University of Brighton

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Abstracts and Conference Materials for the

15th European Conference on Games Based Learning

A Virtual Conference hosted by The University of Brighton, UK

23-24 September 2021

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Abstracts of Papers
Presented at the

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ECGBL 2021

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Papers submitted to this conference have been double-blind peer reviewed before final acceptance to the conference. Initially, abstracts were reviewed for relevance and accessibility and successful authors were invited to submit full papers. Many thanks to the reviewers who helped ensure the quality of all the submissions.

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ECGBL Preface

These proceedings represent the work of contributors to the 15th European Conference on Games Based Learning (ECGBL 2021), hosted by The University of Brighton on 23-24 September 2021. The Conference Chair is Dr Panagiotis Fotaris and the Programme Chairs are Dr Cate Grundy and Dr Marcus Winter, all from University of Brighton, UK.

ECGBL is now a well-established event on the academic research calendar and now in its 15th year the key aim remains the opportunity for participants to share ideas and meet the people who hold them. The conference was due to be held at The University of Brighton, UK but due to the global Covid-19 pandemic it was moved online to be held as a virtual event. The scope of papers will ensure an interesting two days. The subjects covered illustrate the wide range of topics that fall into this important and ever-growing area of research.

The opening keynote presentation is given by Pete Jenkins, CEO of Gamification+ Ltd, on the topic of *Seven Steps to Gamification Success.* The second day of the conference will open with an address by Diana Laurillard, Professor of Learning with Digital Technology at UCL Knowledge Lab, University College London, who will talk about *A Constructionist approach to games for conceptual change*.

With an initial submission of 163 abstracts, after the double blind, peer review process there are 88 Academic research papers, 12 PhD research papers, 1 Masters Research papers and 10 work-in-progress papers published in these Conference Proceedings. These papers represent research from Australia, Austria, Belgium, Brazil, Canada, Croatia, Cyprus, Denmark, Finland, France, Germany, Greece, India, Indonesia, Ireland, Israel, Italy, Japan, Malaysia, Malta, Mexico, Netherlands, Norway, Portugal, Republic of China, Taiwan, Romania, Russia, Scotland, Slovakia, South Africa, Spain, Sweden, Switzerland, Taiwan, UK and USA

We hope you enjoy the conference.

Dr Panagiotis Fotaris
The University of Brighton
Brighton, UK
September, 2021

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Biographies

Conference Chair

Dr Panagiotis Fotaris is Senior Lecturer and Course Leader for BSc Digital Games Development and BSc Computer Science for Games at the University of Brighton. He has previously held posts at the University of East London, University of West London, King's College London, and Abertay University. Before entering academia, he spent a decade in the Creative Industries in a variety of roles including mashup artist, radio producer, DJ, graphic designer, web developer, and music journalist. When not playing adventure games, Panagiotis focuses his research on the pedagogical potential of escape rooms, games, and immersive technology in the context of computing and design education.

Programme Co Chairs

Dr Cate Grundy is a senior lecturer, design practitioner and researcher at the University of Brighton, focussed on the creative application of design thinking and interaction design principles across a range of disciplines. Cate is versed in UX methods and specialises in applying them to three dimensions, from digital games to product design. Using the motivational power of games for social benefit is of particular interest and Cate currently works with Forestry England creating location-based games inside woodland areas, to encourage outdoor play for older children. Cate has developed new and innovative methods for co-designing games with young people, with a focus on addressing the latent and emotional needs that can lead to game success. She also developed an 'experience map' for games, to scaffold the user research process. These techniques been applied to a variety of projects, including the design of new games for Mind Candy Ltd., the creators of Moshi Monsters and Warriors. During her 18 years of teaching experience, Cate has attempted to introduce a variety of real-world projects to students. She runs a design consultancy, known as Brighton Product Lab, with final years and has project managed teams working for a variety of clients, from designing toys and games for a Gambian school, to medical products. Cate has also worked professionally as a designer with innovation companies, PDD Ltd.

Dr Marcus Winter is a researcher at the Centre for Digital Media Cultures and senior lecturer in the School of Computing, Engineering and Mathematics at the University of Brighton. His research is about enabling people to create and share content and applications with and for emerging technologies in the contexts of learning, cultural heritage and public engagement. While his earlier work focused on computer-supported collaborative learning, with particular attention to situated and social-constructivist models of learning, more recent work explores game-based crowdsourcing, social interpretation in museums and creative engagement with machine learning. Marcus collaborates with charities, educational institutions, cultural heritage organisations and industry partners in projects funded by national and international organisations**.**

Keynote Speakers

Pete Jenkins is an international authority on gamification, a lifelong gamer, successful entrepreneur and a lecturer. As CEO of Gamification+ Ltd he mentors and trains companies world-wide on the use of gamification to solve business challenges. Gamification+ won the Board of Trade Award from the UK's Department of International Trade in January 2019. Pete is an Honorary Ambassador for GamFed (International Gamification Confederation), having previously been the Chair from 2014 to February 2019, whose aim is to spread best practices within and support the gamification industry. Pete is in his 12th year as a Lecturer at the University of Brighton. He lectures on gamification and entrepreneurship at undergraduate and post-graduate levels. He also guest lectures on Gamification at King's College London and at ESCP Europe. Over the past 20 years Pete has built and sold two businesses. One was in security software and the more recent one was a telecoms and internet connectivity business. He is also an Ambassador for Brighton & Hove Chamber of Commerce and an Export Champion for the Department of International Trade, UK.

Diana Laurillard, Professor of Learning with Digital Technology at UCL Knowledge Lab, University College London. Formerly: Head of the e-Learning Strategy Unit at the government's Department for Education and Skills; Pro-Vice-Chancellor Learning Technology and Teaching at the Open University. Served on: the Governing Board of the UNESCO Institute for IT in Education, Moscow; Visiting Committee on IT, Harvard University. Researching: Neuro-informed digital games for low numeracy; the Learning Designer tool. Leading the Blended and Online Learning Design course, free and open to all. Recent book: Teaching as a Design Science, Routledge. Lifetime Contribution Award, E-Assessment

Association; Honorary Life Membership, Association for Learning Technology and Club Fondation Universitaire, Belgium.

Mini-Track Chairs

Ronald Dyer is currently EMBA-Director & Senior University Teacher in the department of Executive & Professional Education at SUMS with over 20 years of project management experience across financial service, education, agriculture and energy focused organizational transformation initiatives. His research focuses on serious games, gamification and play with a specific interest in the use of these tools for improved risk-based thinking practices within projects as well as strong interest in artificial intelligence, theories of play for pedagogical innovation and ideation to support general learner improvement & retention.

Thorkild Hanghøj is a Professor of Games and Learning at the ResearchLab: IT, Learning and Design (ILD Lab), Aalborg University, Copenhagen, where he also co-coordinates The Center for Applied Game Research (CEAGAR). His work focuses on exploring links between games and dialogue, games and literacy, and how to learn through designing games. He currently manages the research project GBL21: Game-Based in the 21st Century (gbl21.aau.dk), which takes a Dialogic perspective on how students develop design competencies when redesigning games within Danish (L1), mathematics, and science.

Olga Shabalina, PhD, associate professor at Computer-Aided Design (CAD) Department in Volgograd State Technical University, leader of itGames Group, hosted by CAD Department. The subject of scientific research concerns methodologies and techniques of learning games (including adaptive learning games) design and using them for teaching and training children and adults.

Dr Charlotte Lærke Weitze, PhD in innovative use of educational technology. Founder of Digital and Creative Learning Lab. Former assistant professor at IT, Learning and Design (ILD Lab), Aalborg University, Copenhagen, and at LearnT, DTU Compute, Technical University of Denmark. Educated Pianist. Research focus: Learning through game design, design of motivating and efficient educational technology, design for students' and teachers' motivation and engagement in learning situations involving technology.

Author Biographies

Ms Mifrah Ahmad, PhD scholar in Faculty of Arts & Education at Deakin University Australia. She completed her master's in computer science in Malaysia. She is a reviewer, software engineer, and currently sessional lecturer at Deakin University. Main research focus is educational games in primary school, teachers' perspectives and game designers' approaches to design complexity of games.

Saif Alatrash is a Full time PhD student under the cotutelle program between Coventry and Deakin University. His research investigates the utilisation of gamified storytelling experience via immersive technology in museum environments, which focused on Coventry's engineering heritage, specifically, the Lanchester petrol-electric car invented 95 years ago.

Mrs Evgenia Anagnostopoulou is a teacher of mathematics at ISC, University of Sussex, UK. She received her MSc in astronomy from University of Sussex (1991), PGCE from Edge Hill University (2018), and is currently doing her PhD in informatics at University of Sussex. Her main research area is game-based learning.

Jimmy Andersson is a teacher in neuroscience at University of Skövde, trying to understand the human mind from a biological perspective. Jimmy also has an MSc in evolutionary psychology to try to understand where human behaviour originated. With this background Jimmy now explores the mental and cultural effects of videogames on human behaviour."

Märtha Andersson, Ph.D. in Swedish and didactics, is a senior lecturer of teacher education at Luleå University of Technology. Her main research focus is multimodality, creativity, literacy, storytelling, and aesthetic learning processes in primary education.

Stavroula Andreopoulos is a Professor, Teaching Stream, in the Department of Biochemistry at the University of Toronto. In 2017, she was recognized by the Faculty of Medicine for her multi-year contribution to undergraduate teaching with the Sustained Excellence and Innovation in Life Sciences Education Award.

Sylvester Arnab is a Professor of Game Science at Coventry University UK, where he forefronts the investigation into the application of playful and gameful approaches in teaching and learning. He co-founded the award-winning GameChangers initiative, which is being adopted and adapted in other countries, such as Malaysia.

J. M. Asbee, M. A. 2016, Ph.D. candidate 2021, Behavioral sciences, Department of Psychology at the university of North Texas (UNT). Graduate Research Assistant in Computational Neuropsychology and Simulation (CNS) Laboratory at UNT and Teaching Fellow at UNT. Research focuses on neurocognitive and affective aspects of transcranial direct current stimulation, virtual environments, and brain-computer-interfaces.

Pratama Wirya Atmaja is a lecturer and researcher in Informatics Department of UPN "Veteran" Jawa Timur, Indonesia. His research is focused on serious games, gamification, and procedural content generation. For serious games, he is especially interested in game design on the technical level, e.g., how to integrate specific components of the gameplay and the lessons.

Masiar Babazadeh is a teacher-researcher at the Scuola universitaria professionale della Svizzera italiana (SUPSI), Dipartimento formazione e apprendimento (DFA), Locarno, Switzerland. He received his PhD in computer science from the University of Lugano in 2017. His main research areas include game development, game-based learning, and computational thinking.

Chitra Balakrishna, Ph.D, SFHEA, CeH is the Program leader for Cybersecurity at Open University. As part of her recent projects funded by Higher Education Academy and Department for Education, she has explored novel techniques such as game-based learning, behavioural analytics, and artificial intelligence to address challenges in cyber security skills training and human-errors in cyber security.

David Bar-El is a PhD candidate in Learning Sciences at Northwestern University. His dissertation explores how teachers design curricula using digital games, with Minecraft Education Edition as a focal case. David has published papers on digital games, accessibility design, and maker education in *Computers Science Education, The International Journal of Child-Computer Interaction,* and academic conferences.

Gavin Baxter is a lecturer in Computer Games Development at the University of the West of Scotland. His research activities include the use of serious games for teaching and learning purposes. His interests also reside in applying serious games as an immersive approach towards informing students about 'hard' and 'soft' skill sets required for employability.

Luca Botturi holds a PhD in Communication sciences from the University of Lugano. He worked in field and research projects in educational technologies in Switzerland, Italy, Canada, Spain and the United States of America. He is currently Professor in

Media in education at the Scuola universitaria professionale della Svizzera italiana in Locarno.

David Buentello Montoya conducts research and lecturing at Tecnológico de Monterrey, Campus Guadalajara, since 2019. Although his main area of research focuses on the use of biomass as a source of energy, he also conducts research related to innovation in education.

Tina Helene Bunæs is a Doctoral Research Fellow at Østfold University College and a PhD student in informatics at the University in Oslo. Her main research interests are game-based learning and virtualization technologies. In her PhD she investigates how this type of technology can be used as training applications for employees involved in time and safety critical work at hospitals.

Lance Bunt: Lecturer working in Vanderbijlpark, South Africa. Received a Communications degree from NWU in 2013, an Honours degree (Communication and Media studies) in 2014, and a Master of Science degree (Computer Science and Information Sciences, with I.T.) in 2020. Research areas of focus include communication, graphic design, serious games, learning design, user experience and much more. ResearchGate link: https://www.researchgate.net/profile/Lance-Bunt"

José Ramón Calvo-Ferrer holds a PhD in Translation and Interpreting from the Universidad de Alicante, where he teaches different modules on Translation, English and teacher training since 2008. His research interests lie in ICT in general and video games in particular for second language learning and translator training.

Fadi Castronovo Ph.D. is a Senior Lecturer in the Built Environment at the University of Brighton. His research focuses on the use of innovative technology for the enhancement of construction management and engineering education. His research focus also lies in the development and assessment of educational video games for the advancement of STEM education.

Jared R. Chapman has 25 years experience in education. For the past 9 years he has been researching and publishing in educational gamification and developing gamification plugins for the Canvas LMS. He is an Associate Professor at Utah Valley University and founder of Delphi-me.com. His career goal is to create environments where people are successful.

Dr. Luuk Collou finalized his PhD in 2020 at the University of Twente during which he developed and tested a simulation model and serious game for strategic human

resource management (HRM). Currently Luuk is working as an associate lector for the research group strategic HRM of Saxion University for applied Sciences in Enschede, the Netherlands.

Mário Cruz is Associate Professor in Foreign Languages Teaching at the School of Education of the Polytechnic of Porto. He is also an integrated researcher at inED - Center for Research and Innovation in Education. He holds a PhD in Didactics and Training, a PhD in Linguistic Studies and multiple MA.

Mária Čujdíková is a PhD student at Comenius University in Bratislava. She is studying a program Theory of Mathematics Education at the Faculty of Mathematics, Physics and Informatics. In her dissertation thesis, she explores how video games can develop mathematical thinking and how pupils perceive that they encounter math when playing video games.

André Czauderna is an education researcher working at the Cologne Game Lab of TH Köln, where he coordinates and develops the BA and MA Digital Games as well as teaches player research. His research interests include educational games, digital games as political education, game design education, learning in communities of practice, and qualitative methods.

Vincent Delke is a researcher at the University of Twente (NL) and Münster University of Applied Sciences (D), working on his PhD. His dissertation focuses on future skill requirements and roles of purchasing professionals within a future industry paradigm, Industry 4.0. Also, his work addresses future methods to educate the needed skills in purchasing and supply management.

Ryann Deloso is a project researcher at Satakunta University of Applied Sciences Well-being Technology research group. He received his Master's degree in Welfare Technology in Satakunta University of Applied Sciences. With years of professional experience as a nurse, he is interested in user experience of healthcare technologies and improving accessibility for older adult users.

Natalie Denk has a degree in Educational Science and Game Studies. Her research focuses on Game-based Learning, Educational Game Design and gender aspects in relation to digital games. Since 2014 she has been involved in research and teaching at the Center for Applied Game Studies at the Danube University Krems in Austria.

Pierpaolo Dondio is a lecturer at the School of Computer Science, Technological University Dublin. His research interests include Artificial Intelligence applied to Education and game-based learning. Since 2019 he is leading the Happy Maths

project to investigate how game-based learning can be used to mitigate the negative effect of Maths Anxiety in primary school pupils.

Lars Elbæk is an associate professor and researcher in the unit Learning and Talent in Sport (LET'S), SDU. Lars lecturer and do research in movement interaction and design research and has several years of experience in sport, physical movement, learning, and sport pedagogy. His special interest is movement-based design methods in sport and movement entrepreneurship.

Marta Ferreira Dias has a PhD in Economics from the University of Warwick. She is an Assistant Professor in the University of Aveiro. She is an integrated member of the research unit GOVCOPP. She participates in several European sponsored projects. She is Director of the PhD in Energy Systems and Climate Change. She is an author of scientific research.

Adriana Fogel is a Digital Media Ph.D. student at the University of Porto, Portugal. Her main interests encompass serious games, media literacy, health, and food literacy. She is also a research assistant at the project PLATE (Promoting food literacy through technology).

Micaela Fonseca holds a PhD in Physics. Micaela is Principal Researcher at HEI-Lab (Digital Human-Environment Interaction Lab) and assistant Professor at the ECATI, Lusófona University. Micaela has been engaged in several VR-based simulation projects, she is co-founder of VR4NeuroPain and Games for Good. She has published several scientific papers in ehealth and serious games.

Sílvia Fornós: PhD fellow in the Center for Computer Games Research (IT University of Copenhagen). Research is focused on game making as a learning strategy for chemical engineering. She is investigating how game jams can be used for learning in Higher Education and presents a custom-made game editor through which learners create game levels about chemical engineering processes.

Marta Fortunato is a PhD student in Education at University of Aveiro. Her research interests reside in how technological affordances can support foreign language learning. Marta's other interests include gamification and project-based learning in collaborative problem-solving contexts, which is the purpose of the study she's developing.

Sonja Gabriel works as a professor for media literacy at University Teacher College Vienna/Krems (Austria). Her primary focus of research is on digital game-based learning and using serious games for teaching different subjects at school and

university as well as evaluation of various projects for learning with games and game-design approaches.

Carolin Gellner is a research associate at Beuth University of Applied Sciences Berlin, Germany. She received her M.Sc. in computer science and digital media from Beuth University of Applied Sciences Berlin in 2019. Her main research areas are instructional design, gamification, and pedagogical agents in e-learning.

Henrique Gil is a PhD student at Glasgow Caledonian university. His main research area is gaming and ethics (empathy and game design techniques). He also teaches game design at the university. Game design, ethics and education are the areas which he is building his career around and the direction after his PhD.

Roger Gilabert is currently an associate professor and researcher at the University of Barcelona. His research interests include second and foreign language production and acquisition, task-based needs analysis, task design and task complexity, individual differences and L2 production and acquisition, multimedia learning, and game-based learning and SLA.

Marco Gilardi is a Lecturer in the Computer Games Development degree at the University of the West of Scotland. He received his PhD in Informatics from the University of Sussex in 2015. His research focuses on XR applications to different fields, from education to industry and cultural heritage.

Stefan Göbel holds a PhD in computer science from TU Darmstadt and has longterm experience in Graphic Information Systems, Interactive Digital Storytelling, Edutainment applications and Serious Games. Dr. Göbel is academic councilor and lecturer at TU Darmstadt and heading the Serious Games group at the Multimedia Communications Lab.

Pilar Gómez-Rey holds an MSc in Business Administration and an MSc in Education and Information and Communications Technology. She received her PhD in Education and ICT in 2017. She is an assistant professor at the Universidad Loyola Andalucía, Spain. Her research is focussed on measuring quality in online and distance scenarios.

Caroline Graeske is an associate professor in Swedish and didactics and ArcTech Learning Lab manager at Luleå University of Technology. Her leading research focus is didactics of literature and how to promote reading with the help of new methods like gaming and VR.

Mike Hyslop Graham is a first-year PhD student at the IT University of Copenhagen. With a varied background of physiotherapy, pedagogical management, and a MSc. degree within Games Studies, Mike researches players and their play-practises via ethnographic methods within the sociocultural frame of play and digital games as a mode of understanding, experiencing, and learning.

Dimitar Gyaurov is a PhD student at the Department of Control and Computer Engineering in Politecnico di Torino. Dimitar's research is focussed on interaction, engagement and learning in games, and the use of computer games to promote the development of complex problem-solving skills and sustainability learning. Dimitar's current project is 'Gaming for Sustainability'.

Daniel Handle-Pfeiffer is a team leader of digital teaching at university of vienna, center for teaching and learning. He received his MSc in teaching studies of computer science and mathematics. He is reviewer of online conference "digiPH". His main research areas are playful pedagogy, gamification, digital teaching and teacher training.

Thorkild Hanghøj: Professor of Games and Learning (Aalborg University, Copenhagen) Co-Directs the Center for Applied Game Research. Heads the GBL21 project, which explores how students can develop 21st Century Skills based on game design activities. Holds a PhD on playful knowledge in educational gaming. Current research areas include: games and dialogic education, games and literacies and games and teacher roles.

Raphael Heereman von Zuydtwyck is a PhD candidate at the Maastricht Sustainability Institute (Maastricht University), focusing on sustainability research projects. He is the deputy head of the research institute GEMIT at the University of Applied Sciences Niederrhein, Germany and project manager of the Dutch-German publicly-funded research project STRASUS.

Jérôme Hernandez is a Ph.D student affiliated with Sorbonne University and French National Center for Scientific Research in the MOCAH team. He is supervised by Thibault Carron and Mathieu Muratet (both associate Professor). His main area is the assessment of behavioural profiles relying on gamification and serious game approaches.

Henry Himmelstoss is researcher at the Fraunhofer Institute for Manufacturing Engineering and Automation IPA since 2019 where he is working in the department competence centre for Digital Tools in Manufacturing. In one of his roles, he is one of the project managers of the innovation lab Future Work Lab.

Alexander Hofer is a master student at Johannes Kepler University Linz, having just recently finished his bachelor thesis on the topic of gamification. He currently works on a research project regarding diversity in programming education.

Huei-Tse Hou: Professor of Mini Educational Game Development Group, Graduate Institute of Applied Science and Technology, National Taiwan University of Science and Technology, Taiwan. Expert in game-based learning, gamification for teaching, and learning behavioral analysis, Prof. Hou has more than 150 publications in the fields of education and technology, including more than 50 ISI-SSCI-indexed journal articles.

Mona Höyng is a doctoral candidate and research associate at the Department of Human Resource Management at University of Duisburg-Essen in Germany. Her research focusses inter alia on challenges of digitalization in the workplace and education as well as new approaches in crises and change processes, such as the Covid-19 pandemic.

Suzaan Hughes is a lecturer in the College of Business and Economics, at the University of Johannesburg. She has a keen interest in leveraging technology to enhance student learning and engagement. Suzaan initiated and continues to co-manage the longtitudinal research project, “Increasing the impact of simulation based courses”.

Niklas Humble is a PhD Student in Computer and System Science at the Mid Sweden University. He has a background as a K-12 teacher and IT-coordinator and is now teaching on programming courses. Research interests include Programming education, Game-based learning, System development, Artificial intelligence, Learning analytics.

Jennifer Jenson is Professor of Digital Languages, Literacies, and Cultures in the Department of Languages and Literacy Education, Faculty of Education, The University of British Columbia. She has published on game-based learning, digital game cultures and gender, gender and technologies, and online learning in higher education, among other topics.

Osvaldo Jiménez is an Associate Professor of Computer Science at the University of the Pacific. His interests lay at the intersection of computer science and education, thinking of how to leverage both areas to improve one another. He has published and is active in both educational game and computer science education circles.

Patrick Jost is a researcher at NTNU University, Norway, with twelve years of experience and expertise in User Experience Design and Human-Factors in Computing Systems. In his research he has specialised in Game Studies and Gamification where he has led international Design-Science projects delivering Serious Games and AAL products.

Michal Kabát (1985) is a lecturer at the University of Ss. Cyril and Methodius in Trnava (department of digital games). His research focuses on local history of games and play, virtual worlds and pornography. He teaches various game development and esports related subjects.

Zoi Karageorgiou: PhD candidate of the School of Applied Arts (Hellenic Open University-HOU) and student at the University of Aegean. She studied Applied Informatics (University of Macedonia) and graduated the Master Program of Graphic Arts-Multimedia (HOU). She is actively involved in STEAM Escape rooms and the combination of creative writing, theater and technology tools.

Sarah Kernaghan-Andrews is an Innovation & Community Assistant at DMLL and has a keen interest in progressive methods of filmmaking and learning technology. She co-created the initiative, Virtual Escape Rooms (VERs), an adaptation of the escape room methodology in online learning to facilitate active learner-led activities for Higher Education, which has been adopted by European-funded projects.

Md Saifuddin Khalid is an Associate Professor in Learning Technology and Digitalization at the Department of Applied Mathematics and Computer Science and the leader of the Centre for Digital Learning Technology (LearnT) at the Technical University of Denmark (DTU). His research and teaching contributes to both developing and adopting digital systems in learning contexts.

Akif Quddus Khan is a PhD Candidate at the Norwegian University of Science & Technology Norway. He graduated with distinction from NUCES Pakistan. He was awarded a gold medal from the president of Pakistan for excellent academic achievement.

Thorsten Kodalle LTC lectures on security policy at Command and Staff College of German Armed Forces, focusing on NATO, Cyber and Strategic Wargaming. He is a member of the NATO research task groups “Gamification of Cyber Defense/Resilience” and “Distributed Wargaming in a COVID-19 World”. He is a certified Scrum Master and an experienced wargaming facilitator, especially for matrix wargaming.

Ekaterina Kubina. She is a master's student and is actively engaged in research activities. It cooperates and develops projects with representatives of business and universities. Her works are devoted to such topics as: modern education, redevelopment of territories, innovations in the development of urban space.

Tamara Kuhn is Vice President and Research Scientist at dfusion, a small business focused on improving health and well-being through technology. She received her masters degree in Sociology from Stanford University. Her focus is on using technology to bridge research to practice, primarily through digitally delivered interventions across a variety of topics. She has been PI on more than 35 NIH funded research projects.

Sandra Miranda Leal holds a Bachelor of Computer Systems Engineering and a Master of Information Sciences and Knowledge Management. She is a full-time professor of computing at PrepaTec at Tecnologico de Monterrey, Mexico. Since 2015, she has been involved in different educational innovation projects.

Meng Chew Leow is an academician at Multimedia University, Malaysia. His research interest is in game-based learning, specifically in role-playing game-based learning. He is also interested in system science, practical spirituality, and philosophy. He is currently engaged in works related to digital advertising using Digital-out-of-Home (DOOH) platforms and is studying the relationship between audience engagement and advertising effectiveness.

Georgios Liapis: Post graduate student in Artificial Intelligence (Aristotle University of Thessaloniki, Department of Informatics). He graduated in 2019 from the Department of Information Sciences (University of Macedonia) with a degree in Applied Informatics. His research interests span the fields of intelligence, smart vocational guidance and machine learning, with a primary intelligence testing in different areas.

Maria Ximena López, PhD, is a psychologist and affiliate research fellow at the University of Huddersfield, UK. She received her PhD in innovation and evaluation in education from Roma Tre University, Italy, in 2010. Her research interests span across disciplines involving technologies for dementia, game-based learning, sustainable development and critical thinking.

Alexander Lund, Masters student (Sports & Health Sciences) at University of Southern Denmark. Main field of work is Digital design and sports, and how that can be used to promote a healthy lifestyle. Specializes in VR games for disabled children

Joelle-Denise Lux is research assistant and doctoral student at the Institute for Geography Education of the University of Cologne. Focus of her research is the education about current socio-ecological challenges with the help of digital games, for which she draws on her backgrounds in both geography and multimedia design.

Patricia Lyk is a PhD student in the Department of Embodied Systems for Robotics and Learning Unit at the University of Southern Denmark. She has a MSc in Engineering (Learning and Experience Technology) and is currently interested in Mixed reality for education.

Kayleigh MacLeod is a Doctoral Researcher and Teaching Fellow in the School of Design and Informatics at Abertay University. Kayleigh's main research interests include the exploration of the beneficial factors of games with cultural heritage and minority languages. Prior to joining Abertay, Kayleigh worked within the Games Industry after gaining her MProf in Games Development.

Dominic Mahon is a Research Fellow at Coventry University, UK, with research interests in the field of Education. He is particularly interested in measures of student development of skills and capabilities and the factors that impact that development.

Gunver Majgaard (PhD) is Associate Professor at Embodied Systems for Robotics and Learning, Mærsk Mc-Kinney, University of Southern Denmark. She holds PhD in Robotics and Learning processes, which focused on design of educational tools and learning processes. The research focused on usage of physical-digital media and children as co-designers.

Joachim Majors (B.Ec Information Systems, Certified Usability Analyst (CUA by Human factors International)) is a usability and user experience (UX) practitioner and specialist (Experience Lab at Åbo Akademi University). Works mainly with companies and organizations with UX and Human-Centred design development processes projects. Current main project and future research areas are game development, game-based learning and player experience.

Christos Malliarakis: PhD in Serious Games and Masters degrees in Information Systems and Management. Has developed CMX, an educational MMORPG for learning and teaching computer programming that won the 2nd Educational Game Competition in the category of the install-based games in the 8th ECGBL 2014. Has published more than 40 papers in international conferences, journals and book chapters.

Andrea Maragliano is a Researcher Fellow of Experimental Pedagogy at University of Genoa, Italy. Them main research field is Educative Game Design and Game for Social Change. They also has developed edu-larp scenarios for EU project and NGO training on field as migration, social justice, gender issues and sustainability.

Asge Matthiesen is a Ph.D. student at the university of Southern Denmark. His master thesis was based on design of a VR tool to help patients with eating disorders together with the clinical department of health at the university hospital of Odense. His interests are mainly in VR, development, design and usage of such technology.

Mihaela Moca is a teaching economy at the "Partenie Cosma" economical college in Oradea, Romania and starting with 2019 she is enrolled as a PhD student at the Faculty of Economic Sciences, University of Oradea. Her main research activity is focused on e-learning, m-learning and the role played by technology in relation with gamification and game based elements in economical education.

Jana Müller is a bachelor student in digital business administration at Beuth University of Applied Sciences. She is interested in the research area of digital learning on seniors.

