individualized instruction in groups (classes) so that children may work/play on different levels without leaving their class, which will have a social integrative effect.
- 6.Be a tool for teachers who want variation of methods in their teaching.
- 7.Be a tool with obvious connections to other learning material (like text books) and physical/tactical/motoric learning situations.

In the context of school it has been important to emphasize the fact that digital learning may never fully replace traditional, non-digital learning. Children are physical beeings, and in order to learn they need to apply most senses. Tactical and motoric stimulation are crucial, and such activities are not afforded adequately by a screen. On the game website teachers are given examples of how to extend the game into physical space.

Design process: The process of designing the game, has been crucial to the result (which we consider a success) and also somewhat innovative. Experienced teachers have collaborated with designers and programmers, making sure that the game contains traditional elements of gaming, as well as meeting pedagogical objectives.

Within the possiblilities given by tablets, we have aimed to adapt the game to the Norwegian national standard of universal design of ICT (for the inclusion of people with disablilities):
http://uu.difi.no/english

Game website (includes download info): http://tella123.org
Game play video: https://www.youtube.com/watch?v=__YFwoMXRLM

NOUS: Playing how-to-learn

Gillian Morrison
Swinburne University, Australia

THE GAME: Nous is a strategy based board game, designed, through play, to teach primary school students in Grades 5 and 6 (10 - 12 year olds) the neuroscience and behaviours of learning. Namely how the human brain acquires, retains and processes facts and knowledge (explicit memory).

Our character, Nous is drowning in a sea of knowledge. Students, playing as a cooperative team of 'Lifesavers' against the Tidal Board, need to give Nous important information to swim safely with the current before the Tide takes Nous out to sea.
Each player must move 3 information tokens, Squidea, through specific functional areas of Nous' 'brain' ie the Thalamus, the Hippocampus, the Amygdala and the Cortex mimicking the encoding, retention and recall of information. Strategy cards, dealt at the beginning of the game, give each player opportunities to move their Squidea along the neuronal pathways but at each round a Tide card is played that works against the players. Each player is also dealt a unique Power card that they can use to boost a play in their move. Players need to work together and talk about their options during each round to maximise their moves within 7 rounds before the last Tide card is played and Nous drowns.

THE DESIGN AND DEVELOPMENT PROCESS: Nous is the artefact component of a PhD being conducted by artefact and dissertation by the author.

The dissertation will present the results from testing Nous on 2 populations (n=100) of students within a classroom setting over a 10 week period to first, determine whether the students increase their knowledge of the game's learning content (i.e. the neurobiology and behaviours of learning) and secondly, whether their class-room behaviour is altered as observed by their teachers.

Observations of these groups will inform design iterations of the game prior to a 3rd population of students (n=50) play-testing the game with a pre and post-test assessment. A standardised academic achievement test will be administered as a control and to test groups of students before the game-play (T= 1), after 10 weeks of play (T=2), and after 12 weeks of no-further play (T=3). The standardised testing will be used to assess if the game-based-learning translates to a variation in academic scores.

Whilst many games teach specific subjects, facts or skills, no games, to the knowledge of the author, teach the neuroscience and behavioural techniques of 'how humans learn'. Therefore the main aim of this research is to address this gap in the game-based-learning field by developing Nous to teach children how-to-learn and increase their academic performance.

POSITIONING THE GAME: For educational reference, the game is positioned with Board Games such as Code Monkey Island or Prime Climb. For collaborative play-style reference the game is positioned within a Pandemic context, though less complex, and the small race against the round, card game Hanabi.