Gabriel C. Natucci is a PhD student at University of Campinas (UNICAMP), Brazil. He works with game design in an indie studio and as an associated teacher at UNICAMP. His main research areas are serious games, emotional design, human-computer interaction and affective computing. His research is focused on integrating game design, emotions and learning.

Derek P. Ng is an Assistant Professor in the MScBMC program at the University of Toronto. He teaches courses on interactive media design and biomolecular visualization. His research focuses on developing and evaluating novel data visualization and interaction methods and tools for knowledge discovery, interpretation, and communication in molecular biology.

Iolie Nicolaidou is an Assistant Professor in "Emerging technologies for learning" at the Department of Communication and Internet Studies (Cyprus University of Technology). She holds a Ph.D. in Educational Technology from Concordia University, Canada. Her research interests revolve around emerging technologies, particularly digital games, and the evaluation of their impact on learning and motivation.

Thea Nieland (M.Sc. Psychology) works as a research assistant at Osnabrueck University. She studies the management of digital transformations in organizational contexts and user-centered design. She has been involved in various research projects in the field of higher education and is currently ensuring user-centeredness in the course of the development of a game-based learning application.

Mareike Nutz: a master's student of computer science and geography at the University of Tuebingen. In my bachelor's thesis I developed and evaluated the educational board game "On the Trails of the Traveling Merchant".

Jorge Oceja is a teacher, Ed. psychologist and M.A in instructional design by California State University. While working on his PhD he completed academic residencies at Universidade do Minho (Portugal), Aalborg University (Denmark) and Leuphana University (Germany). Besides working on the university, he has taught in Elementary and Secondary in Spain, UK and USA.

Sónia Pais, PhD in Education, is an Associate Professor at the Polytechnic of Leiria. She is a researcher at CiTUR- Centre for Tourism Research, Development and Innovation. She is interested in Mathematical Education, Educational Technology and Mathematics and Arts.

Adam Palmquist is an industrial PhDc in Applied IT at Gothenburg University and works as Chief Scientific Officer (CSO) at the Swedish gamification company Insert Coin. Palmquist has a background in learning and (analogue) game design. His PhD project is a collaboration between the University of Gothenburg and Insert Coin.

Matthew Pattemore is a PhD student at the University of Barcelona, investigating the effective use of feedback in digital game-based language learning.

Chiara Piazzalunga (leading author) is a research fellow at Politecnico di Milano. She is focusing on learning disabilities and serious games design and she is currently developing tools to provide early screening and reinforcement methods to children at risk.

Aristidis Protopsaltis is a senior researcher at the Innovation in Learning Institute, Friedrich Alexander University of Erlangen-Nuremberg, Germany. He holds a BSc in Primary Education, an MSc in Cognitive Science and Intelligent Computing and a PhD in Cognitive Science and he is a scholar of the Hellenic State Scholarships Foundation (IKY).

Maria Rigou is an assistant professor at the University of Patras, Greece. She received her PhD in computer science from University of Patras in 2005. Her research interests are in the fields of web mining, interaction design and usability evaluation, and has published her research in international journals, books and conference proceedings.

Cornelia Schade is a research associate at the Media Centre of Technische Universität Dresden. She received her M.Sc. in Management and Organisation Studies from Technische Universität Chemnitz in 2017. At the Media Centre she works in the department of Digital Learning and Teaching and her main research area is Game Based Learning and Serious Games.

Antonia Schorer is researcher in European educational projects and PhD candidate at the Innovation in Learning Institute, Friedrich Alexander University of Erlangen-Nuremberg, Germany. Her research interests include different aspects of digital learning and how digital technologies can be used to achieve educational and social goals, particularly through the use of serious games and game-based learning.

Anna Seidel is a research associate at the Brandenburg University of Technology Cottbus-Senftenberg, Germany in the field of psychology of learning and instruction. As part of the *Learn&Play* project, her work focuses on motivation in game-based learning scenarios, feedback and evaluation.

Olga Shabalina is an Associate Professor at Computer-Aided Design Department of Volgograd State Technical University. Her research interests are in educational sphere, including how best to teach engineering subjects. She is particularly interested in new methods and technologies for educational games development and application of game-based learning to the higher education curriculum.

Anjuman Shaheen: PhD student of computing, engineering and mathematics at the University of Brighton, UK. She has been working in game design and development for over five years and remained engaged with multiple projects, mainly education, people's wellbeing, and entertainment. Currently, PhD research is developing Reflective game design principles to improve self-regulatory behaviour for game-based learning.

Daria Shalina studies at the Ural Federal University (Yekaterinburg, Russia) in the 3rd year, Department of Economics and Management of Construction and Real Estate Market. Has been engaged in research activities for 2 years. Has more than 15 publications. ORCID 0000-0001-5930-1340. Research interests: real estate

development, game-based management, new educational technologies, and human resource management.

Karen Shanks is a PhD research student at Glasgow Caledonian University. After receiving a First-class honours degree in Psychology with Interactive Entertainment, she started her PhD in May 2019. Her main research areas are serious video games, game design and behavioural psychology.

Bernadette Spieler is Professor of CS Education at Zurich University of Teacher Education in Switzerland. Previous, she was a visiting professor at the University of Hildesheim, Germany and a postdoctoral researcher at TU Graz, Austria. Her work focuses on engaging teenagers in playful CS activities with the goal of improving girls' experiences in particular.

Ton Spil (1964) teaches in the area of Business Information Systems. He is track chair e-health in main conferences and published on ISI A level. In 2021 his main topics are adoption of IT, business modeling, serious gaming and digital strategies applied on (tele)health, music and banking.

Ramona Srbecky holds a bachelor degree in computer science and a master degree in IT-Management from Wilhelm Büchner Hochschule in Pfungstadt (Germany). During her studies, she held various roles in software development at Siemens Energy (Germany). She currently works as a vocational trainer for computer science in the internal training center at Siemens Energy.

Antonia Stagge is a research associate at the Media Centre of Technische Universität Dresden. She received her M.A. in Communication and Media Science from Universität Leipzig in 2017. In the E.F.A. project her main field of activity is the media-didactic conception of the serious game.

Matilda Ståhl (MEd, certified primary teacher) is a doctoral candidate in educational sciences at Åbo Akademi University, Finland. Her doctoral thesis focuses on identity (co)construction online within an educational context. Parallel with her thesis, she does research on a participant's perspective of games in various contexts.

Kristian Stancin is a PhD student and teaching and research assistant at University of Rijeka, Department of informatics. His field of research include the use of information and communication technology in learning, especially for students with disabilities.

Francesco Strada, received the MSc degree in Digital Media from Politecnico di Torino. He is currently a PhD student at the Department of Control and Computer Engineering of the same university. His research focuses on Human Computer Interaction, Virtual Reality, Augmented Reality, game-based learning.

Anton Sukhov is an associate professor at the Ural Federal University. In 2012 he create (the first in Russia) electronic course on game studies. His research papers on game studies were in the Top 2% on Academia.edu (2018). His main research areas are educational, ethical, religious and aesthetic discourses of video games.

Veronica Szczygiel, Ph.D., is Assistant Director of Online Learning at Fordham University's Graduate School of Education. Her study, "Middle School Students' Political Interest, Efficacy, and Commitment to Future Participation During Game Play", examined motivation during a simulation game she designed based on *Lord of the Flies.* She has over ten years of classroom teaching experience.

Sundaramadhavan Thittanimuttam is an innovator, chess education and activist for peace education. As a principal investigator for the largest impact Chess-in-Schools study in India (and in Asia). He was a former FIDE Secretary for Higher Education & Research, FIDE Chess-in-schools Commission. He holds a Masters Degree in Information Technology and Specialisation in Robotics from Carnegie Mellon University.

Stina Thunberg, Ph.D.-student in Swedish and didactics, is a lecturer at teacher education and researcher at ArcTech Learning Lab at Luleå University of Technology. Her main research focus is games, literacy, and educational design.

Elaine Tsai is an 11th grade student attending Taipei American School. The reason for her to work and write on this topic is due to her interest in creating a fun and engaging way of learning solubility rules as high school is oftentimes stressful and high-demanding academic environment. She wishes that through this card game students can enjoy learning solubility rules and achieve good learning results.

Stavros Tsikinas MSc is a PhD candidate of Applied Informatics at University of Macedonia, Greece. He received his MSc in game and media technology from Utrecht University in 2015. His main research area is serious games in special education and in particular serious games for people with intellectual disabilities and autism.

Chioma Udeozor is a Marie Curie research fellow under the EU Horizon 2020 CHARMING project (https://charming-etn.eu/). She is a PhD researcher in

immersive technologies such as digital games, virtual and augmented realities for engineering education at Newcastle University, UK. Her interests include the use of innovative technologies to improve education, businesses and healthcare.

Peter Vankúš is a university teacher at the Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Slovakia. He received his PhD in theory of mathematics education at Comenius University in 2002. His main research areas are game-based learning, mathematics related beliefs and attitudes and study of pre-service mathematics teachers beliefs.

Tamara Voigt works as a research assistant and lecturer at the University of Applied Sciences in Berlin. With an educational background in international media and computing she is doing research on the impact of innovative applications in educational or sociological contexts with a special interest in game-based approaches and immersive technologies.

Tone Vold lectures at The Inland Norway University of Applied Sciences, Norway, in courses within digitalization of workforms, organizational learning and knowledge management, and is particularly interested in games for learning. Her PhD is about work relevance of higher education for innovative and entrepreneurial behavior in organizations.

Sam von Gillern is an Assistant Professor of Literacy Education at the University of Missouri. His research focuses on people's digital literacy practices, which relate to how people utilize, learn from, and communicate through digital technologies. A primary area of interest is video game literacies and understanding how people interpret and learn from video games.

Philip Wolfgang is a master student in Sports and Health Science at the University of Southern Denmark. Philip is an experienced project manager within the field of movement based learning and innovative sports activities. Philip has a special interest in the juxtaposition between behavioral psychology and healthy lifestyle among kids and adolescents.

Wong Choon Yee is a lecturer of computing at University of Wollongong (UOW), Malaysia. He received his Master in Graduate Enterprise in Multimedia from University of Teesside in 2001. His main research areas are in gamification, education, and motivation.

Ningna Xie is a researcher in multidisciplinary sustainability projects in The Netherlands. She holds an MSc. In Sustainability Science, Policy and Society from

Maastricht Sustainability Institute (Maastricht University) and a B.A. in International Communication from Hanze University of Applied Sciences. Her research areas are game-based learning, sustainability communication and education for sustainability.

Marvin Zammit is a researcher at the Institute of Digital Games (University of Malta), currently reading for a Ph.D. course in Game Studies. His primary research interests are artificial intelligence, procedural content generation and computational creativity. He is also the co-founder of Mighty Box, a game development studio based in Malta.

Nathalie Zetzmann is a researcher and doctoral student at the Faculty of Educational Sciences at Saarland University. She received her master's degree in Psychology from Saarland University in 2019 and her main research topics are self-regulated learning in university context, game-based learning, as well as attitudes towards e-learning.

Stavroula Zoi, is a computer scientist, researcher, and faculty member of Athens School of Fine Arts, since 2004, where she exerts educational and scientific work, at undergraduate and postgraduate level. Her personal research interests focus on the intersection between technological thinking, creative expression and education, aiming to highlight innovative perspectives and applications for society.

Pei -Ying Zuo, is the master student of Mini Educational Game Development Group, Graduate Institute of Applied Science and Technology, National Taiwan University of Science and Technology, Taiwan

Keynote Outlines

Keynote Outlines

The following are outlines for the Keynote Speeches which will take place at ECGBL 2021.

Seven Steps to Gamification Success

Pete Jenkins, Gamificationplus, uk

Pete talks you through the Gamification+ framework for designing & delivering gamification projects. After 8 years of gamification consulting, the seven stages in this process are the secret to our continuing success.

For each stage Pete will explain how to apply it, the best practices from around the industry to apply at each stage and a few of the critical issues to watch out for.

You can have a free copy of the framework as a takeaway, but you will have to play and win the game to earn it...

A Constructionist Approach to Games for Conceptual Change

Diana Laurillard, Professor of Learning with Digital Technology, UCL Knowledge Lab

The design of games for learning begins with an analysis of what it takes to achieve the target learning outcome. The point of the transactional processes in an educational game is to entice the learner into doing the kind of cognitive processing that develops conceptual change, or skill improvement. This talk will focus on conceptual change, and the Constructionist approach to learning, derived from Seymour Papert's work at MIT. The talk will describe how it can guide the generic pedagogic design of game mechanics that are aligned with a conceptual learning goal, illustrated especially with reference to basic maths for dyscalculic learners.

Research Paper Abstracts

An Adaptation of the 'Escape Rooms' Methodology in Online Learning to Facilitate and Investigate Active Learner-led Activities and Experiences

Sylvester Arnab, Emma Eyre, Mark Noon, Sarah Kernaghan-Andrews and Dominic Mahon
Coventry University, UK

aa8110@coventry.ac.uk
DOI: 10.34190/GBL.21.005

Abstract: This paper discusses the adaptation of 'Escape Rooms' methodology in online learning and investigates whether meaningful learner-led activities can be supported. The study has been built into an existing module at Coventry University, where students are expected to demonstrate study skills/competencies needed to analyse, employ, synthesise, and communicate evidence. The sampling was opportunistic, targeting students (n=13) who were already registered on the module. Microsoft Teams was selected as the online platform. This paper firstly discusses the design and development considerations, and secondly explores students' experiences using a multi-method approach to evaluate student engagement and competencies. The engagement aspects include the playful experience, perspectives on the approach, and gameplay strategy. Competencies associated with the learning objectives of the module include identifying a range of evidence types (scientific discovery and application, digital literacy) and interpreting information from a range of different evidence types (data interpretation, time management, problem-solving, exploring data). The target competencies also include communication and teamwork. The findings identify that co-created virtual escape room (VER) features enabled students to positively engage in the task leading to positive feelings about the experience. Students perceived that the VER enabled them to develop skills/competencies and knowledge, specifically problem solving and teamwork. The investigation highlights that online platforms not necessarily associated with playful experiences can be recontextualised to support meaningful learning experiences. The approach can be adapted on other platforms.

Keywords: online learning, playful learning, active learning, escape rooms, virtual escape rooms

Towards the Mapping of Learning, Playful, and Frugal Aspects for Developing 21st Century Competencies and Resilience

Sylvester Arnab[1], Dominic Mahon[1], Alex Masters[1], Luca Morini[1], Jacey-Lynn Minoi[2] and Fitri Mohamad[2]

[1]Coventry University, UK

[2]Universiti Malaysia Sarawak, Malaysia

aa8110@coventry.ac.uk; ad5251@coventry.ac.uk; ac0187@coventry.ac.uk; ac2009@coventry.ac.uk

DOI: 10.34190/GBL.21.043

Abstract: The paper draws from the development of playful approaches in education in the ACES project (http://aces.gchangers.org), which aims to underpin a playful approach as an empathic, agentic, and frugal means for engaging young people within a creative inquiry process to enhance social resilience. Play is considered an enabling instrument for equipping young people with the relevant skills to manage the realities of tomorrow, where play is the freedom for them to engage with, develop curiosity about, and learn from the world and people that surround them in positive ways. Acknowledging that there is a link between play and the development of a range of competences young people will need to flourish, this paper proposes a mapping framework towards articulating the relationships between the aspects of play, the competencies that playful learning may afford, and the types of resilience that these competencies may develop. Such a mapping approach can be used to analyse and form considerations for the design of playful educational activities. The mapping is co-created with the ACES partners in Malaysia, Vietnam, and Indonesia, and the approach takes inspirations from Arnab et al. (2015)'s Learning Mechanics-Game Mechanics (LMGM) mapping model which has been extended to consider motivational theory (Proulx et al., 2017). The paper will present the mapping framework of the aforementioned aspects and provide a mapping example using the "STEMBucket" programme in Malaysia, which is designed to engage teachers and learners in playful STEM activities towards social innovation and resilience development.

Keywords: playful learning, resilience, 21st century skills, frugal education

Video Game Usage, Substance Use, and Sleep Among College Students

Justin Asbee[1], Danica C. Slavish[1], Daniel J. Taylor[2] and Jessica R. Dietch[3]

[1]University of North Texas, Denton, US
[2]Arizona State University, Tucson, US
[3]Oregon State University, Corvallis, US

justinasbee@my.unt.edu; danica.slavish@unt.edu; danieljtaylor@arizona.edu; j.dietch@gmail.com
DOI: 10.34190/GBL.21.058

Abstract: Video games are a popular form of entertainment, and their popularity is projected to grow in many industrialized nations. Research has indicated that video game usage could have potential benefits and drawbacks on health. One such drawback is poor sleep. Short sleep and poor-quality sleep are linked to increased risk for depression, obesity, all-cause mortality, and diabetes. The current study examined the associations between sleep behaviors and video game usage. Additionally, caffeine and alcohol consumption were investigated, as they may co-occur with excessive video game use and may jointly impact sleep. In the current study 1032 (72% female) undergraduate students were recruited from a university in the southern United States between 2006-2007. Participants completed several questionnaires examining various health behaviors and demographics at baseline, as well as sleep diaries every morning for 1 week, reporting on their sleep from the night before. Researchers conducted statistical analyses using traditional frequentist linear regression models, as well as Bayesian models. Traditional analyses revealed that video game usage was related to increased variability in total sleep time (TST), but not average TST across a week. Alcohol use moderated the relationships between video game usage and TST and variability in TST. Video game usage was not associated with sleep efficiency (SE) or variability on SE, nor was this association moderated by caffeine or alcohol consumption. Caffeine consumption was related to average TST, average SE, and variability in SE, while alcohol consumption was related to variability in TST and variability in SE. Bayesian models suggested little evidence that average or variability in TST was related to video game usage, caffeine consumption, or alcohol consumption. Only caffeine consumption was associated with decreased average SE and increased variability in SE. Overall, this study provides evidence that video game usage is not robustly associated with poor sleep among undergraduate students. However, caffeine or alcohol use may negatively impact the ability to fall asleep or stay asleep. Studies should replicate these results using longitudinal or experimental designs to

understand the directionality of these effects. Avoiding caffeine or alcohol prior to bedtime may lead to more consolidated sleep among undergraduate students.

Keywords: Video games, Sleep, Alcohol, Caffeine, Frequentist, Bayesian

Supporting Teachers Adopting Game-based Learning in Formal Education: A Systematic Literature Review

Mohammad Assaf, Ton Spil and Guido Bruinsma
University Of Twente, Enschede, Netherlands

m.h.a.assaf@utwente.nl
a.a.m.spil@utwente.nl
g.bruinsma@utwente.nl
DOI: 10.34190/GBL.21.131

Abstract: The COVID-19 pandemic has reinforced the significance of adopting a technological-approach for advancing the future of education, underscoring the need to bring transformational changes in teaching methods by making them more technology-centric. In this context, Digital game-based learning (DGBL) is an efficacious educational tool to improve the quality of education in future classrooms. According to extant academic literature, digital video games entail myriad benefits, such as enhancing students' learning motivation and boosting their involvement in the learning mechanism. In spite of the constructive characteristics of DGBL, digital games' utilization in formal education remains very limited. Additionally, the uptake for meaningfully embedding these games into everyday classroom practice or the curriculum at large has failed to meet expectations. Given the immense contribution of teachers towards the educational framework, their views on the potential accomplishments of digital games will inevitably affect decisions concerning how, when, and the purposes for which they would be coalesced with the learning process. Consequently, game designers and developers have taken commendable measures to encourage teachers to adopt game-centric learning in formal education. This paper conducted a systematic study of scientific literature using Grounded Theory to shed light on the various techniques utilized to shape teachers' acceptance for digital games and their implementation across formal settings. The study's findings suggest that it is possible to positively change teachers' attitudes towards DGBL by engaging them in game design, provided that it is done in a cost and time-effective manner.

Keywords: Game-based Learning, Serious Games, Formal Education, Literature Review, Grounded Theory

Integration between Learning Content and Educational Game Narrative: An Empirical Investigation of Technical Factors

Pratama Wirya Atmaja and Sugiarto Sugiarto
University of Pembangunan Nasional "Veteran" Jawa Timur, Surabaya, Indonesia

pratama_wirya.fik@upnjatim.ac.id
sugiarto.if@upnjatim.ac.id
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Abstract: Educational games keep gaining popularity among practitioners and researchers in the 21st century. Central to the games is the integration between game content and learning content. However, the integration is still poorly understood, especially on the lower, more technical level. Indeed, educational games' state of the art is arguably still fragmented, and educational game studies exploring lower-level technicalities are much needed. A subset of the integration topic is integrating the game's learning content with its narrative. Like games for entertainment, educational games can significantly benefit from compelling narratives. This paper, therefore, presents our preliminary empirical investigation into the topic. We experimented with an educational role-playing game whose narrative presented learning content consisting of lessons on informatics-related learning topics. The game's heroic-themed narrative framed the lessons' elements as items, which the player would collect to defeat the main antagonist. The integration followed an approach termed *medium coupling*, which partially integrates learning content with game content. The partial nature allowed us to change the game's learning topic and lessons while keeping the narrative intact. We employed three topics differing in familiarity, comprehensibility, and memorability aspects. Furthermore, we composed our game's narrative to possess several technical aspects: straightforward yet immediately engaging storytelling, an imaginative story, compelling plot hooks, and relatable and empathy-inducing characters. Sixty first-year Informatics students playtested our game in three sessions under different learning topics. Afterward, they reported their experiences through a questionnaire based on the Game User Experience Satisfaction Scale (GUESS) and EGameFlow scales. Our correlation test and analysis of the questionnaire responses uncovers several insights; among them is that familiar, easy to comprehend, and easy to memorize learning content can most effectively integrate with a narrative. Two other significant insights are: (1) simple and relatable characters suit educational games, and (2) being immediately engaging, enjoyable, and imaginative are essential qualities of the games'

narratives. From the analysis results, we extract general principles of integration between learning content and narrative. We also discuss our study's implications and limitations, with the latter concerning the lessons' category according to Bloom's Taxonomy and the preliminary nature of our study.

Keywords: Educational games, learning content, narratives, content integration, role-playing game, medium coupling

Enhancing Problem-Solving Skills with Educational Escape Rooms: a Middle School Case Study

Masiar Babazadeh and Manrico Francesco Frigerio
Scuola Universitaria Professionale della Svizzera italiana, Locarno, Switzerland

masiar.babazadeh@supsi.ch
manrico.frigerio@student.supsi.ch
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Abstract: Escape rooms and escape games have become a popular recreational activity which has also drawn the attention of teachers and educators in recent years. Educational escape rooms have been shown to be a fun and entertaining activity if brought to the classroom: while trying to break out of the room, students can develop soft skills as well as subject-matter-related competencies. In this paper, we present a case study on educational escape rooms used in a first-year Swiss middle school class in an effort to enhance mathematical problem-solving skills. We conducted the experiment on two different classes: an experimental class in which three math-related escape rooms have been played during the fall semester 2020, and a control group which had not played any. We assessed their problem-solving skills using a mathematics-oriented SPM Test (Lucangeli et al. 2003) to measure their problem-solving skills. The assessment was broken down into six categories: comprehension, representation, categorization, planning, execution, and evaluation. The test was administered to both classes at the beginning and end of the semester. Quantitative results indicated that escape rooms improved students' problem-solving skills, especially among pupils with a lower degree of performance. Empirical qualitative observation demonstrated an improvement in students' engagement and commitment during mathematics-based classroom activities.

Keywords: Educational Escape Rooms, Mathematics Education, Game-Based Learning, Problem Solving, Soft Skills

MountainQuest: Designing an Action/Adventure Game to Teach Children About Nutrition

Dmitriy Babichenko, Patrick Healy and Cynthia Danford
University of Pittsburgh, USA

dmb72@pitt.edu
pat.healy@pitt.edu
danfordc@pitt.edu
DOI: 10.34190/GBL.21.082

Abstract: Introduction: Worldwide, childhood obesity puts children at risk for co-morbidities and early death. Despite innovative interventions to enhance healthy nutritional choices, effective, sustainable outcomes are lacking, and unhealthy behaviors persist. Gamification shows promise in increasing child engagement, motivation and learning, while minimizing teacher burden. With child input, we designed an interactive digital game focused on basic nutrition knowledge for children to foster healthy nutrition choices. Our purpose is to describe the process, challenges, and lessons learned while designing MountainQuest, a multi-level, action/adventure, digital game engaging school-age children in decision-making through a game narrative incorporating mechanics. Method: Four design, implementation, and playtesting/user iterations were completed to assure acceptability, feasibility, and rigor of MountainQuest: 0.0) preliminary design; 1.0) initial prototyping with 2D platformer; 2.0) 3D platformer; and 3.0) 3D redesign. At least five SA children (8-14 years old) played each version for 3-5 days and provided feedback through semi-structured interviews. Affinity diagram analysis was used and informed each iteration. Inter-rater agreement on common themes was ≥ 70%. Results: Common themes were mapped into two prioritized lists: issues/bugs and game features wish list. For iteration 0.0, children collaborated with the research team to develop the game narrative and characters. Iteration 1.0 was evaluated as too "simplistic," "short," preachy," and "cartoonish." Iteration 2.0 had scenes deemed too long with difficult mechanics, and disruptive food management scenes; suggestions included incorporating more exploration and mazes. Iteration 3.0 yielded a game where school-age children manage food inventories influencing hunger, thirst, and energy metrics to successfully navigate a mountain, defeat trolls, and save a village. Conclusion: The children's input was direct, precise, and challenged the game designers. Inclusion of children as direct informants guided the development of MountainQuest into an engaging, interactive, and educational game to enhance healthy nutritional choices, preparing it for an experimental trial.

Keywords: game-based learning, serious games, nutrition, game design

A Skill tree Method to Identify and map in-game Skills to out-of-game Contexts

Per Backlund, Patrik Erlandsson and Jimmy Andersson
University of Skövde, Sweden

per.backlund@his.se
patrik.erlandsson@vgmuseum.se
jimmy.andersson.1986@gmail.com
DOI: 10.34190/GBL.21.011

Abstract: Gamification is the application of game design elements in non-gaming contexts to reach some purposes. It has been proposed as a solution in several domains, such as teaching, corporate training and healthy living. This paper presents the design and evaluation of the skill tree method which is a part of a gamified approach to motivate and support NEET-youth (Not in Education, Employment or Training) to leave their isolation and take steps towards better inclusion in society. The overall approach is based on two principles: 1) it targets adolescents with an interest in games 2); it utilizes their interest in games as the starting point for the intervention. Part of the intervention is based on a skill tree which maps in-game skills to out-of-game skills and visualizes the output so that the participant can become better aware of how their interest can drive personal development towards societal participation. The paper presents an evaluation of the skill tree method from the project staff perspective. The findings are positive but some need for improvements in the method as well as the tool were identified.

Keywords: Gamification, NEET, skill tree, effects, socialization

Design Considerations for Developing a Game-Based Learning Resource for Cyber Security Education

Chitra Balakrishna
Open University, Milton Keynes, UK

chitra.balakrishna@open.ac.uk
DOI: 10.34190/GBL.21.123

Abstract: An effective cyber-security training calls for change of behaviour that requires more than providing information about risks and reactive behaviours as in existing instructional approach. This involves complementing traditional lectures with active learning experiences. The young learners that are exposed to digital

technologies all their lives, often referred to as 'Millennials' (Brinkworth et al, 2009) are not particularly motivated by traditional, one-way lecture/presentation-based learning within the classroom setting. Consequently, there is an increasing pressure on educators to promote student engagement by being not just deliverers of content, but facilitators of the learning process (Hamari et al, 2004). This is often accomplished through active learning strategies such as the flipped classroom, technology integration and use of game-based learning methods. In this paper, we present the design considerations for developing game-based learning resources for cyber security education within the higher education setting. The discussion in this paper is based on the experience of designing a cyber security game for a second-year cyber security module to introduce concepts penetration testing and information gathering to students. The paper explores the challenges in designing a game-based learning resource for cyber security education. The particular focus is on the impact of using game jams and student-centric co-creation methods in game design. The paper further elaborates on how the learning objectives and pedagogical intent were mapped to the appropriate game mechanics during the game design process ensuring the game-based learning resource do not compromise on learning. The paper presents initial results of field-trialling the game among 16-17 year old learners.

Keywords: Cyber security game, game-based-learning, co-creation, student-centric

That Cute Creeper Just Blew Up My House: Lessons in resilience in Minecraft games

Kim Balnaves
Murdoch University, Perth, Australia

Kim.balnaves@curtin.edu.au
DOI: 10.34190/GBL.21.064

Abstract: Understanding children's authentic perspective of their participation and learning in games is integral to understanding how the learning is occurring. The aim of this paper is to uncover the children's reflections on how they have participated in and developed their strategies for developing resilience within a game built in the sandbox world of Minecraft on a Java server. Children in this study were 12-14 years old and participating in an after-school club. The school club takes place at an International Baccalaureate middle school where the children are encouraged to reflect using the Learner Profile Attributes. Across the IB continuum of programmes, the Learner Profile explains the ten attributes, consisting of both academic and social-emotional traits, that students develop through their

educational experiences. The development of the Learner Profile attributes is a central goal of an IB education. The Attributes were used to scaffold the discussion around learning and to enable the participants to reflect broadly about the way in which they had participated in the games. All children in the club had a common language for reflection, which they also used in school activities. Through this common language the researchers were able to expose the learning occurring at the apex of informal gaming literacies and formal education. The results are particularly interesting as the children not only reflected using the International Baccalaureate Middle Years Program Learner Profile Attributes but went on naturally to develop strategies also using these attributes- this was not anticipated by the researchers. Attributes were, after reflection, used by the children to develop ways of improving their gameplay and teamwork and the strategies for building resilience around these aspects. This was done through utilising a range of skills and resources from their informal play networks. This paper gives an overview of how the participants reflected on their development of resilience strategies and informal gaming literacies using the Learner Profile framework from the International Baccalaureate.

Keywords: Resilience, International Baccalaureate, Productive Failure, Learner Attributes, Tween Culture, Minecraft, games in schools

Teaching History and Bringing the past back to life with Serious Games

Gavin Baxter, Thomas Hainey, Antea Savorelli, Umar Akhtar and Ralica R. Ivanova
University of West Scotland, UK

gavin.baxter@uws.ac.uk; thomas.hainey@uws.ac.uk; B00350868@studentmail.uws.ac.uk; B00349339@studentmail.uws.ac.uk; B00361333@studentmail.uws.ac.uk
DOI: 10.34190/GBL.21.007

Abstract: Serious games are often characterised as being games developed and used for educational or non-entertainment purposes. The academic literature is saturated with definitions and developed games surrounding the concept. Despite this, there is a lack of quality meta-analytical and longitudinal analysis studies associated with use of serious games. One area where serious games have pedagogical potential is in teaching historical subjects and in displaying historical artefacts. Serious games, combined with evolving 3D modelling techniques and Virtual Reality (VR) capabilities can replicate historical events, artefacts, and

environments. The creation of a serious game or even virtual museum that informs individuals about the past have the potential to provide a sense of historical realism or immersion. In the context of Covid-19 and the current global impact to the tourist industry, the application of serious games for such purposes has undoubted significance. This paper reviews the academic literature surrounding the concepts of content and assessment integration in relation to developing historical games for pedagogical and knowledge sharing purposes. The research focuses on two points. Firstly, can serious games exhibit a sense of realism and immersion towards teaching and learning history. Secondly, what are the immersive characteristics needed to make a historical game immersive. Based on the literature this paper will provide a framework that identifies best practice towards making historical games immersive from a games design perspective. The paper also presents an example of a serious game intended to educate users about military machinery used in World War two. A display of 3D modelled Roman artefacts is also presented to document how 3D modelling can replicate an interactive and immersive virtual experience. The findings of the paper argue that there is a close interdependency between aesthetical and content design and learning outcomes towards depicting historical realism and immersion. Future empirical work is also discussed in the paper with the aim of evaluating the framework presented.

Keywords: Serious Games, Content and assessment integration, 3D modelling, Virtual reality, Historical realism, Games immersion

Fighting Viruses Though Escape Room Design with Students

Luca Botturi and Masiar Babazadeh
Scuola universitaria professionale della Svizzera italiana, Locarno, Switzerland

luca.botturi@supsi.ch
masiar.babazadeh@supsi.ch
DOI: 10.34190/GBL.21.037

Abstract: The first countermeasure against new waves of the pandemic is diffused science knowledge about what viruses are and how they harm our body. Can the design of a game offer suitable opportunities for relevant science learning about viruses? Moreover, can it contribute to the development of collaboration and communication soft skills, central both for academic success and in real life? This paper reports a case study of a mixed-class group of lower-secondary students in a Swiss Italian-speaking rural school that engaged in the design and development of

an educational escape room on viruses during a project week. The paper illustrates how the activities were organized following the *Star Model* for the design of educational escape rooms, how roles were distributed among pupils and teachers, and what scaffolding was offered in order to blend content and game design, so to achieve a scientifically precise and at the same time fun game. The game design experience has been evaluated through (a) the pre-post assessment of teamwork and leadership self-efficacy; (b) the pre-post assessment of science knowledge about viruses; and (c) an interview with the teacher. The case study illustrated that, while self-efficacy variations are minimal but still positive, designing an educational escape room with pupils can be conducive to relevant subject-matter learning and team building.

Keywords: escape rooms, game design, secondary school, science learning, soft skills, project-based learning, game-based learning, Covid-19

The Effect of Collaborative Gamification in the Student's Experience in a Mathematics Course

David Antonio Buentello-Montoya
Tecnologico de Monterrey, Zapopan, Mexico

david.buentello@tec.mx
DOI: 10.34190/GBL.21.026

Abstract: Gamification is a methodology with a potential still not wholly understood nor exploited, where game mechanics are presented in different environments like teaching and learning. Although the main advantage of gamification in teaching is an increased motivation to learn, it can also promote teamwork and collaboration. This work explores the advantages of using a leaderboard to motivate students and promote their teamwork in an undergraduate mathematics course. A team-based leaderboard and an individual leaderboard were implemented to display rankings in different groups, to determine if there was a difference in performances. Additionally, to find out the effect of rewards other than merit, a bonus was given to final grades in some groups based on the leaderboard score. Results came from evaluating the student's performance, as well as using a student experience survey. Findings indicated that the leaderboard increased the overall student motivation, but the effect was more significant when bonuses were given to students based on standings. Additionally, it was found that team-based gamification scenarios can lead to developing teamwork-related skills and improving the grades of underperforming students who receive help from the top students. Moreover, from the student experience

survey, it was found that most students liked using the leaderboard, and particularly those whose groups whose focus was to work in teams benefitted from the gamification mechanic.

Keywords: Gamification, collaborative gamification, gamification in mathematics, gamification in undergraduate teaching

End-user Development of Virtual Simulations for Task Training: A Literature Review

Tina Helene Bunæs and Joakim Karlsen
Østfold University College, Halden, Norway

Tina.h.bunas@hiof.no
Joakim.karlsen@hiof.no
DOI: 10.34190/GBL.21.085

Abstract: Extensive training in a safe environment is key when practicing medical procedures. At Østfold University College in Norway we are investigating the design and use of games and clinical virtual simulations, shedding light on how these can become more suitable as digital training tools for the medical practitioners at Østfold Hospital Trust. Previous studies have revealed multiple benefits when using virtual simulations as medical task trainers, as well as various issues regarding design, development and use of these digital tools. One of the issues point to the complexity of virtual simulations and their development cost. In a previous study, we discovered that simulations often lack variation within each training exercise and that the cost of expanding the simulation to better support a varied gameplay with multiple scenarios is high. To understand how these tools can be more beneficial to medical practitioners we have turned to the field end-user development (EUD), which focus on methods, tools and techniques that enable users to make adjustments within different software, modifying them to the user's needs. By combining knowledge from both research fields when designing virtual training tools, medical instructors can be empowered by using a digital toolkit where they can build various adjustable virtual training exercises. In this paper, we will present findings from a literature review focusing on EUD and how this field can improve and give insights into the design and use of serious games and clinical virtual simulations for task training. In addition to literature on EUD and serious games, we have looked at state of the art tools developed for users to create virtual simulations for both entertainment, education and task training. In this review we have identified 1) promising end-user tools for creating virtual simulations

for task training, and 2) issues and implications regarding the design and use of such tools. From discussing these findings, the article will recommend the next step to take in developing usable and effective tools for end user development of clinical virtual simulations for task training.

Keywords: End-user development, clinical virtual simulations, serious games, authoring tools, co-creation

Heutagogy as Narrative: Role-Playing Learning Design for Computer Science Teaching and Learning

Lance R. Bunt
North-West University, Vanderbijlpark, South Africa

Lance.Bunt@nwu.ac.za
DOI: 10.34190/GBL.21.006

Abstract: This theoretical article presents the foundational aspects of a conceptual, role-playing learning design intended for use in Higher Education Schools of computer science and information technology. The learning design intends to improve learning ecosystems, bolster student engagement and afford learners and educators the benefit of choice and amplified autonomy. Second-year students at North-West University (South Africa) will be the first cohort to experience the application of the newly-designed basic literacy framework which informs the broader role-playing learning design exhibited here. The Web literacy framework put forward by *Mozilla* in 2018 to teach critical online proficiencies serves as the inspiration for the framework; informing the overall role-playing learning design at various levels. Depth of Knowledge indicators are mapped onto the *Mozilla* framework to deepen its applicability to tertiary education contexts. Elements of gamification, furthermore, are imbedded into the learning design to engage students with the self-directed learning aspects of the concept itself, i.e. to participate in authentic learning experiences as put forward by heutagogical instructional strategies. The role-playing learning design makes three roles available to learners, namely: Business Analyst (Read), Web Developer (Write) and Customer Service Representative (Engage). These roles are tied directly to the three basic literacy skill areas iterated upon in the basic literacy framework discussed here. Moreover, this article represents part one in a series of articles exploring the efficacy and potential of this approach to better serve our student cohorts and expand educational offerings. Proceeding papers

Keywords: Heutagogy, learning design, role-play, teaching, tertiary education, computer science and information systems

BITInLine: A Serious Game to Enhance Business Information Technology and Strategy Alignment

Luuk Collou[1], Guido Bruinsma[2] and Maria-Eugenia Iacob[2]
[1]Saxion University of Applied Sciences, Enschede, The Netherlands
[2]University Twente, Enschede, The Netherlands

l.d.collou@saxion.nl
g.bruinsma@utwente.nl
m.e.iacob@utwente.nl
DOI: 10.34190/GBL.21.032

Abstract: For organizations that use IT systems in their primary business or as support of their business processes, optimal alignment between the business strategy and their business information technology (BIT) is critical. However, achieving business information technology alignment remains challenging due to the vast number of choices one has to make. Firstly, one has to choose from a large number of potential BIT practices. Secondly, one has to choose BIT practices that align with the business strategy. Thirdly, one has to understand the dynamics of combining multiple BIT practices. And, finally, as business strategy and BIT practices evolve, one needs to consider the long-term alignment as this has significant consequences for both the business strategy and the overall enterprise architecture. These intricacies of alignment mirror the challenges apparent in other business strategy-practice alignment domains. An example is human resource management and strategy alignment for which a simulation model and serious game has been developed in prior research. Here, we build upon this prior research. In BITInLine players have to select a set of BIT practices with the best strategy fit from a list of 48 different BIT practices. The challenge is to select a combination of practices over multiple consecutive simulated years (rounds within the game) that align to the organisations' strategic profile, and adapt to the outcomes of the choices made in previous years. Practices in the game are clustered around six key BIT topics emerging from the strategic alignment and enterprise architecture disciplines: (1) service strategy, (2) information & data strategy, (3) platform & application strategy, (4) Infrastructure strategy, (5) security strategy, and (6) operations and performance. In BITInLine feedback on the BITA and the deviation from the desired strategic profile is presented after each round (representing a year of using the selected practices). Using BITInLine, players can experiment with, and in doing so learn from, selecting multiple combinations of BIT

practices and experience the outcome of their choices in terms of BITA over multiple simulated years, while adapting their choice of practices to the situation at hand. In the current paper the serious game (re)design to create BITInLine and an initial trial run will be presented.

Keywords: Business information technology, business strategy, serious game, competing values model, game-based research method

Towards a Quality Label for Educational Games and Serious Games

Julian Conradt[1], Tobias Eckert[1], Polona Caserman[1], Marcel Schaub[2], Regina Bruder[2] and Stefan Göbel[1]

[1]Technical University of Darmstadt, Multimedia Communications Lab, Germany

[2]Technical University of Darmstadt, Research Group Didactics of Mathematics, Germany

julian.conradt@stud.tu-darmstadt.de
t.eckert@stud.tu-darmstadt.de
polona.caserman@kom.tu-darmstadt.de
stefan.goebel@kom.tu-darmstadt.de
schaub, bruder}@mathematik.tu-darmstadt.de
DOI: 10.34190/GBL.21.049

Abstract: Although digital serious games are becoming increasingly popular, it remains challenging to evaluate and compare them. Based on the "DIN SPEC 91380 Serious Games Metadata Format" and the "Serious Games Information Center," we present criteria for a quality label for effective and attractive serious games. With such a label, transparent requirements for high-quality serious games should create trust and thus increase the acceptance of serious games among all stakeholders – from users to developers. A digital game is considered to be a serious game when it fulfills the following requirements. Serious games aim to accomplish goals or challenges (mental or/and physical tasks) through game actions and defined rules. The intention of serious games must be to achieve at least one additional goal, a so-called characterizing goal, e.g., improvement of player's skills or sensibilization of player's values and orientation. This characterizing goal needs to be appropriately integrated into the game. Furthermore, serious games must be interactive and should enable players to explore or influence the virtual environment (the game world). Moreover, they need to be entertaining and must elicit and maintain the player experience. In this paper, we aim to identify quality

criteria for serious games and, in particular, educational games. These quality criteria can also be applied in other fields, such as healthcare, training, and simulation. We propose requirements for the three quality areas: (1) the serious part including the characterizing goal, (2) the game part maintaining the player experience, and (3) the fit between these two areas including technical implementation of the game. The first part of the paper provides background information and the motivation for this work. In the main part of the paper, the concept and criteria for a quality label are introduced. Hereby, the idea and aspects of the three dimensions are detailed. Afterward, the elaborated concept for a quality label is validated in the context of an existing educational game, Meister Cody – Talasia (Meister Cody GmbH). Finally, the results of this work are summarized and further research, development, and transfer activities are outlined.

Keywords: Serious games, educational games, quality criteria

Development of Mathematical Thinking through Playing Video Games

Mária Čujdíková and Peter Vankúš
Comenius University, Bratislava

maria.cujdikova@fmph.uniba.sk
peter.vankus@fmph.uniba.sk
DOI: 10.34190/GBL.21.039

Abstract: In our paper we describe possibilities for development of mathematical thinking through playing selected video games. In detail these games are Warcraft III, Machinarium, Divinity: Original Sin 2, and Cyberpunk 2077. The aim of our paper is to analyse the opportunities for development of mathematical thinking that these commercial games offer. A part of the paper concerns the theoretical background of this problem and the analysis of selected games from the point of mathematical thinking elements. For this analysis we use a qualitative approach - content analysis. In conclusion, we identified that selected games could help in the development of logical, strategical, combinatorial, and probability thinking, spatial ability, and quantitative thinking.

Keywords: video games, mathematical thinking, content analysis of games, informal learning

How Insights into Entertainment Games can Improve the Design of Educational Games on Complex Societal Problems

André Czauderna[1], Emmanuel Guardiola[1], Joelle-Denise Lux[2] and Alexandra Budke[2]

[1]Cologne Game Lab, TH Köln, Germany

[2]Institute for Geography Education, University of Cologne, Germany

ac@colognegamelab.de
eg@colognegamelab.de
jlux2@uni-koeln.de
alexandra.budke@uni-koeln.de

DOI: 10.34190/GBL.21.119

Abstract: Many educational games have been criticized for their lack of enticement to players, which is attributed, among other factors, to a low degree of complexity and a limited amount of choices, when compared to entertainment games (Sanford *et al.*, 2015). From the perspective of learning theory, this is insofar problematic as successful processes of learning require player motivation, great agency, and a well-balanced level of complexity, which correspondents and adapts to players' knowledge and skills (Gee, 2007). We thus assume that educational game design can learn from entertainment games, i.e., must look at them in order to improve educational games when it comes to their allure, their simulation/moderation of complexity, and their enabling of meaningful choices. With this in mind, we conducted a series of studies on commercially successful and critically acclaimed simulation and strategy games such as *Cities: Skylines*, *Civilization VI: Gathering Storm*, and *Tropico 6* referring to the topics of climate change, urban planning, migration, and/or resource management – from the perspective of geography education. Our research focused on different aspects such as the games' realism, complexity, geographical topics, facilitation of decision-making, and principles of political education, utilizing 18 game analyses and 8 qualitative interviews with game designers of these games. Based on the results of these studies, the present paper derives seven recommendations for the design of games on complex societal problems that can be used for educational purposes in geography education. Overall, the paper contributes to the greater effort to bridge the gap between entertainment game design and educational game design, thereby facilitating the creation of games that are both motivational and educational.

Keywords: complex problems, educational games, game design, qualitative methods, strategy games

Assessing Serious Games Within Purchasing and Supply Management Education: An In-class Experiment

Vincent Delke[1,2], Wolfgang Buchholz[2] and Holger Schiele[1]
[1]University of Twente; Enschede, Netherlands
[2]Münster University of Applied Sciences, Germany

v.f.delke@utwente.nl
wbuchholz@fh-muenster.de
h.schiele@utwente.nl
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Abstract: Purchasing and supply management (PSM) is evolving with the introduction of new technologies. To benefit from purchasing activities and technological advancement, purchasing professionals need specific skills (Bals et al., 2019). Therefore, current study programs need to be adjusted, and educational methods need to be found (Pekkanen et al., 2020). An example of these educational methods is Serious games as the beer distribution game within the Supply Chain Management (SCM) context (Forrester, 1961). However, available games are not focused on purchasing. Thus, an online purchasing game has been developed, focusing on cost-reduction techniques and supplier relationship management. In the game, the students manage an organisation's purchasing department and progress from an operative buyer towards a chief purchasing officer. Since this game is a substitute for the existing traditional lectures, the usefulness of this is tested in a group comparison experiment. A group following the traditional lectures (N=66) was compared to the group of students learning through serious game lectures (N=105). For data collection, self-rated surveys, pre-and post-survey, and the exam scores have been analysed. Based on the experimental methodology applied, it has been observed that students who played the game, scored significantly higher in the exam. Further, the design of the game was evaluated based on various criteria, such as competitive and collaborative elements, game design, and understandability. It has been shown that serious games are useful to deepen the understanding of purchasing and develop purchasing skills.

Keywords: Purchasing and Supply Management, Education, Serious Games, Skills, Experiment

Cultural Dimension in User Experience – Mobile Games for Older Adults: A Case Study

Ryann Deloso[1], Anja Poberznik[1], Nuno Pombo[2], Bruno M. C. Silva[2,3] and Sari Merilampi[1]

[1]Satakunta University of Applied Sciences, Pori, Finland
[2]University of Beira Interior, Covilhã, Portugal
[3]IADE, Universidade Europeia, Lisboa, Portugal

ryann.a.deloso@samk.fi, anja.poberznik@samk.fi, ngpombo@di.ubi.pt
bruno.silva@it.ubi.pt, sari.merilampi@samk.fi
DOI: 10.34190/GBL.21.162

Abstract: Cultural background of end users is usually neglected in the interface and product design as well as in the development process. This has led to poor usability and reduced quality of user experience of early products. This paper presents the effect of the cultural issues on the user experience of older adults from the Philippines and Portugal when using software, in particular mobile games. In our research, we investigated (i) what user experiences the two prototype mobile games evoke in elderly users; (ii) which features of the prototypes influence the participants' user experience; and (iii) how the cultural dimensions of the two countries affect the implementation of the study and the user experience of the participants with poor exposure to technology. In this qualitative study, we analyze and elaborate on the cultural dimensions of Portugal and the Philippines. In our discussion, we also refer to the findings of the previous studies on similar games conducted in Finland and China. We observed that gaming provided new experience for older adults and improved their confidence related to technology, along with the similarity of competitiveness, cheering, and usability during the trials. An unexpected finding was the negative effect that inappropriate assistive aids had on user experience among Filipino participants. The main goal of this paper is to propose a guide for developers, designers, and creators for a more user-centred design approach that views culture as an important part of the development process. In line with this, we highly encourage to consider cultural background in game design including the implementation of gaming into elderly care routines.

Keywords: serious games, user experience, cultural comparison, self-managed rehabilitation, older adults

StreamIT! - Towards an Educational Concept Centred Around Gameplay Video Production

Natalie Denk [1], Barbara Göbl[2], Thomas Wernbacher[1], Suzana Jovicic[2] and Simone Kriglstein[2,3]

[1]Danube University, Krems, Austria
[2]University of Vienna, Austria
[3]Mazaryk University, Brno, Czech Republic

natalie.denk@donau-uni.ac.at
barbara.goebl@univie.ac.at
thomas.wernbacher@donau-uni.ac.at
suzana.jovicic@univie.ac.at
kriglstein@mail.muni.cz
DOI: 10.34190/GBL.21.073

Abstract: The growing market of digital games has given rise to various activities beyond mere gameplay. Especially among adolescents this gaming culture manifests in the form of e-sports, streaming platforms and "Let's Plays", where gamers capture their game play experience in videos. Building on these trends, this paper outlines the methodology of the project *StreamIT!:* in order to create an educational concept to support social, technical and media literacies, we build on today's gaming culture and related activities to provide an engaging and motivational setting for students. Additionally, we discuss current gender imbalances in the field of gaming and lay out how related issues are considered in order to create an inclusive approach. Thus, working in close cooperation with stakeholders such as teachers, students and professionals from the field of e-sports and game-related streaming, we investigate the potentials and pitfalls of collaborative, gameplay-based video projects. We outline the potential of transferring the informal learning processes of streaming and Let's Plays into formal educational settings. In this active learning approach, various skills beyond the technical domain may be addressed, effectively fostering in-demand competencies such as critical media reception, communicative and social aspects. This paper illustrates how previous work feeds into our research design and what steps we undertake to devise an inclusive educational concept. Thus, by incorporating children's and adolescents' digital gaming culture and related phenomena, *StreamIT!* may address a broad spectrum of competencies in an engaging way.

Keywords: Let's Play, project-based learning, ICT literacy, gaming culture, streaming

Failures in Game-Based Learning Experiences Sometimes Win

Adriana Fogel[1], Daniela De Sousa[1], Patrícia Padrão[1,2] and José Azevedo[1,3]

[1] Institute of Public Health of the University of Porto, Porto, Portugal
[2]Faculty of Nutrition and Food Sciences from Oporto, Porto, Portugal
[3]Faculty of Arts and Humanities of University of Porto, Porto, Portugal

adriana.fogel@gmail.com
daniela.m.sousa@outlook.pt
patriciapadrao@fcna.up.pt
azevedo@letras.up.pt
DOI: 10.34190/GBL.21.080

Abstract: *Introduction:* Although it is conventional wisdom that we learn most from failures, it is uncommon to explore in scientific publications the adversities of the complex process of games' design and implementation. Therefore, mistakes in the process of game development are likely to be repeated, and the complexity of the design and implementation process is underestimated. *Aim:* To address the various challenges and adversities when designing and implementing PLATE, which is a Minecraft-based learning project that aimed to foster nutrition literacy in adolescents. *Methods:* Successive iterations of a qualitative approach including observation, focus groups and interviews were applied to every step. The focus was on what went wrong in each part. Each problem was classified and analysed. We started by designing a gamified strategy to be used in the PLATE project, including (1) analysis of the advantages and disadvantages of various options for games/platforms and digital media; (2) discussion of the content to be included, taking into account the students' curricula; (3) storyboard creation; (4) prototyping and designing process; (5) focus groups with teachers to present the strategy and playtesting with students; (6) game adjustments to meet criticism received. The final version was implemented at three hosting schools with different socio-demographic contexts. The researchers followed the project implementation in close partnership with the responsible teachers, identifying and solving the adversities reported. At the end of the project's implementation, interviews were carried out with the teachers and students, and the impressions of each participant were collected. *Results:* We identified main challenges concerning the game design and development, players experiences, school-receptivity, implementation, effectiveness, and project management. We highlighted unavoidable factors, related to school-receptivity and project implementation that demand customization of the experience according to the socio-educational context of the

host. *Conclusion:* This paper identified and expanded on the existing literature problems that may limit the success of a game-based learning experience, in order to contribute to a successful outcome.

Keywords: Minecraft, nutrition, education, literacy, game-based learning, gamification

Integrating Game-Based Learning for Intercultural Skills Development in Higher Education

Marta Fondo[1] and Pilar Gómez-Rey[2]
[1]Universitat Oberta de Catalunya, Barcelona, Spain
[2]Universidad Loyola Andalucía, Seville, Spain

mfondo@uoc.edu
pgomez@uloyola.es
DOI: 10.34190/GBL.21.084

Abstract: Europe has historically been and still is a multicultural space in which a large number of cultures have coexisted and mixed. However, multicultural coexistence often crashes against problems of social integration, discrimination, economically deprived realities, violation of human and social rights and racism (Ostergren & Le Bossé 2011). Thus, it is key to increase cultural awareness as a way to value each other's culture and promote tolerance to educate future generations within the values of social justice and knowledge democracy. With this purpose the subject *Inclusion, Multiculturalism and Coeducation* was included in the curricula of the degree in Early Childhood Education and Primary Education at the Universidad Loyola Andalucía (Spain). Unfortunately, Covid-19 obliged to migrate to online teaching and learning, hindering the practical approach of the subject. To address this problem, this article explores game-based approaches to help to develop collaborative learning enriching the understanding of cross-cultural realities. The project has a two-fold objective. It aims to foster integration in the multicultural classroom as well as game-based teaching training. With this purpose, a game-based project was designed using the ADDIE model (Yeh & Tseng 2019) as a spine. In addition, an online intercultural exchange between students at the Benemerita Universidad Autonoma de Puebla (Mexico) and Knox College Illinois (United States) served to nourish the intercultural content of the project. Mexicans and Americans gathered the content of their online conversations in a document and shared it with students in Seville. Afterwards, Mexican and Spanish students had the opportunity to interact online in groups in a Q&A session. Finally, there was an online session with an expert to evaluate the games and reflect on game design

principles. Qualitative data was gathered from the 27 undergraduate students in Seville. Results in this study highlight the power of game-based learning and intercultural exchanges to increase student's engagement and motivation through social interaction and enjoyment. However, the use of the ADDIE model for game design was perceived as too challenging by students.

Keywords: Game-design, Higher education, Intercultural Skills, Pre-service teacher training

Towards an Assessment Framework for Learner-Created Game Levels in Chemical Engineering Education

Sílvia Fornós and Daniel Cermak-Sassenrath
Center for Computer Games Research, IT University of Copenhagen, Denmark

sifo@itu.dk
dace@itu.dk
DOI: 10.34190/GBL.21.017

Abstract: Educational initiatives, which allow university students a considerable degree of agency in their learning, are receiving an increasing amount of academic attention. However, how to measure learner-driven experiences in terms of learning can be challenging. This study proposes a framework to assess qualitatively the platform game levels designed for an assignment in a chemical process design course. Students create levels for a digital game to facilitate knowledge about chemical processes. A pilot study is conducted with chemical engineering students, during which they are asked to create a level for a platform game with a custom-made editor. The resulting level, which is to represent a chemical engineering process of ammonia production, is coded and analysed to eventually provide an assessment methodology. After application in the pilot study, the assessment shows to be efficient, and results are discussed.

Keywords: platform games, generative learning, makerspaces, game jams, Higher Education, learning through game design, chemical engineering, qualitative assessment framework

Design-Based Research on a Cooperative Educational VR Game About Ohm´s Law

Regina Frieß, Tamara Voigt, Florian Gnadlinger, Christoph Holtmann and Martin Steinicke
University of Applied Sciences Berlin, Germany

Regina.Frieß@htw-berlin.de; Tamara.Voigt@htw-berlin.de;
Florian.Gnadlinger@htw-berlin.de; Christoph.Holtmann@htw-berlin.de;
Martin.Steinicke@htw-berlin.de
DOI: 10.34190/GBL.21.134

Abstract: Ohm´s Law (V=R*I) is one of the most important rules that any electrical engineer needs to understand. According to vocational instructors who are experienced with learners of heterogeneous educational backgrounds, an overall challenge is to convey a conception of the dependency between voltage, resistance and current. As physical explanations for electricity are complex theoretical constructs, abstraction models and metaphors are used to teach these concepts and their interdependencies. Especially the metaphors do explain certain characteristics but are only applicable to a certain extent. In-class experiments are usually considered to make electrical concepts and components tangible but are limited to simple scenarios that produce observable effects in an (due to regulations) extremely fail-safe environment. In contrast, targeting this topic in a virtual reality (VR) environment could offer several advantages, as the technology facilitates visual representations of abstract content as well as operating in dangerous - yet if simulated harmless - situations. Additionally, proven positive effects of digital game-based learning can be used to optimize learning effects. This paper describes the design-based and iterative development process of a cooperative virtual reality game which aims to improve the understanding of Ohm´s Law. Learners cannot only gain insights on power circuits, but they can also perceive the effects of adapting voltage and resistance. Whereas one of the participants plays the game in VR and is teleported to a crashing space station, classmates support the operator by solving calculation tasks and providing relevant information. The gameplay is designed to allow trainees to construct knowledge according to the experiential learning theory as well as to encourage them to collaborate with their teammates in small groups. Furthermore, the paper will discuss the impact of the game which is currently evaluated with students at different vocational training centres. Learning effects are measured by non-participant observation, questionnaires and group interviews before, during and after the experiments. Early findings indicate an improved understanding of Ohm´s

Law and reveal evidence for a correlation between the target group and the test environment, which will be further investigated.

Keywords: design-based research, educational VR game, cooperative game, ohm´s law, experiential learning

Can Digital Games Improve Critical Information Literacy?

Sonja Gabriel
KPH Vienna/Krems, Austria

Sonja.gabriel@kphvie.ac.at
DOI: 10.34190/GBL.21.056

Abstract: The 21st century has seen an enormous increase in fake news due to social media and the possibility to comment, like and share statements and pieces of news fast and easily. Critical information literacy – meaning the ability to distinguish between trustworthy and non-trustworthy statements – has thus become essential for everybody. As traditional classroom teaching does not seem to solve this problem, four games dealing with the topic of how to find out about fake news (Factitious, SWR Fake Finder, Fake It To Make It and Escape Fake) are presented and briefly discussed regarding their potential for teaching critical information literacy. These games provide completely different approaches towards the topic which will be discussed briefly. Games have proven not only to motivate players to deal with a certain topic in more detail but also have the potential to make people aware of facts / circumstances and also to practice how to find out whether a source might be trusted or not, the methods which are used to spread fake news and so on. This contribution presents selected results from a research project at an Austrian university teacher college: Pre-service teacher students in their first term had to decide upon three links they would click on just by having a look at the search engine results page and also needed to give reasons for their choices. Results show that most of the participants have problems in reasoning their decisions or use decisions which might lead them to not very trustworthy websites. Although the participants belong to the group of digital natives, it has been proven that there is a need in teaching critical information literacy. Digital serious games dealing with these topics might therefore provide a means of teaching.