Weather Trouble

Brian Nelson
Arizona State University, USA

SAVE science is a project investigating immersive games for assessing science learning with a more accurate reflection of scientific complexity than typical tests allow. Our team has developed a series of game-based assessment quests elicit what middle school students have learned in their classroom and that target specific standards that are currently poorly assessed on district or state assessments. Students have an overall goal of uncovering likely contributors to problems facing a small virtual town. Participants complete the games by interacting with characters and objects, collecting and analyzing clues, and using their existing understanding of both content and scientific inquiry to draw inferences. We hypothesize that this type of situated assessment will yield new insights into student understanding. Throughout the assessments, all student activity is automatically recorded in a database, allowing us to analyze both explicit answers to questions posed by characters as well as students' processes in coming to those answers. We are addressing several areas related to games for assessment, including design heuristics and validation of in-world actions as indications of understanding. In addition, we are investigating the use of the data from these assessments for scaffolding student demonstration of what they have learned and for scaffolding changes in teacher practice. Nearly 2000 middle school children (ages 11-14 years) with their 17 teachers have participated in SAVE Science from 2009 to date across the United States.
For the ECGBL 2015 Call for Games competition, we are submitting the mobile version of our Weather Trouble assessment game.

The main purpose of Weather Trouble is to assess students' knowledge of weather and climate concepts, as well as aspects of scientific inquiry. Weather Trouble's curriculum was developed through an iterative process bringing together middle school science teachers, science education researchers, instructional designers, and assessment experts.

In Weather Trouble, students enter a cartoon-themed, single-player virtual world. The game is set in a medieval/fantasy-themed country that is experiencing a drought. Students are asked to help a farmer in the town of Scientopolis find out why there has been no rain in recent months, and if the lack of rain will continue. To investigate this problem, students can interact with NPC characters in three different areas to obtain information about conditions at each area (the northern Shoretown, the southern Deserttown, and the central Scientopolis). Also, students can gather information about weather and climate conditions using a number of tools such as barometers, temperature gauges, wind vanes, recent weather forecasts, recent paintings of the country, and observations of moving clouds. To support scientific investigations within the games, students can compare measurements and observations from the 3 different areas.

A short video of this module can be accessed at:
https://www.youtube.com/watch?v=luaSUoZgOIA .
The Android app can be downloaded at:
https://www.dropbox.com/s/usozvq278zkng00/Weather%20Trouble.apk?dl=0
You will need to enable app installs from 'unknown sources' to install the app on your Android device.

The Hive Mind

Lenka Pitonakova
University of Southampton, UK

The Hive Mind is a creative 3D puzzle game where players explore the world of parallel programming by creating simple rules that control a swarm of robot builders. The game is aimed at teenagers and adults interested in swarm intelligence and computational thinking and has the potential to become a tool that educates a new generation of engineers.

Parallelism is a new paradigm in computing that is becoming more and more important as the computer systems that we rely upon become larger and more connected. Being able to design effective parallel systems is a real problem for modern engineers whose code must run on many interacting devices at the same time. Programmers and roboticists can draw inspiration from social insects in order to design systems of simple programs or robots that work together [1].

In The Hive Mind, a swarm of robots place bricks in the world based on rules that the player defines. One rule might specify that a brick should be placed beside another brick, causing the robots to build a low wall. The player can also place bricks by hand, allowing them to influence the construction process directly. Special coloured bricks emit gas that can affect robot rules, allowing players and their robots to build a huge variety of structures.

The game offers a tutorial, a sandbox mode, and a set of increasingly difficult challenges, each of which presents a specific structure that the robots must build. The challenge of the game is that robots carry out their instructions in parallel, which gives the rules the potential to interact in surprising ways.

The game featured as part of the University of Southampton's Science and Engineering Festival [2], confirming that people are fascinated by swarm intelligence and find parallel programming an intriguing challenge. Many compared the game to Minecraft [3] or Castle Story [4], although it is closer to Spore [5] from an educational perspective, since it embeds a scientific concept into the game play. The uniqueness of The Hive Mind lies in its emphasis on controlling robots in a new way in order to let them do the building work, rather than the player.

The game was developed alongside my PhD research [6], with financial support from the University of Southampton, and is available online [7]. A bug submission feature helps us to get feedback from the players [8] and fits into our agile development process. We also plan on publishing the game on IndieDB [9] and Steam [10], and will keep working on our Facebook page [11] to broaden our audience. Creating relationships with schools is a plan for later stages of the project.