Keywords: serious games, critical information literacy, qualitative research, fake news

Serious Games Focussing on Migration: Which Political Messages do They Convey?

Sonja Gabriel
KPH Vienna/Krems, Vienna, Austria

Sonja.gabriel@kphvie.ac.at
DOI: 10.34190/GBL.21.083

Abstract: Games dealing with topics like refugees and migration also want to convey a political message. They want to make people think about certain events going on and reflect on their own behaviour. Some games might even hope for people to donate money or vote certain political parties. The way these political messages are integrated into game design elements vary. This contribution discusses three serious games (Bury Me, My Love; Resilience, and Survival) and takes a closer look at which political messages they convey and how they do that. As the chosen games differ in their design and representation, the underlying messages are quite similar. They all thrive for people being more empathetic with refugees and understand the situation of people who have to leave their countries better by either sending them on the dangerous journey or putting them in the shoes of someone having to manage a refugee camp. Moreover, the games want to educate their players. All the three games analysed were designed with the help of refugees to make the narration and information the games are based upon correct and realistic. The methodology used for analysing the games is a qualitative one, using questions as guidelines for looking at certain game-elements like narration, rewards, choices, and player agency.

Keywords: serious games, refugees, game analysis, Bury Me My Love, Resilience, Survival

Application of the Octalysis Framework to Gamification Designs for the Elderly

Carolin Gellner, Ilona Buchem and Jana Müller
Beuth University of Applied Sciences, Berlin, Germany

carolin.gellner@beuth-hochschule.de
buchem@beuth-hochschule.de
s82646@beuth-hochschule.de
DOI: 10.34190/GBL.21.022

Abstract: Many publications have been devoted to gamification in recent years, but most studies have focused on younger populations in educational contexts. The elderly have been neglected in research, and most of the few studies with senior users have been conducted in the health context, e. g., to increase physical activity. However, only a few studies with senior users addressed gamification in the educational context. Gamified systems hold the potential for offering a wide range of new leisure activities for senior users that can improve their quality of life. Therefore, this publication, which is part of the ePA-Coach project, addresses the motivation of senior learners in an e-learning context. The ePA-Coach project aims to develop a digital learning environment for the elderly to improve their digital literacy in the context of the German electronic health record. Previous research recommended the need for age-specific considerations of gamification because of the deficits in older peoples' cognitive and physical abilities. Also, studies identified age-dependent differences regarding the persuasiveness of gamification. This paper presents an initial gamification approach for senior learners in e-learning, which we developed using an extensive literature review, the guidelines from the Octalysis framework, and data from a survey with experts from the project partner organisations. First, we describe the background of gamification and the Octalysis framework. Then we show senior users' game and gamification preferences and provide a review of the persuasiveness and gamification for the elderly. Based on the literature review results, we summarise implications for gamification designs for older learners and the quantitative survey results. Next, we outline the base gamification model with eight senior-friendly gamification techniques, including qualitative feedback and considerations for implementing an e-learning environment. The base gamification model described in this paper can be used by other researchers and designers. The paper ends with conclusions and next steps in research and development in the ePA-Coach project and general recommendations for further research.

Keywords: Gamification, elderly, Octalysis framework, senior learners, e-learning, digital literacy

Developing Reading Skills in EFL Through Adaptive Game-based Learning

Roger Gilabert, David Israelsson, Judit Serra, Matthew Pattemore, Sara Feijoo and Joan Castellví
University of Barcelona, Spain

rogergilabert@ub.edu; david.israelsson@gmail.com; judit.serraf@gmail.com; mattthew.pattermore@ub.edu; sfeijoo@ub.edu; joan.castellvi@ub.edu
DOI: 10.34190/GBL.21.076

Abstract: Digital game-based learning has been suggested as a potentially useful method to help improve literacy skills. Games have been shown to draw attention to and engage in processing of specific linguistic features and may allow personalization (Holmes et al. 2018). Yet little is known about how games may contribute to improving bottom-up development of specific linguistic features and how this may impact reading accuracy and fluency. iRead is an EU-funded innovation project promoting reading skills in different languages among 6000 primary school students. Curriculum-embedded lessons combined gameplay with reading from an e-reader. An adaptivity algorithm integrated in the system was used that generates individual trajectories that may vary in amount of practice of each feature. The system covers phonology, morphology, morphosyntax and syntax. In this study the overall goal is to measure the amount and quality of practice through both gameplay and e-reader use and measure their impact on reading accuracy and fluency. 72 EFL learners attending 6th grade participated in the study and they used two iRead apps 1-hour per week for 4-5 months. Pre-tests and post-tests were administered, measuring word and non-word reading accuracy and fluency (words per minute). Outcome measures include the number of games played with each feature, time on task, number of correct answers, errors and recovery from errors. Results are discussed in the light of both reading and overall language acquisition theories.

Keywords: game-based learning, serious games, reading development, personalization, adaptivity

XR Maths: Designing a Collaborative Extended Realities lab for Teaching Mathematics

Marco Gilardi, Thomas Hainey, Andisheh Bakhshi, Cristina Rodriguez and Alan Walker
University of the West of Scotland, Paisley, UK

Marco.Gilardi@uws.ac.uk; Thomas.Hainey@uws.ac.uk;
Andisheh.Bakhshi@uws.ac.uk; Cristina.Rodriguez@uws.ac.uk;
Alan.Walker@uws.ac.uk
DOI: 10.34190/GBL.21.115

Abstract: Serious games, games-based learning, and simulation-based learning have been used to teach Mathematics at various educational levels. In this paper we shall present a design process and the first steps towards an extended realities (XR) collaborative lab for teaching of mathematics at HE level, which is currently under implementation. Designing for XR applications is a complex task that requires knowledge from multiple disciplines in terms of interaction design, user experience, programming, and content creation. This complexity increases when the XR application is for educational purposes. XR education applications require additional competencies for defining learning objectives, designing activities that ensure that the objectives are achieved, and know-how regarding the integration of the application in the curriculum, whilst, at the same time, overcoming external barriers such as student access to technology and institutional support. The design process proposed in this paper aims to give guidance to designers of XR applications that are integrated in an education context. The design process is then applied in the design of XR Maths, a XR mathematics collaborative lab which aims to help students understand and familiarise themselves with mathematical concepts and improve the learning experience offering an additional teaching tool to lecturers. The purpose is to complement, and not replace, frontal teaching of Mathematics in different disciplines across different programs, supporting lecturers rather than being their substitute. To gather students' views and initial requirements regarding the use of XR for teaching mathematics, a survey and follow-up interviews were conducted between July and September 2020. The sample targeted were first year students enrolled in six different programmes at the University of the West of Scotland that involved mathematics modules. Lecturers in mathematics were also consulted to understand how the subject is taught to students from various programmes. In this paper, we propose a process for designing XR application for education and initial findings regarding the user and functional requirements for the XR Maths lab as well as the limitations and barriers that need to be overcome for the success of such platform are presented.

Keywords: Extended Realities, Design Process, Mathematics

Do Games Reduce Maths Anxiety? A Review of the Current Literature

Viacheslav Gusev[1], Mariana Rocha[1], Flavia H. Santos[2] and Pierpaolo Dondio[1]

[1]Technological University Dublin, Ireland

[2]University College Dublin, Ireland

viacheslav.gusev@tudublin.ie; mariana.rocha@tudublin.ie; flavia.santos@ucd.ie; pierpaolo.dondio@tudublin.ie

DOI: 10.34190/GBL.21.112

Abstract: The paper proposes a systematic review of game-based approaches to reduce Maths Anxiety (MA). Thirteen experimental studies carried out in children and young adults were included in the review. In all the studies analysed, the games used were designed for general learning, usually quiz-based or puzzle-based games. Although 8 out of 13 studies report a reduction of MA after the intervention, only in 6/13 studies this was significant versus a traditional learning control group. This could be explained partially by the absence of games explicitly designed to deal with MA. Just two studies explicitly considered anxiety-aware features in their intervention strategy, including working on the competition element and a real-time indicator of MA embedded in the game. Our review shows the need for targeted studies to understand the impact of specific game features on MA in order to support the design of anxiety-aware games. Potential features include the introduction of gender-aware game design to account for the prevalence of MA among girls and the investigation of more collaborative and interactive game-modes.

Keywords: Mathematics Anxiety; game-based learning; literature review

Development of an Instrument to Analyse Gameplay Features Promoting Complex Problem-Solving Conditions

Dimitar Gyaurov[1], Carlo Fabricatore[2] and Andrea Bottino[1]
[1] Politecnico di Torino, Italy
[2] E.H.E. Europa Hochschule EurAka, Switzerland

dimitar.t.gyaurov@gmail.com
carlo.fabricatore@gmail.com
andrea.bottion@polito.it
DOI: 10.34190/GBL.21.159

Abstract: Developing complex problem-solving skills and attitudes to survive and thrive in our uncertain and unpredictable world requires engaging in meaningful activities within appropriately designed learning environments. Even though serious games have the potential to satisfy these needs, there is a specific demand for additional research tools that offer a better and functional understanding of the relationships between gameplay features and desired impacts on players. Therefore, in this article we present the development and preliminary validation process of a theory-based analysis instrument of game elements, gameplay features, and their functions suitable to promote complex problem-solving conditions (GEFF-CPSC). The instrument integrates concepts from the theory of intention regulation for complex problem-solving and the theory-based complex problem-solving game based-learning model. The GEFF-CPSC instrument was created to analyse how core game elements promote core gameplay features and how core gameplay features promote each of the four complex problem-solving conditions for effective intention regulation processes: (i) acceptance of self-incompetence; (ii) prioritisation of important problems; (iii) routinisation of actions; and (iv) recollection of correct mental representations. The three stages for the design and preliminary validation of the analysis instrument were item creation, scale development, and instrument testing. The objectives of the stages were to ensure content validity, construct validity, and instrument reliability, based on preliminary item assessment, scale evaluation, and instrument pre-test performed by expert reviewers. The theoretical background, the development process, and the results from the preliminary validation suggest that the GEFF-CPSC instrument can be a significant contribution towards the comprehensive analysis of the relationships between core game elements and core gameplay features suitable to promote core complex problem-solving conditions required for managing complex problems.

Keywords: serious games, complex problem-solving, game-based learning, game analysis instrument, gameplay features

Playing and Reflecting Games: The Production of Gamified Learning Artefacts in Teacher Education

Daniel Handle-Pfeiffer and Christoph Winter
University of Vienna, Austria

daniel.pfeiffer@univie.ac.at
christoph.winter@univie.ac.at
DOI: 10.34190/GBL.21.122

Abstract: At the University of Vienna, students played and reflected different games within a blended learning course conducted by the teaching study program. The course included various aspects of digital learning such as the organisation of knowledge and flipped learning. It was held digitally using a videoconference tool called BigBlueButton and was designed in the Learning Management System Moodle due to COVID 19 restrictions. The structure of the session was based on the method "game based dialogue" (Schmoelz, 2016, p. 116). In the first part of the program students chose and played different games, like „Bad News" or „Quizventure" in Moodle. Thereafter, the students evaluated this experience in regards to their own needs as future teachers. Guided by questions, they discussed and reflected in small groups of pupils the potential of games for their own future of teaching. Their new found experience was critical for the production of a learning artefact, which contained gamified elements. The learning artefacts themselves were built in moodle or in H5P. The self-evaluation showed that the participants were able to utilize their aquired new set of skills develop, implement and improve a learning artefact over a self-chosen topic. The following paper describes the didactical approach of the gaming session, which was based on the "4Cs" of 21st century skills. Creativity, collaboration, communication and critical thinking (Fadel, et. al, 2017). Furthermore, we share the results of the students perspectives and learning outcomes towards game based dialogue, which were recorded in a feedback tool in Moodle. We learned that students consider gamification and games as useful for different aspects of teaching, but the application of such elements might be restricted to experienced and motivated teachers.

Keywords: Game Based Dialogue, Digital Learning, Gamification, Collaborative Learning, Use Case, Reflection

Games, Dialogue and Learning: Exploring Research Perspectives

Thorkild Hanghøj[1], Kenneth Silseth[2] and Hans Christian Arnseth[2]
[1]Aalborg University, Denmark
[2]University of Oslo, Norway

thorkild@hum.aau.dk
kenneth.silseth@iped.uio.no
h.c.arnseth@iped.uio.no
DOI: 10.34190/GBL.21.111

Abstract: Several studies of game-based learning in classrooms show that the role of dialogue is crucial in order to ensure valuable learning outcomes. This both pertains to dialogue between students and the game, dialogues between students playing games, as well as dialogues between teachers and students in game-based learning contexts. Moreover, the dialogic aspects of learning are both important during gameplay and around digital game activities. In spite of a growing interest in the dialogic aspects of games and learning, there exists no systematic overviews or focused theoretical discussions on the why, how and what when enacting and studying dialogue around digital gameplay within educational contexts. In this paper, we will outline and discuss key theoretical approaches to conceptualising games, dialogue and learning and discuss the possibilities as well as limitations of different approaches as exemplified by selected case studies within the context of primary and secondary education (K-12). Moreover, we will discuss key aspects that need to be considered, when researching dialogue in relation to digital games and learning. First of all, researchers need to clarify what they mean by dialogue, when researching digital games and learning. This involves discussions of related concepts such as conversation, discourse, interaction, communication, debate, and discussion. Secondly, it is necessary to discuss how dialogue is shaped in a complex relationship between specific game affordances and pedagogical approaches that may potentially both open as well as close possibilities for meaningful dialogic interaction. Thirdly, it is important to bear in mind that the notion of dialogue in dialogic education may be based on different theoretical assumptions - i.e. the term may both refer to ontological aspects (e.g. relationships between participants) as well as epistemological aspects (e.g. knowledge construction). The paper marks a preliminary first step in an ongoing work that aims to conduct a systematic review of empirical work on digital games, dialogue and learning. Consequently, the paper concludes by outlining key areas of interest for further exploration of the complex relationship between digital gameplay, dialogue and learning.

Keywords: Dialogue and games, dialogic education, game affordances, pedagogical approaches

How to Model a Visual Novel Game to Train and Identify Players' Soft Skills?

Jérôme Hernandez[1,2], Mathieu Muratet[1], Matthis Pierotti[2] and Thibault Carron[1]

[1]Sorbonne Université, CNRS, Paris, France
[2]Origamix-RH, Paris, France

j.hernandez@origamix-rh.com
mathieu.muratet@lip6.fr
m.pierotti@origamix-rh.com
thibault.carron@lip6.fr
DOI: 10.34190/GBL.21.050

Abstract: Companies and the human resources (HR) population have shown a growing interest in assessing and developing their employees' soft skills. Management and leadership soft skills are currently the most affected by this heed. Indeed, companies are currently complex human organizations where managers and team leaders have to supervise together a multi-generational / cultural group. That is why soft skills, also referred to as interpersonal or behavioural skills are expected to be valued in HR management. Companies and HR experts are able to train their peers through different tools, like interactive workshops, instructive videos, and online learning. Likewise, they use interviews and situational judgment tests (SJT) to identify soft skills. In an innovative approach, the process of training and the assessment of the learning progress may be enhanced through game-based learning (GBL) and synchronized into a sole serious game. To this end, we propose a generic framework enabling the creation of a Gamified Situational Judgment Test (GSJT). The first part of the framework is about the gamification of an SJT to enhance the learning of a soft skill and we rely on a visual novel game approach to support the gamification process. The second part is focused on the evaluation process of the players' learning. We propose a model based on a decision tree enabling the collection of a data set through indicators. These indicators will permit us to evaluate the learning of the different soft skills through the game, and it will point us towards a tendency behavioural profile of the player. Our framework and models have been instantiated on a serious game intended for managers of an important banking group on an international scale. We will illustrate the instance with four primary leadership soft skills and will demonstrate the possibility to detect soft skills tendency profiles amongst the players.

Keywords: Soft Skills, Gamification, Human Resource, Situational Judgement Test, Clusterization, Visual Novel Game

Methods for Design 'with' Movement: A Systematic Literature Review

Maximilian Hille, Nadia Boujari, Kristina Bilkova, Tobias Ohm Søby and Md Saifuddin Khalid
Technical University of Denmark, Lyngby, Denmark
Copenhagen Business School, Copenhagen, Denmark

maximilian-hille@t-online.de
nadiaboujari@live.dk
kristina.bilkova@gmail.com
tobyohm2830@gmail.com
skhalid@dtu.dk
DOI: 10.34190/GBL.21.145

Abstract: In the overlapping fields of human computer interaction and game-based learning, methods for designing with physical movement play an immense role throughout the design and development process. The design of products for physical activities (i.e. exercise, fitness, play and physiotherapy) to the design of aircraft seating arrangements involve a range of design methods. The trend of literature review covered methods for design 'for' or 'of' movement based interaction but not 'design with physical movement'. This study reports a systematic literature review of peer reviewed articles on interaction design methods for 'design with movement' in the area of Human-Computer Interaction. The papers are selected from the ACM Digital Library, SpringerLink and Scopus with emphasis on selecting papers contributing to interaction design, service design and the broad experience design fields. The review is expected to inform the pattern of conducting the methods as part of the different activities in the design process. It also informs novel methods or variants of known methods. In total, 32 papers have been assessed eligible for reviewing with eventually 13 papers included for analysis and synthesis. The methods for design with physical movement are classified under four broad categories, Embodied Sketching, Eye-movement, Kinesthetic Experience, and Interaction through gestures.

Keywords: Movement-based design, design methods, interaction design, body movement, Stanford, Human-Computer-Interaction, game-based learning

Systematic Extension of a Simulation game for Digitalised Production

Henry Himmelstoß, Simon Rapp, Ozan Yesilyurt and Andreas Bildstein

Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Stuttgart, Germany

henry.himmelstoss@ipa.fraunhofer.de; simon.rapp@ipa.fraunhofer.de; ozan.yesilyurt@ipa.fraunhofer.de; Andreas.bildstein@ipa.fraunhofer.de
DOI: 10.34190/GBL.21.031

Abstract: The simulation game "Digitalised Production Control" was developed at Fraunhofer IPA to give participants an understanding of the digital transformation in production (Yesilyurt et al., 2019). The simulation game aims to show participants the transition from applied lean principles in production to a digitalised production. New technologies contribute to the realization of the target vision of digitalised production, but at the same time also lead to the constant transformation of this vision due to ongoing provision of new solutions. The simulation game is intended to raise participants' awareness of the ongoing challenges of the digital transformation and to give them insight into the practical utilization of new technologies. The first version of the simulation game has already proven itself and has been evaluated in detail by participants. (Draghici et al., 2019). In order to sufficiently address this constant change in the simulation game and to introduce the participants to the use of new technologies, an expansion of the game to include an artificial intelligence (AI) component will be implemented. AI is chosen as a new technology to be implemented to address the current demands of small and medium sized enterprises (SME) companies and to initiate further discussions in the workshop format. However, the framework conditions that the current game concept entails must still be considered. This paper indicates a systematic approach, for deriving a new concept integrating an AI use case that complements the existing concept. For deriving and choosing an adequate AI use case suitable to the simulation game, use cases conducted by Fraunhofer IPA in industry as well as a systematic literature review have been performed. The current scientific standard will also be explained in order to place the project in its proper context. The derived concept and the way it integrates into the existing simulation game are explained in this paper. It also presents how the new concept should be implemented by applying AI-based image recognition.

Keywords: Simulation game, digital transformation, digitalised production, artificial intelligence, game-based simulation

Evolving and Improving a Board Game to Enhance Business Acumen

Suzaan Hughes
University of Johannesburg, South Africa

shughes@uj.ac.za
DOI: 10.34190/GBL.21.151

Abstract: Undergraduate University students training to be future accountants have a clear career path ahead of them in South Africa as members of the South African Institute of Chartered Accountants (SAICA). Their future employers have recognized a knowledge gap in terms of their insights into the world of business. A key industry employer and training company partnered with the University to develop a bespoke board game to develop their business acumen using a gamified learning experience. On game day 350-550 students (depending on the year) simultaneously compete in groups of 6 with a game master at each table. After the conclusion, students receive questionnaires soliciting their feedback and suggestions for improvement. The researcher and other organisers' also have an annual reflection and brainstorming meeting where feedback is discussed, consolidated and incorporated. The open-ended student feedback from 2015-2019 were thematically analysed and mapped to iterative improvements. The study reveals that the concerns of students and game masters are vested in their own experiences and perspectives. Themes revolve around students concern for procedural justice related to time allocations and the influence of luck and potential variations between game masters on their final results. The findings from the researcher and organisers' reflexive standpoint relate to improving the flow of the game and building in mechanisms to support student preparation and mastery of game play. Questionnaires soliciting feedback from students are influenced by self-reporting bias. However, this feedback stretches across years and therefor data triangulation plays a mitigating role. The research offers an overview of the evolution of a board game designed to facilitate student mastery of business concepts. In the emerging market context of South Africa the board game is a novel approach to teaching and assessment and creates both excitement and anxiety amongst students.

Keywords: games based assessments, gamification, board games, serious games, management education

You can't Escape Learning, but Maybe you can get out of the room! – Game-based Learning for Programming Education

Niklas Humble[1], Peter Mozelius[1] and Lisa Sällvin[2]
[1]Mid Sweden University, Östersund, Sweden
[2]Mid Sweden University, Sundsvall, Sweden

niklas.humble@miun.se
peter.mozelius@miun.se
lisa.sallvin@miun.se
DOI: 10.34190/GBL.21.044

Abstract: Programming education has been classified as problematic learning in higher education, and in the current process of reaching a younger audience there are several challenges. Three of them that are highlighted in this paper are learner motivation, visualisation, and the need for engaging self-learning. To address these challenges this study builds upon a combination of the old idea of game-based learning, and the new trend with escape rooms for educational purposes. The overall aim of the study is to design, develop, and evaluate a game where players can learn about fundamental programming techniques such as variables, data collections, selection and iteration. In the first step a web-based game prototype has been created and tested on teachers in K-12 education, and on teachers in the Makerspace movement. The main research question to answer was: "What are the teacher perceptions about important design factors for an escape room game on computer programming?". This study was conducted with a design science approach involving the recommended steps of 1) Explicating the problem, 2) Defining the requirements, 3) Design and development of an artefact, 4) Demonstrating the artefact, and 5) Evaluation of the artefact. The requirement specification was built around the syllabus framework recommended from the Swedish National Agency for Education. Evaluation data were divided into categories in an inductive thematic analysis, and later compared with design factor found in other studies on educational games for programming education. Preliminary findings show a mixture of attitudes among the teachers in the test group, there are also several suggestions for further development. The two important next steps are to 1) Test the prototype on students, with help from the teachers in the test group, and 2) To refine the prototype and develop the game further to meet the standard of games that K-12 students and Makerspace kids play. To obtain a high-quality outcome of the second next step, there is probably a need for a shift to a more professional development environment.

Keywords: Game-based learning, Escape rooms, Game development, Programming education, K-12, Makerspace

Designing an Educational Board Game-"Story of Court" for Training Chinese Reading Comprehension: Analysis of Learning Effects, flow, Acceptance and Anxiety

Jyun-Yi Ji, Yu-Chi Chen, Chih-Chen Kuo and Huei-Tse Hou
National Taiwan University Of Science And Technology, Taipei, Taiwan

hthou@mail.ntust.edu.tw
DOI: 10.34190/GBL.21.129

Abstract: Educational board games can enhance learners' achievement, motivation, concentration, and interpersonal interaction. Although many studies have explored the positive effects of educational board games on various subjects. Board games are rarely used to train Chinese reading comprehension for high school students. In Taiwan, Chinese reading skill is a core ability of the compulsory education. Classica Chinese reading is an important issue recently. This research developed the board game "Story of Court" with cognitive design to enhance the Chinese reading skill. The sorting mechanism is the main feature of this game. It requires participants to read and understand the context on the cards, and to further sort and make the plots meet the task goal to win the game. Real-time evaluation is another feature of the game. Participants can get explanations of difficult vocabulary and correct situational answer which they don't know when they played cards from the card back. This design allows students to immediately revise their misunderstanding of story context and learn difficult vocabularies in every game round. The aim of this study is to investigate the learning achievement of Chinese reading comprehension and its effects on students' anxiety, flow, and acceptance in this board game. The participants in this study were 38 high school students. This research conducted pre-test and post-test including Chinese reading skill and learning anxiety scale. Learners' flow and acceptance were also measured after the game. Among the evaluation of Chinese reading skill, the ability of reading semantic context is the most obvious improvement. The results showed that educational board game can assist classical Chinese learning. As for anxiety, there was no significant difference between pre-test and post-test, but communication anxiety showed significant decrease. Moreover, learners have high flow statement and acceptance in games, and this result indicated that they engaged in the game and can manipulate the game well. This study also discusses the effect of different genders. The report reveals that there are no significant differences in learning achievement, flow, and acceptance between genders. To summarize, "Story of

Court" is a useful tool to improve the Chinese reading comprehension and will not cause students' anxiety.

Keywords: Board Game, Flow, Cognitive design, Game-based learning, Chinese reading comprehension

Comparing Design-Based and Agile Methodologies in Educational Game Development

Osvaldo Jiménez and Dennis Ramirez
Computer Science, University of the Pacific, Stockton, US
Twin Cities PBS, Minneapolis, US

ojimenez@pacific.edu
dennispr@gmail.com
DOI: 10.34190/GBL.21.062

Abstract: This paper explores the question: when faced with a fixed time-constraint, what impact does a process have on developers' abilities to create effective educational games? In this paper, we discuss the process in which educational games are constructed and explore how different processes related to software development could impact those games, both from a product and process standpoint. The paper highlights how one of the authors used two different processes related to developing games, a design-based process versus a scrum framework with students in a course where they focused on developing educational games. With presenting data on evaluations of the products produced and surveys of the student experience, the paper aims to highlight how the process may have influenced both the products that were constructed and the experience for the students in the class.

Keywords: learning, design, software development, scrum, computer science, educational games, design-based approaches

Privacy Awareness by Online Co-Design: Investigating Reflection and Learning Qualities of Card-Based Educational Game Creation

Patrick Jost
Norwegian University of Science and Technology, Trondheim, Norway

patrick.jost@ntnu.no
DOI: 10.34190/GBL.21.059

Abstract: Sharing of personal data, consciously or unconsciously, has become a ubiquitous affair. Even from a young age, students are confronted with privacy choices such as giving consent to sharing personal data when, for instance, using social media or remote learning tools. Despite that, privacy awareness is still an educational area often only addressed superficially. A team-oriented approach through educational game design could help engage students, stimulate thinking, and familiarise them with crucial privacy issues. This paper investigates the *reflection* and *learning* qualities of *co-designing games for privacy awareness*. Addressing the current pandemic circumstances, a playful online workshop is presented that enables remote co-creation of educational game concepts with design cards. By taking the roles of player, teacher, researcher or designer, students worked together remotely to discuss the subject matter, learning assessment and game mechanics to elaborate a balanced game concept targeting everyday privacy issues. The qualities of the co-design workshop to induce reflection and learning were examined in a two-stage user study. First, in a between-subjects trial (n = 61), the ability of the online workshop to encourage reflection about privacy decisions was compared to a paper-based offline version. Second, remote co-designing was further examined in a within-subjects evaluation (n = 32) in which students rated their learning gains in terms of privacy compared to their learning gains in designing educational games. The outcomes of the questionnaire and post-activity feedback indicate that remote and on-location co-design of educational games are equally effective for sparking reflective thinking about privacy decisions. Thus, both can be applied adjusted to contextual conditions regarding social distancing or other requirements. When contrasting learning quality between privacy awareness and game design, remote co-creation showed more supportive of conveying knowledge about balancing the games for learning than about the privacy domain. Conclusively, implications regarding educational game co-design with card toolsets are synthesised from the empirical findings.

Keywords: Educational Game Design, Online Co-Design, Online Co-Creation, Serious Games, Privacy Decisions

‘Dangerous Zone’: Games Caught Between Education and Indoctrination

Michal Kabát and Juraj Kovalčík
University of Ss. Cyril and Methodius, Trnava, Slovak Republic

michal.kabat@gmail.com
kovalcik.juraj@gmail.com
DOI: 10.34190/GBL.21.100

Abstract: While game-based learning has been extensively studied only over the last few decades, the use of game mechanics in pursuing specific educational goals is considered an ancient tradition. When we look at the current state of education in Slovakia, we can see that it has inherited much from the post-war era of Soviet influence (1945–1989) and therefore it is reasonable to closely examine the use of games in education during this period. The Communist regime in the former Czechoslovakia (analogous to other countries of the Soviet bloc) clearly identified and accentuated the potential of games in education of the young generation. Games were understood as a preparation for adult employment and a tool for shaping a regime-friendly, “socialist man” (and woman). Thus, in state socialism, game-based education was openly associated with ideological indoctrination. The educational-ideological development of children through games was undertaken mainly in the mass children’s organization Pioneer, itself built on the Soviet model. A state-socialist alternative to the originally apolitical Scout movement, Pioneer also organized children’s summer camps where children took part in many game-based activities, including so called “terrain games”, infused with a particularly strong ideological element. These games — as period documents reveal — explicitly prepared children for warfare with “enemies of socialism”. The paper explores how the children who were supposed to be shaped into exemplary citizens and soldiers by them appreciated these games. To this end, the paper applies content analysis of the period manuals for Pioneer team leaders, game compilation books and other pedagogical literature and weighs it against the survey reviewing former Pioneer members’ experiences.

Keywords: Pioneer Organization, terrain games, defence education, indoctrination, communism

Smart Escape Rooms for Cultural Heritage: A Systematic Review

Zoi Karageorgiou[1,2], Konstantinos Michalakis[1], Markos Konstantakis[1], Georgios Alexandridis[1] and George Caridakis[1]

[1]University of the Aegean School, Lesvos, Greece

[2]Hellenic Open University, Patra, Greece

zoikara@hotmail.com; kmichalak@aegean.gr; mkonstadakis@aegean.gr; gealexandri@aegean.gr; gcari@aegean.gr

DOI: 10.34190/GBL.21.104

Abstract: The intelligent age and smart culture era provide a new environment where everything, including artifacts, is tagged with devices to capture and provide the required information. Organizations, game designers, educators and other stakeholders can utilize these technological opportunities to create extreme immersive and interactive experiences. They look forward to examining the combination of new methods and tools during in-site or outdoor visits, in order to intrigue and attract visitors and provide opportunities to experience emotional involvement and dominance feelings. Alike cities, heritage sectors all over the world envision to connect artifacts and other objects, so to urge smartness in their environments, and integrate Internet of Things (IoT) and other technologies, in order to uplift visitor's involvement and interest for cultural collections. In addition, serious games development and their evolution enhance mental or physical engagement and broaden knowledge and skills in an entertaining and exciting way. This paper presents a systematic review that focuses on the use of escape rooms in the context of serious games, in museums or other places of cultural interest. Technological tools, platforms, tangible or digital objects, IoT elements, evaluation methods and their results and limitations are organized and mapped through a number of literature publications over the last 5 years. Seven qualified studies fulfilled specific criteria and PRISMA have been used as a guideline. The analysis indicates that IoT-escape room type of games can provide an enjoyable experience and immerse visitors as active learners who creatively use unknown tools, decision-making, communication and critical thinking during their play in a cultural/historic environment. These games refer to any type of visitor's group, affect traffic time and uplift cultural interest. Apart from that, they are also important to anyone who desires to promote and create motivational projects with cultural content using the escape room game mechanics and IoT elements. To the best of our knowledge, this review is among the first to provide a structured study with closely considered data collection and analysis.

Keywords: escape room, smart serious games, IoT, cultural heritage, museums

Serious Games in Science Education: A Systematic Mapping

Akif Quddus Khan
National University of Science & Technology, Gjøvik, Norway

akif.q.khan@ntnu.no
DOI: 10.34190/GBL.21.002

Abstract: Teaching science through the use of computer games and simulations is an increasingly active research field. To this end, we conducted a systematic literature review on serious games for science education to reveal research trends and patterns. Specifically, we covered the research spanning between 2011 and 2020, investigated country-wise concentration and most common evaluation methods, and discussed the positive and negative aspects of serious games in science education in particular and attitudes towards the use of serious games in education in general.

Keywords: serious games, science education, games in education

Gamification of Strategic Thinking: A COTS Boardgame for Learning Scrum, Strategy Development and Strategy Implementation

Thorsten Kodalle[1], Mark Schmidt[2], Will Thomas[3] and Maren Metz[4]
[1]The Bundeswehr Command and Staff College, Germany
[2]Hamburg University of Technology, Germany
[3]University of Suffolk, UK
[4]HFH · Hamburger Fern-Hochschule, Germany

thorstenkodalle@hotmail.com; mark.schmidt@tuhh.de;w.thomas@uos.ac.uk; Maren.Metz@hamburger-fh.de
DOI: 10.34190/GBL.21.127

Abstract: The Bundeswehr Command and Staff College (BCSC) facilitated the Gamification of Strategic Thinking seminar from 11. Nov 2020 – 24. March 2021 with students from the Hamburg University of Technology (TUHH) and Staff Officers from the Bundeswehr Office for Defence Planning. This paper describes the

seminar from construction to end, the sophisticated online facilitation, and the results and evaluation. Thereby, it contributes to discussing how to implement commercial of the shelf (COTS) conflict simulations (wargames) to education, particularly for political science and management. The seminar used the COTS board game 'Scythe' as the strategy development and strategy implementation environment. Seminar goals were applying management tools like SWOT-Analysis, Kanban Board, and the OODA-Loop (Observe, Orient, Decide, Act) to strategy development and strategy implementation in a competitive environment characterised by volatility, uncertainty, complexity, and ambiguity (VUCA). Six Teams consisting of five players each competed at the end of the seminar for three days, had to use the decision-making process several times, and faced the consequences of past decisions. Furthermore, four team members had to Red-Team other competitors and learned how to implement this (business) Wargaming technique into the decision-making cycle. Finally, all participants had to develop a strategy, either their own or their adversary's strategy. The seminar was conducted in eight sprints, following the Scrum framework for agile project management in an agile education approach. Students had to practice an agile mindset, followed the scrum events Sprint Planning, Daily Scrums, Sprint Review and Sprint Retrospective, taking care of the Project Backlog, honouring the Scrum Values courage, focus, commitment, respect, and openness. The lead author planned the seminar as a distributed learning experience with an on-premises final. However, due to COVID-19, the TUHH and the BCSC cancelled the on-premises final. As a result, the lead author had to facilitate the complete seminar entirely distributed using various web 2.0 collaboration tools like Slack, Trello, Zoom and, of course, WhatsApp. The seminar was evaluated regarding the Learning Objective-Game Design framework and the Agile Education approach. This paper provides a new perspective on combining agile education, using a Scrum framework as the organisational overlay over the curriculum, and explicit gamification, using a COTS wargame. It is an update to the ECGBL 2020's paper. In comparison to serious games, explicit gamification is supposed to provide the element of fun by design.

Keywords: Game-Based Learning, Gamification, Strategy, Wargaming, Agile Education, Scrum

Game-Based Learning and Eye Tracking: Approaches to Integrating gaze data into Learning Assessment

Maria Koutroumani and Maria Rigou
University of Patras, Rio Campus, Greece

up1046588@upnet.gr
rigou@upatras.gr
DOI: 10.34190/GBL.21.015

Abstract: The domain of educational games has occupied the academic community for decades. Researchers are trying to embed pedagogical activities in computer games that originally aimed at entertainment. However, the pedagogical potential games is still under consideration as there is limited evidence that players acquire knowledge from a game of such kind. Traditionally newly acquired knowledge is assessed using pre- and post-game questionnaires or by tracking and analyzing student performance in the game. Recently, researchers have attempted to enrich their observations on student learning by analyzing data about the visual behavior of students during game play to take advantage of the non-intrusive process of eye tracking and the unbiased nature of human gaze (vision is a process we cannot consciously control). Gaze data are collected through eye tracking devices which record eye fixations and saccades and can be visually presented in easily conceivable ways (heatmaps, gaze plots, clusters, etc.) that reveal learner visual activity in front of a screen. One of the major challenges in this approach is the interpretation of recorded visual behavior data and the way they correlate with the learning process. Different metrics for eye tracker can be related to user experience during a game like engagement or cognitive effort. This paper aims to review findings from related research efforts that investigated the connection between visual behavior and learning and highlight representative research experiments for assessing the learning effect of educational games by analyzing the visual behavior of learners. To this end, the paper presents eye tracking metrics that are related with the cognitive processes of learners and investigates how these metrics have been used in educational games to help better assess the learning effect of these games.

Keywords: educational games, knowledge, learning process, eye tracker metrics, fixations, cognitive processes, learning effect

Universal Sprint Game That Teaches the Basics of Financial Literacy

Ekaterina Kubina, Marina Bareicheva and Natalia Stepanova
Ural Federal University (UrFU), Ekaterinburg, Russia

kubina.ekaterina@yandex.ru
bareicheva.m@yandex.ru
n.r.stepanova@urfu.ru
DOI: 10.34190/GBL.21.090

Abstract: The basics of studying financial literacy are important for any generation. Representatives of Generation Z, who were chosen as the target audience, are particularly in need of this knowledge today. We offer a training sprint game in the field of finance "Shock Economy" with elements of internal development. For the purity of the experiment, the game was tested on an optional course of studying finance for non-economists when forming an individual learning trajectory by students of the Ural Federal University (Russia). The authors have developed a dynamic and exciting self-development game for reaction and adaptation to changes in the development of financial literacy. The basis of the game concept is the ability to adapt to new conditions and successfully respond to existing game rules, which implies modification, here and now in a limited time. The authors developed a flexible game model with illustrative elements, which were created using graphic editors. The advantage of the game is a steady concentration of attention on obtaining and consolidating the necessary competencies during training. Although the target audience for the game being developed was Generation Z, for the completeness of the experiment, the authors conducted this game with students over 30 years old teachers and teaching and support staff. An experiment to study the behavioral characteristics of each group participating in game training showed that the proposed game may be of interest to the creators and moderators of game practices. Since it is universal and can be adapted to different topics, depending on the requests, and can help in motivating learning.

Keywords: game practice, economy, generation Z, adaptation, skills

STEMadium: Learning STEM From a Mobile Game Using the Science of Baseball

Tamara Kuhn[1] and Jill Denner[2]
[1]dfusion, Scotts Valley, CA, USA
[2]ETR, Scotts Valley, CA, USA

tamara.kuhn@dfusioninc.com
jill.denner@etr.org
DOI: 10.34190/GBL.21.063

Abstract: STEMadium is a serious mobile game designed to improve middle school age youth's skills in science and math by using the science and math inherent in baseball combined with a compelling narrative. This paper summarizes the development and evaluation of STEMadium. This includes the formative research which utilized play testing, interviews, and focus groups, with a particular focus on what would engage girls and minority youth. The results of that formative research drove the development of the game, including the inclusion of a strong narrative with a female protagonist who helps bring the team to victory, an array of team members, each with a unique backstory, who need to work on their STEM (Science, Technology, Engineering, and Math) skills to improve their baseball skills, and the inclusion of exploration and customization elements. The focus during development was to create an engaging science of baseball focused game for youth who may not necessarily be interested in sports or sports games while ensuring the pedagogy and presentation of content was teacher approved and mapped to math and science standards. The completed game was subjected to a three-arm randomized controlled trial (RCT) in which the game was tested against a control condition, and a condition in which the game was combined with virtual class instruction on math and science topics. Results from the RCT show that (1) the game performed as well as the game plus instruction condition; and (2) compared to the control condition, both conditions improved math and science knowledge, reduced the decrease in math skills during non-school periods ("summer slide"), and worked equally well across genders. The youth also reported liking the game, with the majority noting that it was better or much better than most educational games. The results provide support for the use of mobile gaming to improve STEM skills in middle school aged youth. As wellthe development may provide a roadmap for using gaming to engage youth not typically interested in STEM.

Keywords: STEM, educational game, baseball, math, randomized controlled trial, mobile app

The Development and Preliminary Evaluation of a Chinese Painting and Calligraphy Board Game with Situated Learning

Chih-Chen Kuo, Ying-Sang Fang and Huei-Tse Hou
National Taiwan University of Science and Technology, Taipei, Taiwan

d10722301@gapps.ntust.edu.tw
p28017976@gmail.com
hthou@mail.ntust.edu.tw
DOI: 10.34190/GBL.21.093

Abstract: Heritage education has prominent value and universal significance in protecting world heritage for future generations. It has implemented corresponding education policies to promote heritage education for young students. Educational board game has gained much attention and has been applied for learning for many fields. However, few studies focus on Chinese painting and calligraphy, not to mention elementary students learning Chinese painting and calligraphy through board game. This study developed a game" Searching for the secret" with the history of Qing dynasty emperor Qianlong 's south tour in China to explore how educational board game can assist Chinese painting and calligraphy learning. The game mechanisms based on situated learning and clue analysis were designed to promote learners to observe the detail of the Chinese painting and calligraphy. Players as emperor Qianlong 's minister arrange the tour and provide the suitable arts for the specific destination to emperor. To win the game, learners have to cross comparison the information provide on the destination cards with painting and calligraphy cards. The Chinese painting and calligraphy used in the game related to the history of Qing dynasty emperor Qianlong 's south tour in China. Many allusions of this tour are part of the game. All the information of Chinese painting and calligraphy are based on National Palace Museum related researchers' finding. 62 elementary school students from north Taiwan participated in this study. Preliminary result suggested that that game could enhance students 'learnings effectiveness. Students' flow state revealed that learners engaged in the game. Student's game acceptance indicated that learners manipulated the game easily. As for gender differences, the result showed there were no significant gender differences in male and female students' learning effectiveness, flow state as well as their game acceptance. These preliminary findings suggested that situated game" Searching for the secret" could be an effectively tool in learning Chinese painting and calligraphy.

Keywords: educational board game, game-based learning, cultural heritage, situated learning, flow

Thinking Critically About Video Games: A Curriculum Construction Study

Evgeniya Kuznetsova, Jennifer Jenson and Danielle Kim
University of British Columbia, Canada

evgeniya.kuznetsova@ubc.ca
jennifer.jenson@ubc.ca
daniellekim2015@gmail.com
DOI: 10.34190/GBL.21.107

Abstract: There are numerous texts and articles that have theorized game design, providing "how to" guides and whole manuals for carrying out game design projects, as well as many texts on how to use games to teach other. There is, however, a paucity of research and guidance on critical approaches to video games for students – how to research them, and what their study could and already does entail. This lack of discussions of critical methodologies both in courses available in game design programs, as well as in published scholarly work, is not present to the same degree in adjacent cultural studies education programs, such as those focused on film, art, design, drama, or digital media. This project, informed by participatory action research, asked 15 undergraduate researchers in a Canadian university from a variety of disciplines (physics; computer science; arts; gender, sexuality and women's studies; film, and chemistry) to design and pursue a novel video game focused research study, supported by a professor and 3 research assistants (2 Master's and 1 PhD-level). All of the undergraduates were self-selected gender and racialized minorities, some of whom played games regularly and a few who did not and were curious to learn more. Over ten months from September 2019 to June 2020, impacted by the global COVID-19 pandemic, we developed and implemented a curriculum to train and help support participants in how to construct their own research projects to study video games from a comparative media analysis perspective. This paper will report on how we approached the study of games and describe the curriculum framework for studying games we developed. We will report on what worked, what did not work, and our suggestions for future related projects.

Keywords: video game curriculum, game studies, participatory action research, higher education, curriculum development, critical game studies

Run and Solve the Case! Case Studies With Game-Based Learning

Sandra Miranda Leal
Tecnologico de Monterrey, Escuela de Preparatoria, Morelia, Mexico

sandra.miranda@tec.mx
DOI: 10.34190/GBL.21.033

Abstract: Nowadays, the implementation of teaching strategies, tools and/or technologies that allow teachers to motivate, involve, and engage students in their learning process, are not only important but also widely spoken of in professional circles. In order to bring a different motivator into the classroom, I decided to use the case study method to examine how technology affects human rights. The purpose of using this method in the class was to promote both analysis of different perspectives and debate among my high school students. The lack of available time in class (a 50-minute session) directed me to the question that led this research: Can Game-Based Learning (GBL) facilitate the implementation of the case study method and improve the students' learning process? A group of twenty students participated in this implementation. As a first step, teams of students had to race through four stations, where they found a different case study in each. The case studies were delivered as images, and each case required students to answer some questions (short-essay type answers). As a final step, students answered a final reflection intended to measure (qualitatively) the effectiveness of the combination of GBL and the case study method. The findings were very positive and motivating: the game allowed us to work with four different case studies within a period of 50 minutes, students never felt tired or bored discussing the cases and responding to their corresponding questions, and students expressed that they were enthusiastic about reaching all the stations of the game. They also communicated that they were cognizant of their own learning. The aim of this paper is to address the benefits of GBL and to share them with teachers who are looking for strategies to update their instruction approaches.

Keywords: game-based learning, case study method, analyzing different perspectives, high school, images as case studies, educational innovation

Gamified Escape Room Experience for Simulating Team Building Using Deep Reinforcement Learning

Georgios Liapis, Aristotelis Lazaridis and Ioannis Vlahavas
Aristotle University of Thessaloniki, Greece

gliapisa@gapps.auth.gr
arislaza@csd.auth.gr
vlahavas@csd.auth.gr
DOI: 10.34190/GBL.21.068

Abstract: Gamification, which is considered to be an efficient practice for learning through play, can be significantly expanded by Artificial Intelligence methods, and particularly Machine Learning. Nowadays, different industries employ a variety of applications based on gamification to create coherent and effective teams, e.g., by assigning roles based on the knowledge, understanding, and relationships between members. In this paper, we explore an online Escape Room experience that incorporates a variety of Raven-inspired intelligence tests and team-members communication, combined with Machine Learning methods. More particularly, we implemented state-of-the-art Deep Reinforcement Learning (Deep RL) agents, which are used for emulating human-like behaviour to navigate and interact with the 3D rooms, as well as to solve the tests. The RL agents simulate behavioural elements based on OCEAN personality traits model, such as openness, conscientiousness, and neuroticism, while also generating a big number of gameplay data. Analysis shows that their particular behavioural patterns have a significant effect on their performance, stability and time required to solve tasks. These findings allowed us to produce new performance metrics for a generic escape room model, which can categorize human play styles according to the OCEAN Five personality trait model. This approach effectively analyses the teams' behaviour concerning both individual and overall performance.

Keywords: Gamification, serious game, escape room, team building, machine learning, deep reinforcement learning, simulation, agents

Using Multimodal Learning Analytics to Explore Collaboration in a Sustainability Co-Located Tabletop Game

María Ximena López[1], Francesco Strada[2], Andrea Bottino[2] and Carlo Fabricatore[3]

[1]University of Huddersfield, UK
[2]Polytechnic University of Turin, Italy
[3]E.H.E. Europa Hochschule EurAKA, Switzerland

ximelopez@gmail.com
francesco.strada@polito.it
andrea.bottino@polito.it
carlo.fabricatore@gmail.com
DOI: 10.34190/GBL.21.114

Abstract: Serious Games (SGs) are particularly suitable to foster collaboration in complex domains that challenge formal education approaches. However, their effectiveness depends on their features as much as on the ability to assess their impacts on players, and analysing collaboration in games remains by and large an open problem. Research has traditionally used rich unimodal data to examine collaboration processes in games (e.g., video content analysis of verbal exchanges). Despite providing relevant semantic information, this can make data coding and analysis difficult and time-consuming. Furthermore, unimodal approaches can only partially capture complex processes defined by multiple interacting variables, such as collaboration. Recent research highlighted the potentialities offered by multimodal learning analytics (MMLA) to address these issues. MMLA integrates multiple types of data captured both in and out of the game system through different modalities to analyse complex processes. Although it has been highlighted as particularly suitable to investigate collaboration, research on MMLA in SGs is still scarce. This work contributes to the state-of-the-art by leveraging MMLA to explore collaboration indicators in a multiplayer, co-located SG for education in sustainable development. Our results corroborate the MMLA effectiveness in analysing complex collaborative dynamics, and identify key multimodal analytics useful to investigate collaboration in SGs.

Keywords: collaboration, multimodal, analytics, co-located game

Insights from Design Processes Used in Developing Exergames

Alexander Hvidbjerg Kjær Lund, Amalie Finnemannn Sørensen, Lars Elbæk and Maximus D. Kaos
University of Southern Denmark, Odense, Denmark

allun17@student.sdu.dk; amsoe17@student.sdu.dk; lelbaek@health.sdu.dk; mkaos@health.sdu.dk
DOI: 10.34190/GBL.21.102

Abstract: Participation rates in physical activity are low, and with gyms closing and lockdowns becoming a necessary tool to fight the global pandemic, evidence suggests COVID-19 is only exacerbating the issue. People are becoming more sedentary as they stay at home longer and do more home office work. Exergames—games that require physical exertion to play—hold promise to combat sedentary behaviours, since they are typically inexpensive and can be played at home. Despite their potential to motivate people to move, it is challenging to design exergames because they must strike a balance between exercise and play. Current research in exergames provides some advice and guidelines on best practices for developing movement-based games. But, to date little attention has been given to the design processes that lead to the development of these guidelines. This paper aims to fill this gap by contributing 1) an in-depth discussion of and insights gained from the design process used when developing an exergame and 2) a novel movement-based method used in the development of a virtual reality (VR) exergame—VR bodystorming. We illustrate these methods through the development of Diverging Squash (DS), a novel VR squash game. We reveal insights throughout the entire design process from the beginning stages using brainstorming to focus on players' needs and motivation for physical activity, to using exertion cards for framing the game's primary elements. Exertion cards, for example, aided in our decision to gradually increase the difficulty of the game during play. We further demonstrate how our novel VR bodystorming method, or bodystorming in a virtual environment while wearing a VR headset, can be a useful tool for designers. For instance, during a VR bodystorming session, we practiced holding a virtual paddle in the VR environment in different ways. Insights from the way it was being held in VR led to adjustments to the way the paddle should be gripped, and the force needed to hit the ball. We conclude with key takeaways that give designers a view into how design methods for exergames are applied in practice and, thus, how they can be used in their own work.

Keywords: exergames, exertion games, design processes, movement-based design methods, bodystorming, virtual reality

CumbraeCraft: A Virtual Environment for Teaching Cultural Heritage to Primary Schoolchildren

Kayleigh MacLeod[1], Andrew J. Reid[1], Iain Donald[1] and Kasia Smith[2]
[1]Abertay University, Dundee, Scotland
[2]Millport Conservation Area Regeneration Scheme, North Ayrshire, Scotland

K.Macleod@Abertay.ac.uk; A.Reid@Abertay.ac.uk; I.Donald@Abertay.ac.uk; KasiaSmith@north-ayrshire.gov.uk
DOI: 10.34190/GBL.21.075

Abstract: Game-based learning is a research area that has grown within the past two decades, with evidence of tailoring commercial-off-the-shelf gaming, developing bespoke educational games, and using gamification-based learning tools in a variety of educational settings. However, the Covid-19 pandemic has accelerated the need to focus on virtual learning experiences that are engaging and motivating for schoolchildren to participate in as they face learning from home. Games are one such method of virtual learning experiences that aim to provide a stimulating experience for young people to continue their compulsory education. This paper introduces a project developed between Millport Conservation Area Regeneration Scheme (CARS) and a small team of game development students and academics from Abertay University. The purpose of the project was to develop a *Minecraft Education* world that could be used by teachers to engage primary schoolchildren in the history and heritage of the Isle of Cumbrae, an island in North Ayrshire, western Scotland. The project also set out to achieve aims of promoting local heritage and heritage tourism, enhancing national educational standards, serving as an electronic record of local heritage, and introducing potential career options in gaming to young people. The result - *CumbraeCraft* - is a suite of eight lessons that support teachers to use the game within the classroom as a way of teaching young people about local heritage and culture. The world focused on recreating locations and events from the Isle of Cumbrae to present interesting facts and knowledge to pupils in an interactive and enjoyable manner, focusing on interactions of exploration and discovery, narrative and communication, fellowship and teamwork, expression and creativity, and challenge-based learning. The aim of this paper is to present a case study on the design and development of *CumbraeCraft* as an educational environment to teach the heritage and history of island communities in western Scotland. Additionally, the paper spotlights a gap for

games to be used to teach young people about local heritage and the historical significance of their communities and culture, with a particular emphasis on Scottish culture, language, and tradition.

Keywords: game-based learning, game design, cultural heritage, Minecraft, school curriculum

Quick and Dirty Group Testing of Mobile app for Educators Teaching Digital Literacy and Production

Gunver Majgaard
University of Southern Denmark, Odense, Denmark

gum@mmmi.sdu.dk
DOI: 10.34190/GBL.21.048

Abstract: This paper explores and reflects on the development and testing of a mobile application designed to support lesson planning in digital production and digital literacy. The test results were a reality check for the developer team and provided key points for further development. The paper will describe the test process, divided into plan, results and actions for further development of the mobile application. The application is for use by educators in secondary schools. The application introduces basic methods for teaching digital literacy and production and provides examples of concrete learning designs. It is a huge challenge to teach digital literacy and production in secondary schools. It can be demanding to meet learning goals, plan meaningful activities and at the same time apply emerging digital tools. The application was inspired by game-based learning ideas: for example, we visualized didactical concepts using Augmented Reality (AR). The emerging AR technology combined the physical surroundings and virtual elements. Didactical concepts can be quite abstract for a new educator and the visualizations make them more familiar. The application was developed as part of a funded project exploring AR in teaching and learning in upper secondary schools in the Southern Region of Denmark. The application titled in Danish ROBOdidaktik (robo-didactics) can be downloaded from Appstore and Play store.

Keywords: game-based learning, learning design, design, didactics, digital literacy, computational thinking.

Some Killer Feedback: A Case Study on Volunteering as Playtesters and Player Typologies

Joachim Majors [1] and Matilda Ståhl[2]
[1]Experience Lab at Åbo Akademi University, Finland
[2]Åbo Akademi University, Finland

joachim.majors@abo.fi
matstahl@abo.fi
DOI: 10.34190/GBL.21.046

Abstract: While playtesting is an established part of game development, empirical research on playtesting in general and volunteering as a playtester appears to be limited. In this case study, our aim is to explore who volunteers for playtesting and how their player motivation and experience affect the feedback they provide during the playtest sessions. The dataset (2019-2020) is a mixed methods approach, here we focus on three data types: 1) how the playtesters see themselves as gamers in the pre-test survey, 2) the think aloud method during game play and 3) the semi-structured interview after playing. Playtests were conducted for eight local game developers in Finland and Sweden and all games were tested by at least three volunteers. The playtesters were selected based upon a screening survey on gaming habits and preferred devices as the intended age group specified by the developers. Due to the limited research on the topic, we employed Bartle's (1996) player typology as a starting point for the analysis. We focus on one game during two test iterations and four playtesters, each representing one player archetype. The results show that the playtesters provided feedback and suggestions for improvement in line with their respective player archetype, we see the need for more empirical research on the topic.

Keywords: playtesting, player experience player topology, player feedback, game development

Can you Escape from Dr. Tom Cat's Lab? Educational Escape Rooms with Scientists, Riddles and Serious Games as Learning Tools

Christos Malliarakis[1], Olga Shabalina[2] and Peter Mozelius[3]
[1]University of Macedonia, Thessaloniki, Greece
[2]Volgograd State Technical University, Russia
[3]Mid Sweden University, Östersund, Sweden

malliarakis@uom.edu.gr
o.a.shabalina@gmail.com
peter.mozelius@miun.su
DOI: 10.34190/GBL.21.139

Abstract: Imagine parents not asking their children "Did you study today?" but instead asking "Did you play today? If you did not, please go and start playing right now!". This is the general revolutionary idea of game-based learning. This is the ideal experience for every child, to learn by playing, and for parents to see their children loving to learn as they love to play, and finally for teachers to receive major excitement from their students about learning. If serious games are applied in lessons, then teachers stop going to their classrooms telling their students the theoretical part of their lesson and then solve exercises on repeat; Instead they could go to their classroom and say to their students that "today is a special day, as you will get to solve some great riddles in order to escape from Dr. Tom Cat's lab". This paper will discuss how game-based learning and especially escape rooms could be a great learning toolkit for teachers and how these games can foster motivation and help students achieve their educational goals. The paper will describe the story of Dr. Tom Cat, a (great and maybe a little mad) scientist that has a special lab where each room is dedicated to one of the greatest scientists in Mathematics, Physics and Informatics like Alan Turing, Ada Lovelace, Kurt Gödel and Grace Hopper. This way, students learn about these very important scientists' lives, but also, they are required to solve a similar riddle to the problems each scientist had to tackle in their respective lives. Finally, the paper will present how an Augmented Reality application has brought this story and escape room game to life, and how this application helped impress the students more and store learning analytics about which riddle was solved by whom. The results of this experimental launch will be finally presented and analyzed.

Keywords: escape-room, game-based learning, learning analytics, model of learning, game design

Promoting Environmental Education with Escape Room Activities: Critical Factors for Implementation

Gisela Mello, Jessica Reuter, Marta Ferreira Dias and Marlene Amorim
GOVCOPP, DEGEIT, University of Aveiro, Portugal

gisela.mello@ua.pt
jessica.reuter@ua.pt
mfdias@ua.pt
mamorim@ua.pt
DOI: 10.34190/GBL.21.109

Abstract: The environmental concern is a part of the today's global agenda, namely due the negative impacts of human activities into the environment. This scenario has led to a creation of an awareness of the environmental issues and the sustainable concept in society. In this context, the environmental and sustainability education aims to promote a changing in attitudes and behaviours facing the environmental and social challenges, fostering an ethical and social responsibility sense. Moreover, it aims also to develop critical thinking in the society regarding the sustainability and other issues namely: climate changes and the protection of the biodiversity. Therefore, in order to raise awareness about the environmental and social challenges and to prepare the individuals for an active participation in devising adequate solutions, it is urgent to develop innovative transversal educative programs that encompass involve multiple understandings and dimensions and, combine distinct learning and teaching approaches, including non-formal learning. In this sense, the use of game-based learning (GBL) emerges as an innovative method that intends to break mane of the traditional teaching barriers and allow for reaching stronger student engagement. Escape rooms, as a GBL tool, have been gaining great space inside GBL strategies. This approach has been used in formal education by educators from different fields of knowledge. From these experiences are reported results that allow to conclude that these innovative strategies are an effective method to motivate and engage students in the teaching and learning process, and to foster the development of several key skills in students. The design of the puzzles and challenges, the hands-on experience, the immersive factor and the interaction provided through the activity, influence changes in knowledge, values and attitudes towards environmental behaviour and sustainability. This research has implications for the discussion on the most appropriate strategies for the implementation of educational escape rooms (EERs) to boost environmental education, namely in the context of formal education.