The game is under development, with plans to update the tutorial mode to reflect the most recent developments [12], and also to split it into smaller parts, so that players can get into solving the challenges more quickly. To further increase the educational value of the game, the tutorials will also include facts about swarm behaviour in nature and in robotics.

[1] http://thehivemindgame.net/learn

[2]http://ngcm.soton.ac.uk/blog/2015-03-16/science-and-engineering-day-2015-the-hivemind.html
[3] https://minecraft.net
[4] https://www.castlestory.net
[5] http://www.spore.com
[6] http://cmg.soton.ac.uk/people/lp2g12/
[7] http://thehivemindgame.net
[8] http://thehivemindgame.net/news/update_0_5_1
[9] http://www.indiedb.com
[10] http://steamcommunity.com/greenlight/
[11] https://www.facebook.com/thehivemindgame
[12] http://thehivemindgame.net/news/update_0_5_2

The game can be found on http://thehivemindgame.net/
A game play video done for version 0.5 (the current version is 0.5.2 so this video is slightly outdated): https://www.youtube.com/watch?v=DUxrg2nfRR8

Bikeracer: Serious Attention Training Game for Elderly People

Alexander Pfeiffer
Donau Universität Krems, Austria

Our game the "Bikeracer" was developed together with a geniatric hospital, the "Haus der Barmherzigkeit", and funded by the Austrian Research Foundation. The game development had a budget of EUR 7000 within total project costs of EUR 43000. The game genre can be described as mixture of racing game and reaction time game. On the one hand the player has to keep the bike on the track, on the other hand he/she has to react to specific inputs. The target group consists of elderly people who are cycling on a more or less regular basis. In order to enhance the safety of the target group's cycling experience (an interactive attention training programm was developed involving offline trainings in a parkour park and online training sessions using the "Bikeracer". In the game players have to accomplish two main tasks:

a) stay on the track provided
b) react to quick time tasks by pressing the right button

The empirical phase involved three different experimental groups and one control group while all groups obtained offline trainings in a parkour park (where they had to react to real-time tasks):
Game A: quick time tasks only
Game B: cycling only
Game C: quick time tasks and cycling
Reaction time and error rate were measured in order to gain insight into potential effects on attention. Both tasks were tracked seperately while the difficulty was automatically adapted in intervals of 30 seconds.

https://www.dropbox.com/sh/nbr2x3ogxu2ufmb/AAAiG9JkeIVktiXp9JyKctzGa?dl=0
Click on All and download as ZIP. You may have to try a second time if it does not work initially. No Dropbox Login required! This shows the final stage of the game that had to work on approx. 15 year old PCs available at Austrian homes for elderly.
You can also watch a gameplay video which shows the first iteration of the game with higher in-game graphics:

https://www.youtube.com/watch?v=2fUcUhBNUKk
The graphics of the second iteration were downgraded in order to provide:
a) a clean look & feel
b) a low poly environment which is free of distractions
c) low system requirements

Rogi Logi

Jože Rugelj
University of Ljubljana, Faculty of Education, Slovenia, Slovenia

Rogi Logi is an educational computer game, intended for learning truth tables and logical operators. It is made for primary school pupils, who learn and get to know logical operators while studying maths, logics or computer science. The story hides the learning goals and presents the problems intuitively. The player controls Rogi Logi, a friendly rhino, and solves different problems such as fixing the plumbing system of an island called Neináli, which makes life easier for the island inhabitants and their king Bool.

The game encompasses several activities and increases the difficulty level along the way, providing a challenge for the player.

The game presents the operation of logical operators and truth tables for the mentioned operators. The game's feedback motivates the pupils during the play to continue and lets him/her know of success or failure at the end of the game.

Rogi Logi gives pupils and teachers a new and more attractive approach to learning basic logical concepts and acquiring new knowledge. Teachers can include the game into their pedagogical process, because it manages to use learning goals and motivational elements to offer a way of learning which is not very common but still familiar enough.
link to the game: http://radirka.si/?p=84
video of game play: https://www.youtube.com/watch?v=CPvqrGgNpAE

Czechoslovakia 38-89: Assassination:

Vit Sisler
Charles University in Prague, Czech Republic

Annotation: Czechoslovakia 38-89: Assassination is a complex single-player dialog-based adventure game with a strong narrative, including interactive comics and authentic audiovisual materials. It presents key events from Czechoslovakia's contemporary history and enables players to "experience" these events from different perspectives.

Objective: It aims to develop deeper understanding of the multifaceted political, social and cultural aspects of this time period. Its content stems from historical research and personal testimonies. Emphasis is given on the diversified historical experiences of the population, including previously marginalized groups. The game aims to develop abilities to comprehend, compare and analyze sources of facts and create critical judgments.

Story: The story of Czechoslovakia 38-89: Assassination covers the period following the assassination of Reinhard Heydrich, "Reichsprotektor" of the Nazi-occupied Czech Territories and leading architect of the Holocaust. Players are presented with different responses to the assassination of Heydrich, which in reality triggered a wave of brutal retributions, including the annihilation of the Czech village Lidice. Amid the repression, our protagonist struggles to understand: why his grandfather, J. Jelinek, was arrested after the attack? What role did he play in the attack? Why didn't he tell his family? Was he brave or reckless to endanger their lives by becoming a "resistance fighter"?.

Gameplay: Players in the game interact with the “eyewitnesses” in the present and “travel” back in time through these “eyewitnesses’” memories evoked during conversations. Player can’t change the history in the game yet discover different layers of it through individual testimonies and historical materials. The individual testimonies are oftentimes contradictory, incomplete, or the eyewitnesses simply do not want to talk about certain aspects of their past with the players. As a result, players have to critically evaluate the gained information, exert social skills and empathy, and analytically approach the social constructions of history.

Evaluation: Czechoslovakia 38-89: Assassination has been evaluated in 34 Czech high school classes in 2014. The evaluation’s key results show that students perceive the game to be attractive, authentic and immersive. They self-report it enables them to develop a deeper understanding of the time period. For teachers, the game is a learning tool that motivates students to learn about Czech contemporary history, stimulates debates and inquiries, and provides multifaceted perspectives on historical events. We are currently running a large-scale experiment testing the real learning effect of the game.

Development: We have employed a top-down design process, during which designers refined incrementally the game scenarios together with historians, educationalists, teachers and artists. We have separated game content data from the engine, exploiting benefits of the data-driven software architecture. The home-built engine enables modifications and expansions of the game, as well as development of new projects.

Acknowledgments: Czechoslovakia 38-89: Assassination has been developed at the Faculty of Arts and the Faculty of Mathematics and Physics of the Charles University in Prague and the Institute of Contemporary History of the Academy of Sciences of the Czech Republic. The development of the game was financed by the Czech Ministry of Culture.
Web
http://cs3889.com/
Trailer
https://www.youtube.com/watch?v=lfqvcVIgD-8
Gameplay video
http://vimeo.com/98154025

ABC Gurus

Catriona Wallis
Colto, Italy

ABC Gurus is an alphabet and phonics learning App for preschoolers. The App is playable in 5 languages: English (US + UK), Italian, Spanish, French and Portuguese.
ABC Gurus has the following objectives:

- To engage the attention for an average of 15 minutes per play session
- To encourage creativity and stimulate the imagination
- To provide practice for key literacy skills necessary for preschoolers to acquire based on the Emerging literacy skills from the American Core Knowledge Preschool Sequence.

Key literacy skills learnt in ABC Gurus include:

- Phonemic awareness ie. understanding that individual sounds are associated with individual letters
- Associating letter forms with their phonemic sounds
- Pronunciation and meaning of new words starting with each letter
- Recognising phonemic sounds of the first letter of words
- Names of letters

ABC Gurus can be divided into 2 parts; the first where players choose a letter and create characters out of them by colouring in and adding features such as eyes, mouths and moustaches and decorating with accessories and stickers.

The second where the player interacts with an animation of a word starting with the letter and takes a photo of the animation and the players' personalised letter.