Keywords: Escape Room, Sustainability, Game-based learning, Environmental education, Educational serious games, sustainable behaviour

VR is Very Relevant 4 kids: Business Modeling for Virtual Reality In Healthcare[i]

Arian Merzaie[1], Ton Spil[1],Jasmijn Franke[2] and Monique Tabak[2]
[1]University of Twente, Netherlands
[2]Roessingh Research and Development, Netherlands

a.a.m.spil@utwente.nl
DOI: 10.34190/GBL.21.053

Abstract: A healthcare organization in the Netherlands, in collaboration with their research partners and a Virtual Reality (VR) company, have been developing an innovative product for rehabilitation care, the VReye!. This prototype product aims to close the gap between the clinic and the real world, by allowing children with developmental coordination disorder (DCD) to learn how to ride a bicycle in a safe VR environment. The objective of our study was to create a Business Model for this VR product. First, a structured literature review was performed (Wolfswinkel, 2013). Next, 14 interviews were conducted with different stakeholders. The data was analysed with the method of Miles and Hubermann (2014). For the business modeling we used the STOF model (Service, Technology, Organization Finance) (Haaker et al, 2013). The literature study showed that the eye tracking function of the VReye! would be of additional value in the rehabilitation of children with DCD. In addition, the organization and financial aspects of VR in healthcare were insufficiently reported. Based on the interview results, we propose an early-stage business model. In this model, the most viable option for the VReye! is to first apply for a research funding to cover the development stage towards a medical product. For the latter, a possible suitable model would be centered around health insurance companies, in which the VReye! is offered as a service to healthcare organizations. Business modelling for VR in healthcare is still underdeveloped. We proposed a possible business model of a specific case: the VReye! The STOF model was found effective in this case. More research is needed to investigate its suitability in daily clinical context.

Keywords: Serious Games, Virtual Reality, Healthcare, Business Modeling

Relationship Between Spatial Reasoning Skills and Digital Puzzle Games

Iolie Nicolaidou, George Chrysanthou, Marita Georgiou, Christos Savvides and Stavrini Toulekki
Cyprus University of Technology, Limassol, Cyprus

iolie.nicolaidou@cut.ac.cy
DOI: 10.34190/GBL.21.016

Abstract: Spatial relations are an integral component of science, technology, engineering, and mathematics (STEM) disciplines. Despite studies indicating that spatial reasoning skills are important for student success in STEM disciplines, these are not systematically instructed or tested in K–12 education. There are very few widely available opportunities to train spatial reasoning skills that have been proven to be effective tools. Previous studies have found a connection between playing action games and increased spatial skills. Recently, the connection between puzzle games and spatial skills has received attention, as a positive relationship between them was found in school children. The present study implemented a survey research design to examine whether there is a difference among young adults (18-30 years old) with respect to their spatial reasoning skills. The main focus of the study was a comparison between players of puzzle games as compared with non-gamers. For this purpose, a questionnaire was developed that tested spatial reasoning skills (locating patterns, finding symmetry, matching shapes etc.), using ten multiple-choice problems. Fifty-one participants (31 male), with an average age of 22.6 years old (SD=3.48) completed the questionnaire. Data analysis indicated that the number of hours of playing digital puzzle games had a strong, statistically significant positive relation with spatial reasoning skills (Pearson's $r= 0.51$, $p<0.01$). This provides an indication that the more hours young adults play digital puzzle games the higher their spatial reasoning skills. The study did not find a statistically significant correlation between spatial skills and variables such as self-perceived programming knowledge, or frequency of playing non-digital puzzle games. This study argues in favor of the design and development of mobile puzzle games that seamlessly promote spatial skills from a young age, without the need to provide structured formal education interventions for K-12 children. Findings are valuable for game designers and developers as they indicate benefits of playing digital puzzle games.

Keywords: digital games, puzzle games, spatial reasoning skills, spatial visualization skills

Computer Science Unplugged: Developing and Evaluating a "Traveling Salesperson Problem" Board Game

Mareike Nutz and Luzia Leifheit
University of Tübingen, Germany

mareike.nutz@student.uni-tuebingen.de
luzia.leifheit@uni-tuebingen.de
DOI: 10.34190/GBL.21.071

Abstract: Imagine the following scenario: It is the 18th century and you are a traveling merchant, planning to sell your goods in a number of cities. Travel is costly and time-consuming, so you want to visit all relevant cities on a round trip while having to travel the shortest possible distance overall. This challenge has written history under the name of Traveling Salesperson Problem (henceforth TSP). Nowadays, the TSP is not only a combinatorial problem central to theoretical computer science, but also highly relevant for human endeavours as vastly diverse as holiday planning, economic supply chain management, and even DNA sequencing. With the goals of enabling players to (a) explore this fascinating problem and (b) develop intuitive as well as algorithmic solution strategies, we created the educational board game "On the Trails of the Traveling Merchant", which can be played in two different versions: cooperative or competitive. To empirically evaluate and compare both versions with regard to relevant aspects of gamefulness and enjoyability, we conducted a user experience study with 12 participants. Using a paper-pencil version of the Game Experience Questionnaire (GEQ) including the Social Presence Game Questionnaire (SPGQ) module, we assessed participants' game experience along the seven general dimensions of (i) immersion, (ii) tension, (iii) competence, (iv) flow, (v) negative affect, (vi) positive affect, and (vii) challenge, as well as the three social dimensions of (viii) empathy, (ix) negative feelings, and (x) behavioural involvement. Additionally, we assessed players' perception of the game as a learning and playing experience, and their rating of the game materials. The present article concludes that players report an overall positive game experience for both the cooperative and competitive version of the game. Furthermore, results indicate that players are in the zone of proximal development while familiarizing themselves with the TSP and coming up with strategies for solving the problem.

Keywords: computer science education, computational thinking, game-based learning, unplugged game, game experience, traveling salesperson problem

Source Analysis of Wikipedia Articles About Indie Games with Educational Possibilities

Jorge Oceja[1] and Ángel Obregón-Sierra[2]
[1]Valencian International University, Valencia, Spain
[2]Universidad Isabel I, Burgos, Spain

joceja@universidadviu.com
angel.obregon@ui1.es
DOI: 10.34190/GBL.21.010

Abstract: Indie games represent, probably more than any other category, the freedom and creativity of game designers. These innovative games produced outside mainstream studios propose artistic experiences that are full of emotions and have great educational possibilities. Given the vast amount of information compiled in Wikipedia about games, many of these small productions have their own articles. However, the way they are created has not received much study, and even less has been devoted to the kinds of references that they include. This work uses a selection of indie games with educational possibilities to analyze the content of their Wikipedia articles, classifying and assessing the quality of their sources. Thus, after selecting the games and finding their corresponding articles, all their references were tracked. A classificatory system was applied to understand the bias involved in the production of this information, exploring the extent to which the educational possibilities of these games have been explored. Although many games have dedicated articles on Wikipedia, most of their references come from games news websites or sources that lack academic rigor. Particularly significant is the absence of academic books or journals, especially from areas such as education, game studies or game-based learning.

Keywords: independent video games, indie games, game-based learning, Wikipedia

Game-Based Learning Mobile-App for Teaching the Binary Numeral System

Lee-Yeng Ong, Meng-Chew Leow and Chin-Keong Tan
Multimedia University, Jalan Ayer Keroh Lama, Malaysia

lyong@mmu.edu.my
mcleow@mmu.edu.my
DOI: 10.34190/GBL.21.153

Abstract: The binary numeral system is a fundamental and necessary knowledge for people who work within the computer related professional fields such as IT and Engineering. Almost every technological device that we use in our daily life today is operating on the binary numeral system because of its straightforward implementation in the digital electronic circuitry using logic gates. However, many beginners are facing difficulties in learning the binary numeral system, such as misunderstanding the concept, having insufficient time to practice their understanding or having difficulty in grasping the arithmetic procedures. With the fast development of digital devices, people nowadays are learning through interactive and personalized game-plays. Compared to traditional learning, game-based learning (GBL) creates a more attractive channel for knowledge transfer, ensuring more effective learning outcome. This study aims to design a GBL mobile-app for binary numeral system for beginners. The proposed mobile-app adopts James Paul Gee's 16 principles of GBL design methodology and follows the optimal GBL design factors provided by Olsson and Mozelius (2017). Four difficulty levels (beginner, intermediate, expert, and hidden) are available, with the random question generator matching the specific difficulty level. The difficulty level will increase gradually for three basic game modes (decimal, octal, and hexadecimal). The questions can be formulated into two-way conversions, with arithmetic operations covering addition, subtraction, multiplication, and division. Instead of asking users to input the binary number, the inversed questions will ask users to input the decimal number for the given binary number. There were a total of 37 responses collected from the beta testing. The survey questions were divided into three sections, namely the questions on the principles for GBL (12 questions), the questions on user experience (6 questions), and the questions on system integrity (5 questions). Majority of the participants gave positive feedback on the application of the principles for GBL design into the game development and on system integrity. They were satisfied with the user experience. 30 participants felt that the GBL approach is most suitable for learning Mathematics. In addition, the experiment also found that 46% of the participants preferred a better visual experience among other modalities from the VARK model.

Keywords: Binary numeral system, game-based learning, James Paul Gee's 12 Principles, binary number, mobile app

Using Kahoot! to Enhance the Motivation of Undergraduate Students of Tourism in Mathematics Classes - A Case Study

Sónia Pais[1] and Andreia Hall[2]
[1]CITUR – Centre for Tourism Research, Development and Innovation, Polytechnic Institute of Leiria, Portugal
[2]CIDMA, Center for Research and Development in Mathematics and Applications, University of Aveiro, Portugal

sonia.i.pais@ipleiria.pt
andreia.hall@ua.pt
DOI: 10.34190/GBL.21.142

Abstract: Nowadays we live in an ever-changing society. The educational context is no exception and requires a renewal of paradigms. Profound changes to the role and function of the professor and the students are particularly vital. Active, cooperative and participative methodologies of learning must be privileged, breaking with magisterial education and the mere transmission of knowledge. Mathematics is one of the school subjects where demotivation is a frequent concern. Relating mathematics with other areas usually draws students' attention and increases their involvement in the classes. It is necessary to go beyond the traditional; the teacher must look for resources that make his classes flow, so that the students acquire or increase their interest in mathematics. In the last few decades, technology has advanced in multiple fields, including education. Some of its benefits include improving student performance and motivation, fostering active learning, and tracking student progress. Kahoot! is an example of a platform that can be used for reviewing content and motivating students for learning. The main reasons for choosing this tool are related to the fact that the application is accessible online free of charge, allows an intuitive use, both by the teacher/author and by the student/player and allows the participation of the whole class in an interactive, stimulating, and playful way. The teachers involved in this study began using Kahoot! in their classes as an alternative teaching methodology. The participants in the study are undergraduate students from a Portuguese higher education institution and encompassed the curricular unit of Statistics. The aim of the study is to investigate students' perceptions of how Kahoot! can be used as a tool for reviewing class content or designing warm-up activities. A survey was

conducted to gather information about students' insights on the use of Kahoot!. Similar studies have shown that higher education students are usually receptive to the use of this tool, finding it useful to increase their motivation and consider technology can positively impact learning.

Keywords: educational games, game-based learning, higher education, motivation, Kahoot!.

Toward a Successful Badge Design in Gamified e-Learning: A Literature Review

Adam Palmquist[1] and Izabella Jedel[2]
[1] University of Gothenburg, Sweden
[2] Insert Coin, Gothenburg, Sweden

adam.palmquist@ait.gu.se
Izabella.jedel@insertcoin.se
DOI: 10.34190/GBL.21.077

Abstract: This study reviews a sole entity in the gamification design, badges, to determine best practices regarding design and implementation in digital environments. By cond0ucting a literature review covering ten experimental publications that examined the badge isolated in a gamified digital environment, this study concludes that existing research gives varied results in implementing badges. The study's key finding is that due to similar population, context and game attributes, the game element Badges seems to be most effective when used as signs and steppingstones steering the generated user activity towards the intended end-goal of the design. This study has both practical and theoretical implications.

Keywords: Gamification, Badges, Design, Higher education, Behaviour, Implementation

“Face-to-Face” or Sim-to-Sim: Pros and cons Regarding Group Work Using a Games-Based Environment

Ole Jørgen S. Ranglund, Hanne Haave, Synnøve Arntzen and Tone Vold

Inland Norway University of Applied Sciences, Rena, Norway

Ole.ranglund@inn.no
Hanne.haave@inn.no
Synnove.arntzen@inn.no
Tone.vold@inn.no
DOI: 10.34190/GBL.21.137

Abstract: It is argued that face-to-face (F2F) allows students to get to know each other and collaborate, including quite a bit of informal communication in F2F meetings. However, during the pandemic, even the F2F has been digital. There is an uncertainty of how future higher education will develop, with the extension of the digital/virtual appearance being in the future in terms of hybrid solutions. In turn, this will put some constraints on the forming of groups and group work in classes. Some investigations, for example, why students appear with black screens, point in a direction of introducing Sims - virtual characters or avatars - as it is about feeling comfortable in what the students experience as an exposed situation. In particular, the students who entered higher education in the fall during the pandemic (Fall 2020) seem to have a high threshold regarding showing their face on the screen during seminars. The students “disappear” prior to group work sessions, only to “reappear” after the group work. What can we learn from the students when developing a games-based environment to support socializing, and thus facilitate for students to collaborate and cooperate in order to solve tasks during group work? Where do their preferences lie: working digitally “face-to-face” (F2F) or by using avatars, and why? Our data is based on investigations among approximately 450 students at the Inland Norway University of Applied Sciences, where we have interpreted results from a quantitative survey. In this paper, we will argue for both views. And even if the survey showed that the students were not unanimously in favour of avatars, we will conclude with suggestions for a new research project and provide guidelines for a dual approach, as well as investigating which settings provide the most comfortableness and best experienced learning outcome.

Keywords: gamification, digital escape room, enhanced learning outcome, online learning, avatars

An Open Workshop Enabling Art Students and Educators to Collaboratively Construct Multiuser Worlds

Manthos Santorineos, Stavroula Zoi and Konstantina Vetsiou
Athens School of Fine Arts, Greece

msantori@otenet.gr
vzoi@asfa.gr
nantina7@yahoo.gr
DOI: 10.34190/GBL.21.120

Abstract: The majority of children and students play computer games and are familiar with their terminology. However, they may not know how they are constructed and, primarily, they are not aware of their importance for contemporary digital culture. The same applies, also, for educators. In this paper, we present a proposal for an open prototype workshop, a combination of software and methodology, introducing art students and educators to concepts of contemporary digital culture (e.g. ecosystems of humans and artificial entities), through a construction and composition approach, based on powerful tools of multiuser games. The proposed workshop is named ***Creation of the world***, precisely because it concerns the construction of an original multiuser world, collaboratively by educators and students. It is organized in a scalable way, adaptable to different levels of education and technological knowledge. ***Creation of the world*** is built upon the infrastructure of @postasis platform (apostasis.eu), which we have specially designed to support distance, collaborative education and artistic creation. This platform has been implemented based on Unity game engine and provides customizable tools for creating virtual entities with dynamic behaviours (avatars, Non-Player-Characters (NPCs), Internet-of-Things mechanisms) that coexist in a multi-user access space. The role of the educator is important throughout the workshop as to the definition of the world's main concept, the rules of its development (e.g. NPCs' behaviours) based on platform's tools, and the transfer of these to the students through targeted lessons. Students are encouraged to jointly construct elements of realistic or imaginary artificial worlds and their characters, by using composite means, starting from existing knowledge (e.g. painting, texts, digital elements, scripting). Their creations are gradually transformed and integrated in the platform's space, thus developing an ecosystem of interacting virtual characters and humans. Students and educators dressed as avatars jointly experience the constructed world and discuss on its concepts and redesign. Through this process they both acquire practical skills, and a critical view of the production cycle of such a world, and thus are able to reflect

on creative ideas. Results are presented from cases of secondary and higher art education and directions of further research are proposed.

Keywords: multiuser games, art education, *Creation of the world* workshop, Non-Player-Characters, @postasis platform, Alien (Ξένος) concept

Learners' User Experience Assessment of a Serious Game for Social Innovation Education

Antonia Schorer and Aristidis Protopsaltis
Innovation in Learning Institute, Fuerth, Germany

Antonia.schorer@ili.fau.de
Aristidis.protopsaltis@ili.fau.de
DOI: 10.34190/GBL.21.051

Abstract: The use of serious games and game-based learning to develop new skills and knowledge in the context of social innovation education is a new and a promising endeavour. Social innovation education supports the empowerment and activation of students as social change makers. At the same time, the active engagement in socially impacted projects and activities enhances self-efficacy and promotes a positive emotional learning experience through game-based learning. Serious games are an opportunity for players - and learners - to demonstrate the impact of their actions in the creation and implementation of social innovation projects by working on emerging and real-world problems in a protected environment. To be able to achieve the educational goals of the game, the user experience of the learner during the game and learning process is crucial. A positive learning experience and appreciation of the game, for instance in terms of usability and playability, will lead to more promising results than negative assessments. With the purpose of drawing conclusions in this context, the objective of this paper is to present the results of the user experience empirical analysis of learners in the NEMESIS Serious Games for Social Innovation. The game, based on an adventure and open-world game, introduces social innovation to students. This is achieved by bringing the player to NEMESIS City with the aim of increasing the well-being of the inhabitants with his "social innovation power". There, the player gets the opportunity to work on new problems and implement social innovation projects in collaboration with non-player characters (teachers, social innovators, parents', and other stakeholders) in order to be rewarded with happiness points for the city. The evaluation of the game focuses on usability/ playability, narratives, play engrossment, enjoyment, creative freedom, personal gratification, visual

aesthetics and learning success of the game-based social innovation education approach.

Keywords: Serious Games, Game-based Learning, Social Innovation Education, Sustainable Development Goals, User Experience

Evaluating Game and Learning Mechanics Separately: A Practical Approach to Evidence-based Serious Game Development

Anna Seidel, Franziska Weidle and Claudia Börner
Brandenburg University of Technology, Cottbus-Senftenberg, Germany

Anna.Seidel@b-tu.de
Franziska.Weidle@b-tu.de
Claudia.Boerner@b-tu.de
DOI: 10.34190/GBL.21.069

Abstract: Although serious games strive to combine game and learning mechanics as seamlessly as possible, they often provide supplemental learning content such as learning videos, glossaries, appendixes or further information. Due to its complexity, evaluating GBL requires differentiated perspectives on mechanics and their impact on learning. Yet, current methods often focus on overall impressions rather than the effect of individual elements. To ensure quality and meeting the needs of the target group, it is useful to test mechanics separately. For this reason, the paper suggests evaluating additional learning content separately from the game environment. In the study, participants (106 students (65 girls), MWage = 16.41 SD = .75) were asked to answer questions regarding their motivation, attitude and self-concept of ability towards mathematics and physics before and after watching three learning videos from the serious game re:construction. Additionally, they were asked several questions about video characteristics as well as knowledge and interest gain. Furthermore, participants were asked to rate the video formats and report what they liked and disliked. The videos show mathematical and physical content in connection to the storytelling, characters and examples used in the serious game. The factorial repeated-measure ANOVA for motivation, attitude and self-concept of ability shows a main effect for attitude and activity-based motivation as well as an interaction effect regarding activity-based motivation and age. The variables regarding the videos were analyzed via one sample t-tests regarding the average item. All three learning videos were rated better than the average regarding their general assessment, recommendation, general cognitive load, highlighted information, engagement and willingness to

work, individuality, learning goals, quality and comprehensibility. All three examples were rated worse than the average regarding workplace relevance, and the gain of knowledge and interest. To evaluate game and learning mechanics separately can be a useful to assess their individual impact, quality and fit with the target group. Furthermore, it allows an autonomous development of each game component, if the digital prototype is not ready for testing yet. Nevertheless, taking a mechanic out of its context can be biased since its interaction with other mechanics is neglected. However, as part of a broader testing strategy, the revised mechanic could be tested again within the game environment in a subsequent study.

Keywords: game-based learning, serious game, learning video, engineering, future learning, evaluation

A Systematic Review of Using Reflective Design Features in Game-Based Learning

Anjuman Shaheen, Panagiotis Fotaris and Sanaz Fallahkhair
University of Brighton, UK

A.Shaheen@brighton.ac.uk
P.Fotaris@brighton.ac.uk
S.Fallahkhair@brighton.ac.uk
DOI: 10.34190/GBL.21.099

Abstract: Reflective learning forms knowledge from revisiting and reassessing previous experience intentionally and knowingly to modify experience positively. It helps increase self-awareness, which is a critical component of emotional intelligence, creative thinking skills, and a better understanding of an active engagement. Digital games are an appropriate medium for triggering and supporting reflection by providing a safe and immersive environment of stealth learning with the freedom to explore, identify, fail, and retry. Therefore, reflective design in game-based learning aims to trigger critical reflective learning in players, particularly given what game actions may mean in a larger learning context. However, although reflective learning can improve teaching and learning experiences in a new form, work dedicated to reflective design in game-based learning remains limited. This review aims to provide deeper insight into the characteristics of reflective design used in game-based learning to facilitate player reflection via digital games. In this systematic review, after screening against set criteria, a total of 20 studies published between 2010 and January 2021 in indexed scientific journals and conference proceedings were identified. We analysed the

main features of the reflective design in technology and how they are currently incorporated in game-based learning (GBL). In addition, we explored the impact of reflection-in-action and reflection-on-action on players' learning process during and after gameplay. The outcome of this analysis indicated that most of the reviews studies had incorporated reflective design features in GBL to improve the learning process, i.e., improve understanding, enhance user experience among players with active engagement, improve critical thinking, self-reflection, strategy development, reasoning problem-solving, and retention rate. This systematic review aimed to provide an exploratory study for educators, researchers, and game designers by providing valuable information on the main characteristics of reflective design in game-based learning and current limitations with future work.

Keywords: Reflective design, game-based learning, user experience, reflective learning, game design, systematic review

Using Dilemmas to Make Important Decisions: Analyzing Situations Based on the Covid Pandemic

Daria Shalina[1], Natalia Stepanova[1], Viola Larionova[1], Azeddine Bouziane[2], Nana Incirveli[3] and Ken Brown[4]
[1]Ural Federal University (UrFU), Ekaterinburg, Russia
[2]University of Bechar, Algeria
[3]Tbilisi State Art Academy, Georgia
[4]Letterkenny Institute of Technology, Ireland

d.shalina2011@yandex.ru, n.r.stepanova@urfu.ru, viola-larionova@yandex.ru
azzedine.bouziane@univ-bechar.dz, nanu_intskirveli@yahoo.com,
ken.brown@lyit.ie
DOI: 10.34190/GBL.21.079

Abstract: The study describes the problem of the complexity of decision-making. If there is any problem, the person is faced with the question of whether to perform an action or not. Our research focuses on the use of role-playing games to solve debatable situations, that is, where a dilemma appears. Today, covid dilemmas are relevant. Players are offered a brief description of a certain situation with controversial solutions to an urgent problem. This study presents practical cases that relate to vaccination against coronavirus. The participants of the game are divided into teams by roles, discuss and formulate their arguments in favor of a certain decision, depending on the chosen role. Next, each of the participants tries to prove the correctness of their point of view in a reasoned way. If the dilemma is decided by a majority vote, then those players who have convinced those present

of their point of view in solving the dilemma win. Thus, the problem situation is considered from different sides and a common compromise solution is reached, taking into account the interests of all players.

Keywords: dilemma, role-playing game, decision-making, coronavirus

GBL for Psychological Intervention Related Skills: What Challenges? What Paths?

Carla Sousa[1], Micaela Fonseca[1,2], Shivani Mansuklal[1], Jéssica Carvalho[1], Diogo Silva[1], Pedro Neves[1], Filipe Luz[1], Ágata Salvador[1], Leonor Costa[1], Jorge Oliveira[1] and Pedro Gamito[1]

[1]Lusófona University, Portugal

[2]NOVA University Lisbon, Caparica, Portugal

carla.patricia.sousa@ulusofona.pt; micaela.fonseca@ulusofona.pt; shivani.mansuklal@ulusofona.pt; mab4.jessica@gmail.com; diogo.silva55@hotmail.com; pedro.neves@ulusofona.pt; filipe.luz@ulusofona.pt; agata.salvador@ulusofona.pt; leonor.costa@ulusofona.pt; jorge.oliveira@ulusofona.pt; pedro.gamito@ulusofona.pt

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Abstract: In recent research, games have become an important reference with regards to learning skills with certain characteristics, as well as in promoting contemporary literacies. Games have similarly become highly relevant in the promotion of psychological well-being and mental health. Even considering this role in promoting learning in general, soft skills, motivation, cooperation, empathy, among others, in the field of psychological intervention, the potential of games has been much more applied to patients than to the psychologists and their professional development. The present study aims at mapping the intersection between psychological intervention related skills learning and game-based pedagogical strategies. For such purpose, a Systematic Literature Review was conducted through some of the most relevant scientific databases. The obtained sample was further selected following the PRISMA guidelines with screening and eligibility processes based on inclusion criteria, defined considering the research's aim. Non-peer reviewed research and studies aimed at other pedagogical approaches, such as gamification, were excluded from the final sample. Papers were categorized, coded, and analysed through statistical procedures and content analysis techniques. The results contextualize games as effective and feasible tools in the professional development of psychologists and psychology graduates, simultaneously highlighting the scarcity of resources in this field and the need for

more experimental and *quasi* experimental approaches to foster evidence-based pedagogical choices.

Keywords: GBL, Psychology, Psychology Learning, Psychology Students, Mental Health Professionals, Therapists

The Science Behind the Art of Engaging: Support in Games and Coding

Bernadette Spieler
Zurich University of Teacher Education, Centre of Education and Digital Transformation, Switzerland

bernadette.spieler@phzh.ch
DOI: 10.34190/GBL.21.152

Abstract: Although there is growing awareness of the importance of teaching programming in schools, the roadblocks of stereotypes, biases, and social/cultural prejudices often shape the framework of learning settings in Computer Science (CS). In programming, students usually have different uneven advantages or disadvantages prior knowledge, expectations, and approaches: While some have a more substantial need to work collaboratively, share their work, and proceed systematically, others like to develop on their own and tinker without needing immediate help or guidance. During periods of restricted physical presence at school locations, such as during the Corona pandemic, individual digital solutions were required to provide online pedagogical motivation. Especially online, it is crucial to find new ways of encouragement and personal support. A completely stand-alone online workshop (i.e., Massive Open Online Course, MOOC) may not be as supportive as direct support from teachers or tutors. This leads to the question of whether various online support services (e.g., tutoring) are valuable and necessary. In April 2020, learners were encouraged to participate in an online extracurricular programming experience, focusing on mobile visual programming and game design. The goal was to solve small, constructed coding units with the app Pocket Code online and develop their personalized game at the end. This paper presents the four-day extracurricular online programming initiative conducted with 21 students aged 10 to 15 in Hildesheim, Germany. This experimental case study shows the different utilization of support options like tutoring sessions, comment sections, and collaborative group meetings, and provides further insights on the online workshop. Results demonstrate some preferences between genders: girls engaged in tutoring sessions longer and more frequently.

Keywords: programming, online support, collaboration, online workshops, tutoring

Prototypical Implementation of an Applied Game with a Game-Based Learning Framework

Ramona Srbecky, Manfred Krapf, Benjamin Wallenborn, Matthias Then and Matthias Hemmje
University of Hagen, Germany

ramona.srbecky@fernuni-hagen.de., manfred.krapf@studium.fernuni-hagen.de
benjamin.wallenborn@fernuni-hagen.de, matthias.then@fernuni-hagen.de
matthias.hemmje@fernuni-hagen.de
DOI: 10.34190/GBL.21.055

Abstract: Computer and video games have established themselves in society. For example, around 30.4 million Germans play at least occasionally, including 30 percent of 10- to 29-year-olds and 30 percent of 30- to 49-year-olds. Therefore, schoolchildren and students are very familiar with the medium. Learning content presented in game form builds on these experiences. Game-Based Learning Units (GBLU) can support the learning process in many ways. Numerous educational institutions now use digital learning systems in their teaching anyway. GBLUs should be able to be integrated as entirely and seamlessly as possible into the existing digital learning systems. The work aims to develop a prototypical GBLU while using a Game-Based Learning Framework (GBLF). The research goal is to provide a prototypical GBLU and integrate it with an existing Learning Management System (LMS). For this purpose, a 2D-Jump'n'Run game (which refers to a game genre in which the character moves in a two-dimensional environment) is developed. The used LMS will be integrated in the Knowledge Management Ecosystem Portal (KM-EP), and the connection is made by using the Learning Tool Interoperability (LTI). However, the GBLUs created in this way should also be as easy as possible for users to use. This includes the integration into an LMS, the configuration, and, ultimately, the playout to support the learning process itself. The paper presents the conceptual considerations for integrating the GBLU and the usage of the GBLF. Furthermore, the proof of concept implementation of the mentioned systems and the evaluation are presented. The usability of the concept was demonstrated by realizing and evaluating it using a Cognitive Walkthrough (CW) in a prototypical learning unit. The CW resulted in improvements and renewal for future work.

Keywords: game-based learning, unity, LTI, learning analytics, applied gaming, serious games

Realization of a Framework for Game-based Learning Units Using a Unity Environment

Ramona Srbecky, Manfred Krapf, Benjamin Wallenborn, Matthias Then and Matthias Hemmje
University of Hagen, Germany

ramona.srbecky@fernuni-hagen.de., manfred.krapf@studium.fernuni-hagen.de
benjamin.wallenborn@fernuni-hagen.de, matthias.then@fernuni-hagen.de
matthias.hemmje@fernuni-hagen.de
DOI: 10.34190/GBL.21.057

Abstract: Computer and video games have established themselves in society. Around 30,4 million Germans play at least occasionally, including 30 percent of 10- to 29-year-olds and 30 percent of 30- to 49-year-olds. Schoolchildren and students are therefore very familiar with the medium. Learning content presented in game form builds on these experiences. Game-Based Learning Units (GBLU) can support the learning process in many ways. Numerous educational institutions now use support systems in their teaching anyway. GBLUs should be able to be integrated as completely and seamlessly as possible into the existing digital learning systems. The aim of the research is to provide a development environment for the creation of GBLUs with which it should be possible to design GBLUs based on Unity. For this purpose, functions for the integration into existing Learning Management Systems and configuration options are required. Game data analyses should also be possible for learning and Learning Unit evaluation purposes with the help of which the Game result can be evaluated to optimize the Learning Unit, evaluate the task, and support the learners. The prototype framework to be created is intended to support developers of GBLUs conceptually and technically in extending the process of game creation by a component for Game result and learning result knowledge transfer. Furthermore, it should be possible to integrate the developed Game-based Learning Unit as easily as possible via authoring systems. The paper presents the conceptual considerations for the development environment and the gaming analytics component. Furthermore, the Proof of Concept implementation of the mentioned systems and the evaluation are presented. The usability of the concept was demonstrated by realizing and evaluating it using a Cognitive Walkthrough (CW) in a prototypical Game-based Learning Unit. The CW resulted in improvements and renewal for future work.

Keywords: game-based learning, Unity, LTI, learning analytics, applied gaming, serious games

Paper-based vs. Digital Prototyping: How to Evaluate Serious Game Concepts at Different Stages of Development

Antonia Stagge and Cornelia Schade
Technische Universität Dresden, Media Centre, Germany

antonia.stagge@tu-dresden.de
cornelia.schade@tu-dresden.de
DOI: 10.34190/GBL.21.023

Abstract: During the development process of a serious game elements such as storyline, feedback and learning tasks need to be designed in order to create an entertaining but also goal-oriented learning experience. Thus, a decisive challenge is to master the balance between learning and playing. Prototyping and testing can support a systematic evaluation of this balance. This paper describes how the methods of paper and digital prototyping were applied in the project E.F.A. which aims at developing a serious game on occupational health and safety. Paper prototyping was used at an early stage of the development process. Work on the digital prototype only began after the testing and refinement of the paper prototype was completed. This paper aims at answering the following research questions: How do evaluation results of a serious game concept differ between testing with a paper-based and a digital prototype? For which evaluation criteria is either a paper prototype or a digital prototype an appropriate medium to efficiently test and refine the concept of a serious game? To collect data on these aspects, eight test runs with the paper-based and seven with the digital prototype were conducted. Testers were asked to think aloud while playing and were interviewed before and after testing. A comparison of paper-based and digital testing shows that a paper prototype is rather useful for evaluating baseline elements such as the complexity of learning tasks. In the specific case of E.F.A. the implementation of learning contents was criticized and participants perceived only a small grow in knowledge. For testing aspects of usability digital testing, though, turns out to be a better suited method. The digital version revealed problems in the navigation and the position of dialogs or buttons. The results of this research indicate which evaluation criteria are useful for different levels of abstraction of prototypes.

Keywords: serious games, paper prototyping, digital prototyping, learning experience design, evaluation

Gamification of the Middle Ages: Educational Dimension of User Modifications of "Total War: Medieval II"

Anton Sukhov
Ural Federal University named after the first President of Russia B. N. Yeltsin, Ekaterinburg, Russia

suhovband@mail.ru
DOI: 10.34190/GBL.21.106

Abstract: The increasing attention to the Middle Ages in popular culture (e.g. the TV series "Vikings") and scientific discourse (neo-medievalism, H. Bull, S. J. Kobrin, A. C. Arend) in turn, led to a widespread medieval theme in digital media and virtual worlds of modern video games. The paper investigates the gamification of the Middle Ages on the relevant example of innovative educational capabilities of user modifications (mods) of the historical game "Total War: Medieval II" (TWM2). Compared to the original 2006 game, many (still) constantly appearing (even in 2021) custom mods were created in close collaboration with professional historians and significantly improve historical authenticity and the level of involvement (E. Goffman) of gamers. Methodologically, the study takes into account that TWM2 with its mods is a genre hybrid of turn-based and real-time strategy with RPG (role-playing game) elements. According to these three levels, user mods: 1) discover new historical regions as well as the cultural, political, technical, and religious backgrounds of regional medieval history (at a strategic turn-based level), 2) carefully represent new historical types of troops (at a tactical real-time level), and 3) add new historical medieval characters (at an additional RPG level). The paper reveals the innovative educational capabilities of TWM2 mods that improve the historical authenticity of the original game and allow engaging game-based learning of medieval history. In terms of methodology, the study uses the newest theories of gamification (Y.-K. Chou, A. Marczewski, S. Deterding, R. Bartle), the diachronic principle of historicism and regional typology, the dichotomy of ludology and narratology (G. Frasca, J. Juul), the non-reductionist approach of I. Bogost, the concept of the "involvement" (E. Goffman). The findings of the paper can be useful for modern historical, educational, and game studies.

Keywords: total war medieval II, game-based learning, gamification, video games, game studies

Investigating the Effects of Social Gameplay Elements in Gamifying Online Classes.

Chin Ike Tan, Choon Yee Wong, Aidora Abdullah and Julian Eng Kim Lee

UOW Malaysia KDU, Utropolis Glenmarie, Selangor, Malaysia

citan@kdu.edu.my, cywong@kdu.edu.my, aidora.a@kdu.edu.my
ek.lee@kdu.edu.my
DOI: 10.34190/GBL.21.012

Abstract: With the sudden outbreak of the deadly COVID-19 virus, countless academic institutions around the world were driven to shift entirely from teaching in physical classrooms to online teaching overnight. One of the biggest challenges faced by educators is how to sustain student engagement in online delivery. Gamification, the approach of engaging users by employing game design elements and mechanics is one such solution. Nevertheless, in most cases the practice of gamification is more on being results oriented and less experience-centric, while the success of video games is usually more focused on its overall player experience. For the purpose of this paper, the term 'vertical gamification' is used to describe the lower-tier levels of gamification which utilizes game elements such as leader-boards, points and badges as its purpose is to attain higher points for rewards. The utilization of social gameplay elements such as the challenge, opposition, and competition aspects of game design within gamification is termed as 'horizontal gamification'. The horizontal reference refers to a more social-centric aspect of game experience. This paper aims to examine learners and their perceived experience in the gamification of online classes and to gauge the level of engagement and challenges faced by these learners. The research also aims to investigate if a vertical gamification procedure provides a similar level of engagement as the horizontal gamification procedure. Through a series of surveys involving 108 participants within a normal online class environment, online classes utilizing vertical gamification and online classes utilizing horizontal gamification; the research was able to determine at which point the learner's level of engagement increases. The research will apply the GAMEFULQUEST instrument to assess the perceived gamefulness between the various online classes to ascertain the success of using a more distinctive experienced-based gamification approach to enhance engagement for online teaching and learning.

Keywords: Gamification, Online Teaching, Game Design, Serious Games, Social Gameplay

The Joy of Rediscovering Chess: The Perspectives of Dialogic Thinking in Chess

Malolaprasath Thittanimuttam Sundaramadhavan[1], Luis Blasco De la Cruz[2], Astrid Barbier[2], Sharon Whatley[3] and Mustaffa Megrahi[4]

[1]Foundation for Learning Research in Chess, Chennai, India
[2]Madrid Chess Academy, Madrid, Spain
[3]Gibraltar Chess Academy, UK
[4]AtlantisTraining and Consultancy, Cardiff, UK
flrinchess@gmail.com, luisblasco@madridchessacademy.com, Barbier.Astrid@gmail.com, Sharon.whatley@icloud.com, mmegrahi@yahoo.com
DOI: 10.34190/GBL.21.061

Abstract: Chess is a zero-sum game with no uncertainty for any players, as there is no hidden information. The turn-based nature of the game introduces the gaming opportunity as profound in the characteristic of the player's style. Chess players realise and internalise such a body of knowledge, evaluations and further refine the learning from stimulating dialogues that nurture the progressive thinking from shared experience in gaming. Whilst, professional and experts in chess at the highest level have these traits, children and amateurs take a more random approach and enjoy the discoveries in Chess. In this paper, we explore the immersive social space of a playing environment and quantify Individual learning experiences and realise the Chess Board as an Interface to the opponent (who Constraints the Thinking). Further, the gaming opportunity with chess is then reduced to discovering the opponent in the context of effectively engaging in a progressive dialogue (from constrained to the regulated environment). In this formulation, we bring four different accounts of a facilitator's experience to bring an understanding of the journeys of children and young people learning chess. We outline the contrasting ideas and observation from (a) Social Inclusion Perspective with working with children with ADHD in Spain (b) Gender-based Dialogues – understanding female participation in Chess (c) Children's communication in highly Informal, teacherless, teaching less and Self-organised Learning Environment in Wales (d) Reflections from formal Chess-in-school programme in Gibraltar. With various attempts to engage chess in schools and communities, we could now design and nurture dialogic thinking in the context of game-based learning to re-imagine perspectives on how effortlessly (a) Experience is delivered to an audience of a universal appeal (b) Derive useful lessons learned to bring measurable and evidence-based outcomes through Game-based Learning.

Keywords: Chess, Dialogic Thinking, Chess-in-schools, Gender, Inclusive Pedagogy, Children led Approaches

Learning Indoor Navigation Skills: A Mobile Game for People with Intellectual Disabilities

Inga Volosnikova[1], Olga Shabalina[1], Aleksandr Davtian[2] and David C Moffat[4]

[1]Volgograd State Technical University, Russia
[2]Moscow Institute of Physics and Technology, Russia
[3]Glasgow Caledonian University, UK

volo.inga@gmail.com
o.a.shabalina@gmail.ru
agvs@gmail.ru
d.c.moffat@gcu.ac.uk
DOI: 10.34190/GBL.21.078

Abstract: People with intellectual disabilities often experience problems whenever they want to visit large indoor spaces such as shopping centers, hospitals, and cultural centers, as they might be not able to quickly navigate them and find the right place. Interactive message boards, signage systems, helpdesks, and other navigation aids may be useless to them, as they may not be able to read and understand navigation maps, or even communicate with strangers. This article presents a mobile game that trains indoor navigation skills of people with intellectual disabilities. The gameplay is based on user control of the movement of a game character along a route built in the space with several indoor objects. The goal of the game is to complete the route from the entrance to exit with minimal deviations. The indoor space and the objects within the space are represented as 2D or pseudo-3D (isometric) models. The route is rebuilt every time at the beginning of the game, depending on a set of objects which the character wishes to pass by, and is divided into segments between two neighbouring objects. To keep the user's attention while he moves the character, the current section of the route is highlighted and the end of the section is indicated by a bright marker. After the game character reaches the end point of each section, the user is shown a smiling or sad emoticon depending on the success in passing the section. After reaching the end point of the route, the user is shown a list of emoticons matched to each route section. The developed game was integrated with the mobile game for training shopping skills of people with intellectual disabilities previously developed by the authors. For the game, several models of real stores have been developed, , with interior shopping racks. At the beginning of the game, the user

creates a shopping list. The list is used to build a route on the store map, which the user must go through to buy all the goods from the list.

Keywords: mobile game, intellectual disabilities, people with intellectual disabilities, indoor navigation, training indoor navigation skills, training shopping skills

Toward a Game-Based Dialogical Pedagogy: Insights from Massively Multiplayer Online Role-Playing Games

Shangjun Wang[1], Sojen Pradhan[2] and Karlene Cousins[1]
[1]Florida International University, Miami, USA
[2]University of Technology Sydney, Australia

shawang@fiu.edu
Sojen.Pradhan@uts.edu.au
kcousins@fiu.edu
DOI: 10.34190/GBL.21.045

Abstract: Learning through dialogues enables individuals to engage different perspectives of other learners and foster wisdom. To date, researchers have dedicated themselves to utilizing games to facilitate learning engagement. From tabletop games to electronic games, the experience of gameplaying has encouraged dialogues and interactions between participants. The Massively Multiplayer Online Role-Playing Games (MMORPGs) introduced a new level of interacting experience in virtual worlds. They are designed to enhance cooperative experiences. Features like chat boxes, guilds, and easy grouping have afforded players opportunities for creative gameplay and facilitating teamwork. However, through the interviews with the players of Final Fantasy XIV (FFXIV), we found that the communication mechanisms embedded in the game are not always player-friendly. New players are often intimidated by the complexity of the game, and no effective channels have been in place to ask for help. Additionally, constraints associated with the private messaging system and limited communication across data centres further impede new players' abilities to learn how to play. Alternately, players would stream the gameplay on Twitch, inviting other players to chat, which facilitates open discussion and results in a superior exchange of information compared to in-game communication. Over time, this improvisation of utilizing the streaming channel as an extended tool to facilitate dialogical learning of the gameplay has made the game itself more enjoyable. In this study, we explore how dialogical learning occurs in an MMORPG (i.e. FFXIV) and how it contributes to interactions and engagement within the game by using grounded theory approach.

We conduct and analyse interviews of 10 U.S.-based FFXIV players to derive insights that will be beneficial to educators. Although video-based gamification and dialogical learning are not new concepts, they are still rarely implemented; monological structure continues its domination of school curriculums (from elementary to higher education). Through the present study, we want to call for change to this status quo.

Keywords: game-based learning, dialogical learning, MMORPG, Final Fantasy, gaming, Twitch.

Recommendations for Learning Through Educational Game Design: A Systematic Literature Review

Charlotte Lærke Weitze
Digital & Creative Learning Lab, Helsingør, Denmark

clw@digitalcreativelearninglab.dk
DOI: 10.34190/GBL.21.035

Abstract: This article presents a literature review on the state of the art of research on *students' learning through educational game design*. A growing number of researchers are studying students' design of educational games as a means of learning. Students are given active roles as educational game designers and learn by applying knowledge about their academic subjects to game learning and game mechanics, as well as by discussing and playing their games with peers. The role of game designers requires students to be innovative, make complex choices and apply creativity to reach their academic learning goals. The teacher plays the active role of co-creator in educational game development processes. Although this learning approach has great potential, it is complex for individual teachers to apply. Additionally, it can be difficult to assess and measure students' learning outcomes. The present systematic review investigates successful approaches as well as gaps in this research area. A total of 17 articles met the inclusion criteria and were coded for the literature analysis. The findings of the articles were extracted and synthesized to identify the dominating and essential themes and elements that contribute to the success of this way of learning. The reviewed articles shed light on (1) recommended pedagogical approaches, (2) examples of learning design frameworks, (3) methods for applying formal learning goals to students' educational games, (4) methods for measuring learning outcomes and (5) design of teacher and student support in the learning process. For each of these subtopics, future directions are proposed for improving the research area in the best possible way.

Keywords: Learning through educational game design, Game-based learning, Educational Game Design, Students as Educational Game Designers

Strategic Sustainability by Serious Gaming: A Case Study of STRASUS

Ningna Xie[1, 2] and Raphael Heereman von Zuydtwyck[1, 2]
[1]Maastricht University, The Netherlands
[2]University of Applied Sciences Niederrhein, Germany

n.xie@alumni.maastrichtuniversity.nl
raphael.heereman@hs-niederrhein.de
DOI: 10.34190/GBL.21.036

Abstract: There has been considerable progress in incorporating sustainability topics into serious games, particularly on fostering corporate learning about sustainability. Exploration is still limited in connecting learning from game sessions and game development context. Within the Interreg-VA Dutch-German project "STRASUS", a browser-based multiplayer simulation game for logistics-related companies, was designed to sensitise learning about sustainable business. Our study presents research in learning from game sessions and game development, using insights from analyses of documents, interviews, and observations in light of the learning-loop concept. The results show that single-loop was fully achieved; double-loop learning was achieved except for players not consistently linking comprehension of some sustainability concepts to the normative factors in business decision-making. Deutero learning was detected for the game designers and researchers involved in game design: both groups were sensitised about the difficulties to match the linear approach of game development with complex sustainability concepts. Our findings emphasise that strategic decision-making, key performance indicators and reflective debriefing are linked to the effectiveness of game-based sustainability learning. Furthermore, the learning-loop inspired assessment provides a valuable evaluation method for clarifying learning on the cognitive, normative, and contextual level. In conclusion, serious gaming offers a valid and practical approach to foster corporate sustainability learning if the game allows strategic thinking in players' decision-making; if multidisciplinary collaboration leads to the appropriate portrayal of complex decision-making processes for sustainability; and if game-based learning is reflected upon learning objectives that can be thoroughly discussed in the debriefing and beyond game sessions. As a suggestion for future research, we expect further investigation on how sustainability games could work together with other participatory learning activities to capture the benefits of different learning loops in an extended period.

Keywords: learning loops, serious games, game-based learning, multidisciplinary sustainability projects, business simulation, education for sustainability

The Road to AI Literacy Education: From Pedagogical Needs to Tangible Game Design

Marvin Zammit, Iro Voulgari, Antonios Liapis and Georgios Yannakakis
Institute of Digital Games, University of Malta, Malta

marvin.zammit@um.edu.mt
iro.voulgari@um.edu.mt
antonios.liapis@um.edu.mt
georgios.yannakakis@um.edu.mt
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Abstract: The advancement of artificial intelligence (AI) and its increased use in everyday life have exacerbated the need to understand its underlying processes, and to raise awareness about its shortcomings and faults. Consequently there has been an increased effort to teach basic concepts of AI and machine learning (ML) from an early age. Digital games have been shown to be effective as teaching and learning tools, and there are ongoing efforts to increase AI literacy through educational digital games. To this effect, this work describes the process followed to extrapolate the design of such an educational game directly from the pedagogical needs emerging from stakeholders. Seven focus groups and workshops were conducted in Greece, Malta and Norway, with 55 teachers, researchers, practitioners and policy-makers, and 22 primary and secondary education students in total. These workshops identified seven goals which informed the design of a game for AI literacy called ArtBot. The game design process and the final interface and gameplay loop of ArtBot are explained in relation to these goals. The game was subsequently deployed across a variety of platforms, to enable dissemination to a broad audience in classrooms and elsewhere. The game was part of the tools developed in the framework of the LearnML Erasmus+ project. A preliminary online survey was used to gauge how well the game was received by teachers and students, with an overall positive result. A longer-term data collection of the game usage statistics has been initiated and will be analysed over the course of the game dissemination.

Keywords: ArtBot, Artificial Intelligence, Education, Game Design, Game-Based Learning, LearnML, Machine Learning

Development and Evaluation of an Educational Board Game- “118 Job Bank” for Human Resource Training Courses

Pei -Ying Zuo, Ying-Sang Fang, Chih-ChenKuo, Hsin-Ta Lin and Huei-Tse Hou

National Taiwan University of Science and Technology, Taipei, Taiwan

penny10602@yahoo.com.tw
p28017976@gmail.com
d10722301@gapps.ntust.edu.tw
d10622305@gapps.ntust.edu.tw
hthou@mail.ntust.edu.tw
DOI: 10.34190/GBL.21.130

Abstract： Game-based learning has been popular research trend in recent years. Game-based learning may improve students' learning motivation, learning achievement, and involvement. Board game can strengthen interpersonal interaction and involvement in learning. This study developed the board game "118 Job Bank" integrating three cognitive mechanisms to facilitate students' career planning learning. There are “paired mode”, “sequenced mode” and “combined mode”. The corresponding card game tasks includes different personality traits fitting for different job positions, the salary of different job position, and different industry requiring different job positions through playing three game tasks of "Human Resource Agency expert", "Salary actuary" and "Hunter head expert." The purpose of the study is to investigate the effect of career exploration game on learners’ learning achievement, flow, anxiety, and motivation through the game. There are 37 high school in northern Taiwan participate in the research. The pre- and post-test was analyzed by the dependent sample t-test, and the he results indicates that the board game used in this study can enhance students' learning efficiency. Besides, Repeated measured ANOVA was used to compare students' involvement, motivation, game acceptance and anxiety scores in the different game modes. The result revealed that, there were no significant differences in flow, motivation and anxiety among the students in the different game modes.

Keywords: Board game, Game-based learning, Learning motivation, Learning anxiety, Cognitive design

PhD Research Papers

Teachers' Contemplation Towards Selecting and Evaluating Games for Classroom

Mifrah Ahmad
Deakin University, Melbourne, Australia

mifrah09@gmail.com
DOI: 10.34190/GBL.21.065

Abstract: Primary school teachers are equipped with versatile skills to learn, teach, and select learning tools while considering curriculum – only to ensure an engaging experience for learners. Articulating teachers' perspectives and the thought-process of how they select and evaluate a 'game' that has the 'potential' of delivering learning in their classroom requires attention. Teachers' experience of exploring, learning, planning, and training themselves advocates a connection to various personal and past experiences. Hence, understanding their students, gaining continuous experience, and comprehending their 'explorative skills' may allow further insights towards games as learning tools from their perspectives. Therefore, this paper investigates the influencing factors and approaches of primary school teachers in Australia on their decision-making process of evaluating and selecting games for their classrooms. With the concepts and principles adopted from the theory of experience, the need to include andragogical principles is also considered as participants are adults. With the phenomenological approach, the interpretivism paradigm is adopted to allow the acceptance of subjective views. Data is collected through semi-structured interviews with eleven teachers, and it is transcribed and coded through NVivo. Thematic analysis is adopted to ensure the depth of meaning of individuals' experience and how their experience influences their thought-process of selecting, evaluating, and engaging students using educational games. The paper concludes with a broader discussion regarding the influence of experience in teachers' education and learning, and how it influences game selection, evaluation and how they have not been involved in designing an educational game process. The author also proposes a "thought-process" from analysis to demonstrate two emerging approaches alongside tools and resources useful for other teachers in primary schools. Lastly, it is highly crucial to stress the differences between teachers playing a game and teachers evaluating the game for optimizing the classroom environment and learning for their students.

Keywords: Teachers' experience, games, educational games, designing educational games, learning tools/games, evaluating games

Interactive Storytelling Experience for Museums in the era of COVID-19

Saif Alatrash[1], Sylvester Arnab[1] and Kaja Antlej[2]
[1]Coventry University, UK
[2]Deakin University, Australia

alatrashs@coventry.ac.uk
aa8110@coventry.ac.uk
kaja.antlej@deakin.edu.au
DOI: 10.34190/GBL.21.009

Abstract: The recent COVID-19 restrictions have forced many museums and entertainment institutions to shut their doors to visitors. This initiated an extraordinary impact on the heritage sector, forcing museum professionals to rethink and reshape how heritage contents could be made more accessible. This paper is part of ongoing research for developing a theoretical framework towards enhancing the visitor experience within the museum environments. The study investigates the implementation of gamified storytelling experience within the context of immersive technology in museum environments towards increasing the level of immersion of the visitor's when "interacting" with museum artefacts. Digital technology allows museum professionals to implement advanced interaction within their exhibition displays, enabling visitors to be more active and involved in the knowledge exchange process. Museum display and exhibition practices are beginning to explore the potential of immersive technology to provide visitors with meaningful experiences that facilitate the transfer of knowledge. In this study, Virtual Reality (VR) is considered as an instrument that could enable better interpretation of these artefacts. To add and increase immersion and meaningful interactions in VR experiences, this study investigates storytelling and gamified approaches as key enablers of such experiences. The study covers engineering heritage with the Lanchester petrol-electric car developed in 1927 as the subject matter and also an artefact. The car, the inventor, Frederick Lanchester, and the history serves as the focal point of the investigation into the gamified immersive representations of museum objects. Three different VR experiments (gamified, narrated, and immersive) will be conducted in closed (university lab) and open (museum) environments to validate and determine the framework's impact on enhancing the users' experiences and interpretations. The developed framework will benefit museums exhibition in general by improving the interpretation process and educational experience for the visitors. The paper describes different approaches considered in this study such as gamification and

storytelling practices in museum mediums to improve immersions and motivation of the visitors.

Keywords: Cultural Heritage, Museums, Storytelling, Gamification, Immersive technology, Virtual Reality

Identifying the Lack of Immersive Games in Higher Level Mathematics Game-based Learning

Evgenia Anagnostopoulou
University of Sussex, Brighton, UK

ea434@sussex.ac.uk
DOI: 10.34190/GBL.21.116

Abstract: Although many educational games have been created across a range of game genres, the variety is limited when it comes to mathematical games. This paper explores a wide range of maths games available and classifies them in terms of their mathematical content and players' experience, in order to identify a gap that still needs to be covered. The author's PhD research is currently focused on addressing this gap. This work addresses the research question 'Is higher level mathematics included in immersive game-based learning?' To enable this a deeper perception of how maths content is integrated into existing games, the level of maths involved, and the kind of gaming experience provided are required and presented in this paper. A thorough search of mathematics games presently available on PC platforms was conducted. As the associated PhD research is investigating the potential of Massive Multiplayer Online Role Playing Games (MMORPGs) mechanics, mobile games are not considered in this paper. Because of similarities in the content and flow, the games were grouped and 12 cases were chosen as representative. To classify these cases, two scales were constructed: the mathematics content scale and the interactive player experience scale. The first scale classified the mathematical content of the games in five ranks according to the Key Stages of the UK National Curriculum. The second scale classified the interactive player experience. A five rank scale was devised in order to rank the various maths games with respect to the following five aspects: immersion; autonomy; relatedness; challenge and competence; intrinsically incorporated mathematics content. When the data collected was plotted, the findings revealed an area that it is still uncovered by mathematical games. This area represents games with high interactive player experience that would cover KS3–KS5 curriculum. This finding can be used in future research to address this area by making use of previous studies on highly interactive and immersive games that

provide increased players experience, such as MMORPGs, and embed KS4-KS5 mathematics academic learning within the mechanics of these, such that players are enjoying first and learning simultaneously by default.

Keywords: higher level maths; game-based learning; immersive games; mathematics games; interactive player experience; KS3 to KS5 maths

Teachers Designing Lessons with a Digital Sandbox Game: The Case of Minecraft Education Edition

David Bar-El[1] and Kathryn Ringland[2]
[1]Northwestern University, Evanston, IL, USA
[2]University of California, Santa Cruz, CA, USA

davidbarel@u.northwestern.edu
kringlan@ucsc.edu
DOI: 10.34190/GBL.21.135

Abstract: While studies have indicated that teachers are increasingly accepting digital games as a teaching tool, the curricular design work of teachers toward integrating digital games into their teaching has remained relatively understudied. This study explores the learning activity designs of teachers who used the sandbox game Minecraft Education Edition. Taking a grounded theory approach, we analyzed 159 publicly available lesson plans designed by 16 teachers. Through qualitative coding, we identified seven design dimensions that described variations across the lesson plans. We illustrated how teachers combine these design dimensions to arrange the socio-technical learning environment, scripting interactions between themselves, students, the game, and external media. These findings reveal the various design possibilities that teachers have when teaching with a sandbox digital game and highlight the important role that teachers play in designing game-based learning activities. Suggestions for future research and implications for the design of professional development for game-based teaching are discussed.

Keywords: game-based learning, games-based teaching, teachers as designers, Minecraft, lesson planning with digital games

Exploring the Impact of Perspective-taking Game Design Techniques in a Different Context

Henrique Gil, Mike Mannion, Caroline Parker and Romana Ramzan
Glasgow Caledonian University, UK

Henrique.gil@gcu.ac.uk
M.A.G.Mannion@gcu.ac.uk
C.G.Parker@gcu.ac.uk
Romana.khan@gmail.com
DOI: 10.34190/GBL.21.042

Abstract: In game design, the choice of design technique to use to engender empathy within a game player is an outstanding challenge. One element of empathy is the notion of perspective-taking. This paper explores the extent to which four previously used perspective-taking game design techniques, when applied in a different context, have a similar or different impact. The four techniques are point of view, avatar, similarities, and switching avatars. These techniques are known to have an impact on how a player identifies with their in-game representation and how it may have an impact on their perspective-taking. The new context into which they are applied is a game designed to develop empathic feelings towards immigrant workers (a person who goes into another country and works there) in different office workplace engagement settings. Twenty participants played the game. Before playing the game, each participant completed a questionnaire about their perceived level of empathy and their personal attitudes towards immigrant workers. Instrumentation was used to record each player's perspective-taking choices during the game. Each player was interviewed after the game about their choices and the extent to which they felt that their perceived levels of empathy had changed. A total of 45% of the players thought that the techniques enhanced their ability to perspective-take, 25% were uncertain and 30% thought the techniques did not impact their ability to perspective-take. Switching avatars was voted upon the most as the better technique. Authenticity and perceptive reasoning were the most common referenced traits ascribed to the techniques used. Eventually the perspective-taking game techniques provided support in a broader sense showing that they are tools that can be used to help facilitate, contribute, and support some degree of perspective-taking, knowing that each technique has its own merits and should be used with such consideration. This paper discusses implications of these findings.