The game's homepage presents an intuitive interactive menu with the alphabet pulsating on a rotating planet. A button on the top right side allows players to choose between upper and lowercase letters. The Parents and Privacy section on the top left side includes further information about the game, how to play, tips etc. and is protected by a parent gate (in complaince with COPPA).

The player swipes the planet to rotate the letters and when a letter is selected, hears audio naming the letter. The game then goes to the screen where they personalise the letter. The player has complete freedom to create whatever they want with 5 colours and 35 features and stickers. This encourages creativity and stimulates the imagination.

Colouring the letter, the player continually hears the phonemic sound the letter makes in a fun phonemic audio loop. When dropping features onto the letter, short phonemic sounds play. This is incidental learning, one of the most powerful teaching techniques for preschoolers. By continually playing with the letter form and listening to its phonemic sound, players incidentally learn to associate letter forms with their phonemic sounds through repetition.

The player taps the play button and the game moves to the next part with the personalised letter and an interactive animation of a word starting with the letter. Audio associating the letter with a word plays eg. A is for Alligator. Players touch animations to interact with them and hear the audio of the word. Touching their personalised letter they repeatedly hear the name of the letter..

At the end the player has the option to take a photo of their personalised letter and animation and it's automatically saved in a separate album on the device's photo library so players can create their own alphabet album.

iTunes link:
https://itunes.apple.com/app/id932417099
Game trailer link:
https://www.youtube.com/watch?v=hiX-MZa_qV8

ZTECH de OO

Jason Wong Yoke Seng
KDU University College, Malaysia

Ztech de Object-Oriented is an edutainment game that guides users to learn object-oriented programming in an easy and relaxing environment. Players or users will play along with the flow of the program step-by-step as they learn to grow their character (Ztech). To enhance the learning process, this game possesses an attractive storyline, pleasant game environment, nice and suitable sound effects, elegant character design, and appealing animations. When the game starts, the character will have the navigation system that allows it to travel around the game map. In order to become stronger and more powerful, it has to fight with enemies who are terrorists. Some NPCs will help the character by providing it with missions. When the character finishes the missions, it can earn rewards either by increasing experience or by obtaining new equipment to improve current abilities. While the users are having fun with the game, they are actually learning object-oriented knowledge. Ztech de

Object-Oriented is a stand-alone game in which each player will play and learn in his or her own application. The game guides users to understand the concept of object-oriented programming. The gaming part aims to increase and foster the users' interest in learning the knowledge. The game provides users with all the basic object-oriented concepts like encapsulation, inheritance, and polymorphism. In addition, the game includes some basic programming concepts which could improve the users' understanding. Ten mini puzzle games are featured with basic programming knowledge through five levels in the game. With these features, Ztech de Object-Oriented could be a catalyst to smoothen the path of learning object-oriented concepts.

This game consists of five levels. First, the basic knowledge of object-oriented approach is introduced to players. They should pass through the first level after going through the objects and classes test. In level two, players are guided to learn about the control statement like if else and switch case as well as the structure of the method declaration. In the third level, the players are led to learn about the array and three types of looping statements. Quests are assigned to the players to ensure that they comprehend the concepts behind the knowledge. By completing the quests, players can proceed to the next level. In the fourth level, players start to learn about the main principles of object-oriented programming. They are exposed to the concept of encapsulation and inheritance. Examples are provided to bolster their understanding. At the last level, the game guides the players to learn about polymorphism principle. The game ends when players defeat the last boss, called Virus. From time to time, players are rewarded for their enthusiasm, in which they are encouraged to continue to learn new knowledge and skills.

https://drive.google.com/folderview?id=0B5wyC6aXBz9EflNTZ3h6b0xfamNnb3RaTUIySkRJcXZ6LVdsUnBOYXFEeklLMWFaSXB4UGM&usp=sharing

Onlabs: 3D Game for Distance Laboratory Training

Vasilis Zafeiropoulos
Hellenic Open University, Greece

Universities and medical companies face constantly the challenge of training new students and employees in the use of their laboratories. Yet the existing space and time limitations along with the high cost and sensitivity of some laboratory instruments, which are therefore not fully exposed to manipulation, as well as the safety rules that must be strictly abided by, result to a stiff and not always successful

training procedure. Moreover, the trainees don't usually have the opportunity to make improper use of the equipment and learn by "trial-and-error", rather they are instructed what to do and what not to do which definitely doesn't result to the best learning outcome. Our target is to overcome all those obstacles and provide the trainees with a test-bed simulation, yet realistic environment, where the aforementioned time and space limitations are not imposed, in order to experiment and make as many mistakes as they wish in order to learn but, on the other hand, their mission is not considered to be accomplished unless they've made the correct steps and in the correct order, too.

The application allows the open interaction between the user and the environment. This interaction is similar to the one of an adventure game, the trainee makes use of the arrow keys to navigate in the laboratory space and the mouse to press buttons, turn knobs, use specific objects alone or in pairs and collect several of them in their inventory for later use. Our game provides the ability to gain practical experience with the optical microscope, learn its functions and conduct a simple experiment by making a specimen to be viewed as well as get their performance evaluated in real-time by our embedded scoring algorithm. The goal for our students is to acquire useful laboratory skills and the knowledge that the microscopes are delicate instruments which should be properly and carefully used. A different experimental procedure, the preparation of a solution in the laboratory, may also be experienced. This includes the use of magnetic stirrer, accurate weighing scale, electronic pipette, conical flasks and laboratory glassware capable for sterilization and storage of solutions.

The software has so far been pilot tested with almost 60 undergraduate biology students and 100 high school science teachers. Participants had the opportunity to install the application on their PCs, and follow simple written instructions to navigate in the laboratory and familiarize with the optical microscope. In this way they came throughout the whole process and evaluated it in terms of versatility, utility and feasibility; feedback was very positive.This project has been co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) (Funding Program: "Hellenic Open University")

1) Game's site: https://sites.google.com/site/onlabseap/
2) Game's latest version (2.3) for downloading:
https://dl.dropboxusercontent.com/u/26494411/Onlabs_v2.3.rar
3) Version 2.1's screen-grab video with gameplay: https://youtu.be/EK9-aZ9hq1o

4) Learning activity for the microscoping procedure to follow while playing the game: https://drive.google.com/file/d/0BziBWPsYvKwHNThTSVRFMVRldG8/view?usp=sharing

Paper Citations

The importance of paper citations and Google Scholar

As an academic researcher you will know the importance of having access to the work of other researchers in your field as well as making your own work available to others. In the area of academic publishing this is achieved through citation indexing. There are a number of bodies that undertake this task including Thompson ISI, Elsevier Scopus and Google Scholar – to name just a few.

At ACPI we do all we can to ensure that the conference proceedings and the journals that we publish are made available to the major citation bodies and you can see a list relevant to this conference on the home page of the conference website.

However, it is also important for you, the author, to make sure that you have made your work available for citation – particularly with organizations such as Google Scholar. We are providing you here with the simple steps you need to take to do this and we would ask you to take the time to upload your paper as soon as you can.

Step one: Extract your paper from the full proceedings that you have downloaded from the Dropbox link provided to you.

Step two: Upload your paper to your own website, e.g.,

www.university.edu/~professor/jpdr2009.pdf ; and add a link to it on your publications page, such as www.university.edu/~professor/publications.html.

Make sure that the full text of your paper is in a PDF file that ends with ".pdf",

The Google Scholar search robots should normally find your paper and include it in Google Scholar within several weeks. If this doesn't work, you could check if your local institutional repository is already configured for indexing in Google Scholar, and upload your papers there.

More information is available from
http://scholar.google.com.au/intl/en/scholar/inclusion.html

We will separately upload the proceedings to Google Books which is also searched – but evidence has shown that individual upload results in quicker indexing by Google Scholar.

Your own institution may also subscribe to an institutional repository such as
http://digitalcommons.bepress.com/ or
http://dspace.org/

Providing the original reference of your paper is included you have our permission as publishers to have your paper uploaded to these repositories.

Sue Nugus ACPIL

Research Jotter

Research ideas can happen at any time – catch them in writing when they first occur