Keywords: Identity, serious games, empathy game design, immigrant workers, perspective-taking, avatar

Single-Player Digital Games: Hegemonical, Dialogical, or Critical Agents in Identity Formation

Mike Hyslop Graham
IT University of Copenhagen, Denmark

mihg@itu.dk
DOI: 10.34190/GBL.21.094

Abstract: In terms of play with a single-player game and the habitual solitary play experience, there are only few indications as to what might constitute identity development within this practise. This paper asks, how identity may be constructed, maintained, or developed in the practise of playing, and how this can be indicated in play with single-player digital games. Namely, the goal is to decipher games' pedagogical inclinations along with the players' positioning in these towards learning processes which may establish a frame of identity development potential. This is done via the concept of transformative learning situations in gameplay as potentials of identity formation. This, in terms of both the sociocultural and constructivist implications of engagement with a game as culturally situated artifact, and the pedagogical view of these in relation to the practise itself. While this paper is a theoretical discussion around the single-player play-practise with single-player digital games in combination with literature on identity, the discussions are closely linked to the intricacies of qualitative studies on and of these phenomena. For this reason, the focal points of the discussions are centred on re-evaluating assumptions of research and methodological issues towards the cultural play-practise of identity and play. In this sense, the paper poses issues and questions towards utilizing learning theory to study games, and vice versa, while also providing questions towards assumptions in studying games and identity development through learning. The discussion points are linked to Game Based Learning as they open a view of learning that offsets from transformative learning theory specifically. This, while simultaneously focussing on the relational and pedagogical aspect of identity formation in a practise which is often overshadowed by games with an immediate social nature and their more observable interactions. In this, the paper concludes towards attention on methodological issues in player studies by highlighting the intricacies of learning and development processes in habitual solitary practises.

Keywords: Play-Practise, Learning and Identity, Transformational Learning Processes, Single-Player Games, Solitary Play, Identity play

Didactic Planning of VR Alcohol Resistance Training tool for Adolescents

Patricia Bianca Lyk and Gunver Majgaard
University of Southern Denmark, Denmark

pabl@mmmi.sdu.dk
gum@mmmi.sdu.dk
DOI: 10.34190/GBL.21.041

Abstract: This article explores didactic planning in relation to 360-degree virtual reality through the application PartyLab (ed. In Danish FestLab). PartyLab is a Danish educational 360-degree application for alcohol prevention for young adults (ages 15 to 17). The application is used in a virtual reality headset, which results in an immersive experience with an intense feeling of presence. The application consists of 125 different 360-degree movie sequences, which students steer through, through choice making. Hereby students get the opportunity to experiment with alcohol in a safe environment and test different approaches towards consuming alcohol. This results in each user having a unique experience. It is examined how didactic material can be designed to support the experiential learning that takes place in the application. The material is designed through an iterative process with evaluation by schoolteachers, SSPs (a unit of collaboration between schools, social services, and police) and later in a real-life setting in schools. This paper describes the first two iterations, which contain the development of the first edition of the teaching material, evaluation by schoolteachers and adaption of the material followed by evaluation of SSPs. The current material consists of a learning guidance that will enable the general schoolteacher to facilitate the learning course (including the use of VR headsets) and students' assignments to support the learning in the application. It was found that a very thorough guide for the teachers running the course is necessary, due to little or no experience with virtual reality and limited time for preparation. Moreover, using the application several times, with room for reflection on class and assignments on blood alcohol concentration could enhance students learning. Moreover, it was found, that assignments on alcohol consumption should be carefully introduced and not deal with high intake of alcohol, as it could create an incorrect worldview and thus promote alcohol consumption instead of preventing it.

Keywords: virtual reality, didactics, 360-degree video, game-based learning, experiential learning, alcohol, VRLE

Facing your fears: Design of a VR tool for Usage Within Exposure Therapy for Patients with Social Anxiety Disorders Combined with Selected Game-Based Elements

Asge Frederik Matthiesen [1] and Lasse Juel Larsen[2]
[1] Mærsk McKinney Møller Institute, Odense, Denmark
[2]Institut for Kulturvidenskaber, Odense Denmark

asfm@mmmi.sdu.dk
ljl@sdu.dk
DOI: 10.34190/GBL.21.149

Abstract: Anxiety disorders are one of the most common mental health problems in Denmark with an estimated 350.000 sufferers. Social Anxiety Disorder (SAD) often begins in adolescence and has a considerable negative impact on the patient's life. The gold-standard treatment for SAD is cognitive behavioral therapy (CBT). A central element in CBT is exposure therapy. During exposure the patient and practitioner gradually confront the feared stimuli. VR Exposure Therapy (VRET) utilizes virtual reality (VR) to provide an immersive and intense experience, comparable to the real world, for patients with anxiety disorders. This paper examines the development and design of two specific VR scenarios: "A Bench Scenario" with two people interacting with the patient and "An Employee Presentation" with four other people. The focus in this paper is regarding the design and development of the specific triggers used to provoke the fear stimuli within the patients with SAD and combined with game elements to enhance these triggers. These scenarios are developed and includes the usage of different game elements. These scenarios are to be tested in a larger RCT study combined with biometric data such as heart rate, sweat, and pulse sensors in order to measure anxiety levels. Both scenarios are to be interpreted in real-time and the scenarios can relay computer game inspired feedback to the practitioner. The overall goal of this project is: a) to shorten the treatment period for the patients, b) make a new approach for the current standard of treatment, and c) to lower the costs in treatment within the public sector. In the future the project will be able to target the specific anxiety triggers within the current patient. This research is a part of a larger project, called VR8, which is divided into several work-packages and between several partners.

Keywords: Social Anxiety Disorder, VR, VRET, Exposure Therapy, Gamification

Using Game Based Learning Elements in Practice Enterprises for Entrepreneurial Education

Mihaela Moca
University of Oradea, Romania

moca.mihaela@gmail.com
DOI: 10.34190/GBL.21.095

Abstract: Within the present socio-economic context, the entrepreneurial education has become an important topic. To understand the world of entrepreneurship, students from Romanian economic colleges benefit in the national curriculum from a program based on the Practice Enterprise (PE) learning method. It comes as an approach that uses game based learning elements and it has been implemented nationwide with support from the European Practice Enterprises Network (EUROPEN), later one transformed in PEN Worldwide. The aim is to develop entrepreneurship skills through the unique PE methodology "learning-by-doing". A PE is a trainee-run company that operates like a real business. Under the guidance of a trainer, students create their PE, from product development to human resources or sales. These activities involve the use of game based learning (GBL) elements and the simulation of the operations that take place in a real company, in order to create an authentic and realistic learning experience. Students play different roles and thus understand the dynamics of teamwork or the consequences of decisions made. Learning is perceived by students as a natural process, achieved through role playing, simulation or other game elements. This paper aims to identify the perception of the students on how various GBL elements implemented in PE has on their learning outcome and the way in which teachers embrace the PE approach. A survey study was conducted to 165 students and 40 teachers. Students were assessed about the development of their entrepreneurial skills by using PE in contrast to classical lectures methods. The results indicate that students respond better to this approach. The impact on teachers was assessed through a survey as well, to determine whether teachers consider the method practical and valuable for implementation. Teachers were also asked to identify successful GBL activity models, implementation opportunities and obstacles to overcome. The evolution of the number of the PEs in Romania confirms the success of the program, the increase of motivation for the development of entrepreneurial and reinforce academic skills.

Keywords: Entrepreneurial education, Practice Enterprise, Game base learning, simulation

Bridging Emotional Design and Serious Games: Towards Affective Learning Design Patterns

Gabriel C. Natucci and Marcos A. F. Borges
University of Campinas - School of Technology, Limeira, Brazil

gabrielnatucci@gmail.com
marcosborges@ft.unicamp.br
DOI: 10.34190/GBL.21.052

Abstract: It is no secret that learning is a complex set of processes. Researchers and practitioners have been tackling the problem of learners' engagement, motivation, and retention from various perspectives, from pedagogical to cognitive and psychological. Nowadays, learning has become increasingly ubiquitous in multimedia spaces. The use of games in pedagogical practices, known as game-based learning, is one approach that has attracted attention in recent years. There is still much to determine whether and how games affect the learner's cognitive process and stimulate educational gains, besides some findings of positive outcomes of such practices. Recently, some elements were included in the mix of learning variables: emotions and affective interactions. The learners' emotion and cognition are intertwined, and thus influences learning outcomes either positively or negatively; even though this gap between affect, cognition, and pedagogy is narrowing, many conceptual backgrounds could be integrated into a unified view of systematic learning, especially when using multimedia environments such as games. One model that has been proposed towards this unified contextualization is the Integrative Model of Emotion in Game-Based Learning (EmoGBL), which accounts for cognitive-affective processes and their interaction with learning content; it also provides insights into how a particular game element can interact with the learners' emotional and cognitive processes, particularly through game mechanics. However, there is still a gap in how exactly these elements can interact with the player in a way that can both inform designers and educators on how to design games with pedagogical focus (serious games), increasing learner's retention and motivation. This work intends to decrease the gap discussed between game mechanics, learning and affective outcomes. To do so, it proposes a collection of serious game design patterns and guidelines, by linking standard game genre classifications (such as adventure, role-playing, or action) and game mechanics found in the literature with affective appraisal processes related to learning, as well as pedagogical theories and educational practices.

Keywords: serious games, game-based learning, emotional design, human-computer interaction, game design, design patterns

Improving a new Design tool to Inform Serious game Behaviour Change Interventions

Karen Shanks, Mike Mannion, Karen Thomson, Julie Campbell and David Farrell

Glasgow Caledonian University, Scotland

Karen.Shanks@gcu.ac.uk; M.A.G.Mannion@gcu.ac.uk; K.Thomson@gcu.ac.uk; Julie.Campbell@gcu.ac.uk; davidfarrell81@gmail.com

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Abstract: Serious games are an increasingly popular mechanism for encouraging human behaviour change. A difficult challenge is generating game design ideas for a given behaviour change brief. This paper describes a card design tool that supports ideas generation. Each card summarises a behaviour change technique (BCT), provides an application example prompt, and identifies possible game design elements. The research question is: does the card design tool have perceived value for designers for generating ideas for behaviour change games? To evaluate the tool, four recently graduated game design students were given a set of 34 cards, instructions on using the cards, a game brief and then asked to generate ideas. The instructions included sorting the cards into piles with different headings (BCT, application example prompt, game design element). Cards were drawn randomly one at a time from each pile iteratively until all piles were exhausted. Participants recorded ideas using techniques they felt comfortable with e.g. note-taking, mind maps. Qualitative data on the students' perceived value of the design tool was collected using semi-structured interviews and analysed using reflexive thematic analysis. It showed that the cards had some value for ideas generation but often had too much information thereby stifling creativity. Some instructions were also confusing. The cards were modified: information made more succinct and a visual guide added to provide clearer instruction. The experiment was repeated with four serious games academics with more game design experience. Similar qualitative data was collected and analysed. This showed that the design tool provided a framework for designers to organise their initial ideas about how different elements of the game design brief might be tackled. It also helped to identify knowledge gaps and ideas that needed to be developed further. However, there remain some concerns about the tool's complexity inhibiting aspects of creative flow.

Keywords: serious game development tool, serious games for health, behavioural psychology, behaviour change techniques, behaviour change game, behaviour change game tool

"This is My Story": A Serious Game for Independent Living Skills in Special Education

Stavros Tsikinas and Stelios Xinogalos
University of Macedonia, Thessaloniki, Greece

s.tsikinas@uom.edu.gr
stelios@uom.edu.gr
DOI: 10.34190/GBL.21.154

Abstract: *This is My Story*" is a two-dimensional video game, aimed to assist students and young adults with intellectual disabilities (ID) and/or autism spectrum disorder (ASD) improve independent living skills. The main goal of the game is to serve as a means to enhance the learning process of skills related to independent living, in Special Education (SE) schools and organizations. The premise of the game follows the main character that lives independently in hers/his house. Every day, different tasks are completed that are part of a main goal. Each task is rewarded with a number of coins, depending on the game performance. The coins can be used for customizing the avatar of the player, enhancing the house setting accordingly, and ultimately achieving immersion. There is no negative feedback and the feature of repetition is added, in order to assist players improve their score. An in-game assistant informs the player about the tasks that s/he has to carry out and provides feedback. A monitoring mechanism collecting game learning analytics is implemented for monitoring the players' progress and the learning impact of the game. In this paper, the first game prototype that is ready for evaluation by SE specialists and end users will be presented. The game prototype incorporates three mini games that focus on: moving safely as a pedestrian to reach the cinema/shopping mall; performing transactions to buy a cinema ticket; understanding and following a map to reach corresponding shops to buy clothes. The design rationale of "*This is My Story*" will be presented in terms of a specialized design framework for serious games targeted to people with ID/ASD. This framework was designed based on a literature review of existing general-purpose design frameworks, serious games for people with ID/ASD and relevant design guidelines, as well as a questionnaire filled in by SE teachers/professionals. "*This is My Story*" is the first game that was designed based on this specialized framework and this can contribute to research on the field both as a case study and a validation of the underlying design framework.

Keywords: Serious Games, Intellectual Disabilities, Autism, Game Design, Independent Living

Masters Paper

Online Design Facilitation During COVID-19: Recommendations for Future Virtual Sports Innovation Camps

Philip Wolfgang, Lærke S. Rasmussen, Johannes DiBiaso and Lars Elbæk
University of Southern Denmark, Odense, Denmark

phwol17@student.sdu.dk; laera16@student.sdu.dk; jodib17@student.sdu.dk; lelbaek@health.sdu.dk
DOI: 10.34190/GBL.21.081

Abstract: The concept of 21st-century learning proposes critical skills necessary for operating in the future work market. The skills include e.g., critical, innovative and creative thinking, problem-solving, communication and collaboration and the skills are gaining relevance in sports and health science to discover new ways to counter the pressing health-related challenges, e.g., sedentary lifestyle. To incorporate these skills in practical learning processes, a two-day movement-based sports innovation camp was held for 54 K12 PE students. The camp was designed and facilitated by four master sports students in collaboration with local PE teachers. Due to the 2020 COVID-19 lockdown of the Danish society, the camp was forced to undergo a rapid transformation into an online-format. We utilized a qualitative single-case study approach to examine the students' motivation to participate in the online camp and provide recommendations facilitating similar workshops. The Self-determination Theory provides a legitimate ground to analyse the students' motivational perspectives of autonomy, competence and relatedness. A 6-step thematic analytical model was used to analyse the data from the students and teachers reflections and interviews, based on SDT. The analysis revealed four key recommendations in executing a movement-based innovation camp. I) Be well prepared and provide templates for the students to generate and visualize insights, and thus concretize student assignments. II) It is highly recommended to ask the participants to turn on their laptop cameras at all times, to strengthen their relatedness and communication. III) Facilitators should not refrain from using constraints, such as tight timeframes, as the creative output of some individuals flourishes under such conditions. IV) It is recommended to separate the individual groups, so they cannot be influenced by each other's ideas. Thus, gaining a higher reliance on the groups own creative competencies, and leading to greater novelty in the creative solutions.

Keyword: Online teaching; 21st-century skills; design thinking; creativity; Self Determination Theory; virtual workshop

Work in Progress Papers

Gamifying Reading and Writing in Collaborative EFL Primary Education

Marta Fortunato, António Moreira and Ana Raquel Simões
University of Aveiro, Portugal

martafortunato@ua.pt
moreira@ua.pt
anaraquel@ua.pt
DOI: 10.34190/GBL.21.156

Abstract: In this poster, we intend to present an ongoing investigation in the context of a doctoral project, whose main purpose is to investigate, describe and interpret the influence of gamification on the promotion of learning to read and write in a collaborative problem-solving context, in Primary English classes in Portugal. English is a rather recent subject in Portugal. Its learning became mandatory in 2015/2016 in this teaching cycle, starting in the 3rd year of schooling. The study took place in a private educational institution with pupils from third and fourth grades, with whom a set of activities were carried out. It is based on an interpretative paradigm of a qualitative nature and on a case study approach. It relies on participant observation, questionnaire and interview surveys, audio and video recordings, field notes, pupils' work and cloze tests and their triangulation, resorting to webQDA software to make its conclusions more consistent and providing it with scientific validity. Its objectives are: 1) to assess the influence of gamified activities on the learning of reading/writing in the teaching of English in Primary education and its implication in their resolution; 2) to assess the influence of these activities on the development of collaborative work skills in a problem-solving context: a) understanding, exploration and resolution; b) group organization and cohesion. Although without conclusive results, since the research is in its initial phase, the preliminary data collected and analyzed during the implementation of the designed activities revealed positive consequences regarding the learners' engagement and motivation for English language learning. The pupils' interaction with reading and writing activities in English, aroused by the principles of Gamification, with the purpose of solving real problems, seems to have contributed to the development of soft skills, such as creativity and critical thinking and to the deployment of group work strategies.

Keywords: Learning to read and write; problem solving in a collaborative context; gamified activities; teaching English in primary school

Introducing Gamification in Introductory Programming Courses

Alexander Hofer and Iris Groher
Johannes Kepler University Linz, Austria

alexander.hofer@jku.at
iris.groher@jku.at
DOI: 10.34190/GBL.21.128

Abstract: Gamification has developed markedly over the past decade and educational institutions, starting to see its potential, are carrying out research projects introducing gamification to the classroom. Likewise, gamification has also experienced major success in the market of casual language acquisition, with mobile applications such as Duolingo and Babbel using gamification to make learning a new language more engaging. Learning a new programming language is often challenging for students and can be compared to learning a new foreign language. Hence, the authors developed a proof-of-concept for an application adopting the gamification concepts found in the aforementioned language learning apps and plan to evaluate it in an introductory programming course at our university this fall. The proof-of-concept implements game design elements such as rewards, experience points, and achievements and will—in later stages—also include the element of leaderboards, which have produced promising results in previous research. To ease access for participating students, the application will be implemented as a web-based application, requiring no client-side installation. The course contents will be modelled closely to the subject matter of the accompanied lecture, with the webapp taking on a complementary role, thereby enabling students to interact with topics in an alternative way. Students of selected exercise groups will be made aware of the supportive application and compared with groups not aware of it. Students are not obligated to use the application. This should allow for a spread within groups between students who used the app and those who did not, enabling further comparison within the same exercise group. Use, impact, and user satisfaction will be evaluated with use statistics, students' grades, and user surveys, respectively. The goal of our study is to evaluate whether the implementation of gamification in programming learning apps can improve students' engagement with programming, thus furthering their skillset and lowering the dropout rate of the course.

Keywords: gamification, education, programming course, engagement, motivation

The Crucial Role of Participation in the Development of Game-Based Learning

Thea Nieland, Miriam Burfeind, Charlotte Urra and Kai-Christoph Hamborg
Osnabrueck University, Germany

Thea.nieland@uni-osnabrueck.de; Miriam.burfeind@uni-osnabrueck.de; Curra@uni-osnabrueck.de; khamborg@uni-osnabrueck.de
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Abstract: Although game-based learning (GBL) applications are becoming more and more popular in higher education, the challenges in terms of fit to the users' needs, technical requirements, and sustainability are also becoming increasingly apparent. One way to address these common obstacles is to actively involve future users – in this case, students as well as teachers – in the development of GBL. We therefore present a user-centered approach of the development of a GBL application in the context of a vocational training and education study program as best practice example. First, we conducted a requirement analysis to systematically assess students' and teachers' needs and adapt the design of the GBL application accordingly. We then iteratively developed and evaluated prototypes of the GBL application with students and teachers combining a variety of methods. Moreover, we explicitly examined the effect of participation in a survey with n = 112 students who took part in the evaluation of the last prototype. Preliminary research findings suggest that perceived participation as well as perceived target group fit are related to a more positive evaluation of the prototype, highlighting the importance of participation for the success of the resulting product. By presenting our work-in-progress and preliminary research findings, we aim to contribute to the acceptance and distribution of GBL application in higher education. As best practice example our work provides insights on how to structure developmental processes to ensure participation and hence a satisfactory GBL product.

Keywords: game-based learning, requirements analysis, usability evaluation, participatory design, higher education

Schoolers and Scholars: A Project Focusing on RPG in Elementary Education

Eduardo Nunes and Mário Rui Cruz
inED – Centre for Research and Innovation in Education, Polytechnic Institute of Porto, Porto, Portugal

eduardonunes@ese.ipp.pt
mariocruz@ese.ipp.pt
DOI: 10.34190/GBL.21.004

Abstract: The use of teaching based and supported on technology and its assumptions are back on the agenda due to COVID-19. As it is commonly known, teachers have been exploring Digital Game-Based Learning (DGBL) tools, but due to the pandemic context some have also been trying to explore less traditional formats, namely Role-Playing Games (RPG). Boosting the use and (re)creation of technological and digital media made us, educators, reflect upon the need to rethink and shift the learning and teaching processes towards a more hypersensory and gamified approach, which would foster a more sustainable development of the pupil and the tackling of the so-called 21st century skills within the virtual or blended classroom. This paper aims at analyzing the state of the art regarding the use of Educational Digital Games (EDG) on teaching and learning processes, the potential of educational digital Role-Playing Games (EDRPG) as tools for supporting teaching and learning in primary contexts, including the Schoolers & Scholars platform. Preliminary findings suggest that RPG stimulate the development of creativity, logical reasoning, problem solving, cooperation, and interdisciplinarity in primary contexts.

Keywords: Game-based learning; educational RPG; distance learning; storytelling in education; educational tools; distance learning

A Serious Game to Anticipate Handwriting Difficulties Screening Through Visual Perception Assessment

Chiara Piazzalunga[1], Linda Greta Dui[1], Cristiano Termine[2], Marisa Bortolozzo[2], Simona Ferrante[1] and Matteo Matteucci[1]

[1]Politecnico di Milano, Milan, Italy

[2]University of Insubria, Varese, Italy

chiara.piazzalunga@polimi.it; lindagreta.dui@polimi.it; cristiano.termine@uninsubria.it; marisa.bortolozzo@googlemail.com; simona.ferrante@polimi.it; matteo.matteucci@polimi.it

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Abstract: Dysgraphia is a learning disability that causes handwritten production below the expectancies. Its diagnosis is delayed until handwriting development should be completed, with the possible worsening of children's weaknesses. To allow a preventive empowerment program, abilities not directly related to handwriting should be evaluated, and one of them is visual perception. To investigate the role of visual perception in handwriting skills, we gamified standard clinical tests of form constancy, figure-ground discrimination and visual closure exercises, to be played with an eye tracker at three difficulty levels. Then, we related game performances to a handwriting speed test. The aims of this work are: to test game usability and design effectiveness, and to preliminarily explore the relationship between visual performance and writing skills. Game performances were computed with principal component analysis, combining time-to-completion and errors in each game. A linear regression related game performance (predictors) with writing speed (target). Perceived increase in difficulty among levels was tested by means of an ANOVA. As for usability, participants answered the System Usability Scale. In total, 28 subjects – 3 children, 19 young adults and 6 older adults – participated in the study. Game scores provided a good quality of fitting (R^2= 0.67, $p<0.001$) of handwriting speed in the regression model. ANOVA suggested that *masked form constancy* and *visual closure* games were perceived as more challenging as difficulty raised (game score significantly decreased, $p<0.001$), while in *form constancy* and *figure-ground perception* a learning effect was observed (game score significantly increased, $p<0.001$). Interesting qualitative observations emerged from eye-tracking data, drawing suggestions for exploiting ocular strategy to better investigate its role in game performance. The game reached excellent usability (92.86±5.08), which allows to confidently extend the study to a younger, more adequate sample. These results are promising to suggest a new tool for dysgraphia early screening, based on visual perception skills.

Keywords: Serious games, Visual perception, Eye tracking, Handwriting, Development

Learning Glucose Metabolism Through "Sugar Scramble": A Digital Game-Based Approach

Colleen Tang Poy[1], Stavroula Andreopoulos[1], Sian Patterson[1], Jodie Jenkinson[1, 2] and Derek Pat-Shing Ng[1, 2]

[1]University of Toronto, Ontario, Canada

[2]University of Toronto Mississauga, Ontario, Canada

colspleen.art@gmail.com; s.andreopoulos@utoronto.ca; sian.patterson@utoronto.ca; j.jenkinson@utoronto.ca; d.ng@utoronto.ca

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Abstract: A major topic taught in undergraduate biochemistry courses is glucose metabolism. Traditionally, passive and linear pedagogical methods—such as lectures and textbook readings—are often employed to cover the multitude of metabolic pathways together with subcomponents, such as enzyme reactions, associated molecular players and regulation points (Chen & Ni, 2013; Metzger, 2006). This large quantity of information can lead to students memorizing the content rather than developing a conceptual and integrated understanding of the metabolic system as a whole. An active learning approach may be more appropriate in this instance (Prensky, 2001); however, there is a lack of existing active learning resources available to assist with student learning of cellular metabolism. Digital games are a great tool that can facilitate active learning. They can engage and educate the player through an immersive digital environment (Craik & Lockhart, 1972) and provide opportunities for in-game failure which can increase a player's engagement, motivation, and learning (King et al, 2009). We designed an eight-level 2D game, "Sugar Scramble", that uses a circuit board metaphor representing the pathways involved with glucose metabolism. In order to win each level, circuit board connections need to be made between enzymes and pathways to generate a certain target amount of energy. More specifically, players must identify and select the relevant chips—where chips represent enzymes and substrates for each level—place them in the appropriate location, and correctly connect them together within a given number of moves. Players can then run a simulation of the pathways in order to visualize the impact of their chip placement and influence on the energy flux of the system. If the player is successful, their circuit board will power a robot to accomplish activities, and they will unlock an infographic illustration related to that level. Our pedagogical goal for this game is to allow the players to interactively apply and integrate their understanding of

metabolic flux and to visualize how it can change depending on energy demands. Sugar Scramble aims to take advantage of the immersive, exploratory, and engaging opportunities afforded by digital games in order to enrich and supplement traditional learning approaches in the context of metabolism in undergraduate biochemistry. A video demonstrating the game is currently available at https://bit.ly/sugar-scramble-demo.

Keywords: Metabolism, Biochemistry, Digital Game, Active Learning, Undergraduate Education, Pedagogy

Toward the Implementation of Escape Room Games in an Educational Context

Barbara Sabitzer, Iris Groher, Corinna Hörmann and Alexander Hofer
Johannes Kepler University Linz, Austria

barbara.sabitzer@jku.at; iris.groher@jku.at; corinna.hoermann@jku.at; alexander.hofer@jku.at
DOI: 10.34190/GBL.21.125

Abstract: During the last decade, escape rooms have become a popular place of amusement. Escape the Room is best described as a combination of LARP (Live Action Role Play), scavenger hunt, and Sherlock Holmes. The players are immersed in a scenario and have a set amount of time to solve a variety of puzzles using the materials and information provided to move from one room to the next until they can finally leave the building. While escape rooms are mainly deployed for team-building activities or entertainment, there are further fields of application. In an interdisciplinary project at Johannes Kepler University Linz, we adapted escape rooms for educational purposes. The Institute of Business Informatics - Software Engineering and the School of Education developed three escape room games designed to impart the principles of computer science to a younger audience in a fun way. The players can select a board game, a computer game, or a real-life game, each with its unique story, puzzles, and hints. The game variants focus on computer science but can be expanded and adapted to other subjects. As all the constructions and puzzles show a flexible design, they can be adapted to the educational level of the respective target group (primary level, secondary I + II, teacher training, and university courses) and abilities of students. Each game contains additional bonus material for experienced players. Due to the COVID-19 pandemic, the test phase of all three escape room game variants was postponed but is planned to continue in autumn 2021.

Keywords: Escape room, computer science education, board game, computer game, real-life game, STEM

Digital Games for Acquiring Everyday life Skills for Students with Intellectual Disabilities

Kristian Stancin, Natasa Hoic-Bozic and Martina Holenko Dlab
University of Rijeka, Croatia

kristian.stancin@inf.uniri.hr
natasah@inf.uniri.hr
mholenko@inf.uniri.hr
DOI: 10.34190/GBL.21.014

Abstract: The process of upbringing and educating students with intellectual disabilities (ID) should be based on an individualized approach to learning. This can be achieved through the use of game-based learning, which allows presentation of certain educational content in an appropriate way. In this sense, digital games can be a good mediator in the development of everyday life skills, as they can be used to simulate everyday situations (e.g. shopping, dressing, eating, personal hygiene), which allows students with ID to become more independent in life. The aim of this work in progress is to provide an overview of digital games that enable the acquisition of everyday life skills for students with ID. The presented research highlights the importance of digital games in the upbringing and education of students with ID as well as the importance of finding games that are suitable for the individual needs of students with ID. Throughout the work, a number of digital games are presented and their features that make these games suitable for use by students with ID are described. This overview will play an important role in subsequent research steps – in developing an ontology that more formally describes the individual needs of students with ID and the requirements that a game must have in order to be compatible for playing by students with ID.

Keywords: Digital Games, Intellectual Disabilities, Everyday Skills, Domain Ontology

Development and Assessment of a Card Game for Learning Ionic Compound Solubility

Elaine Tsai
Taipei American School, Taiwan

22elainet@students.tas.tw
DOI: 10.34190/GBL.21.067

Abstract: Ionic compound solubility is an essential topic at all levels of high-school chemistry. The concept of solubility involves complex interactions and many high school students find understanding and memorizing solubility rules challenging. An educational card game “Ionic Combinations'' is designed to help students to learn the solubility rules through the game play. The players compete to gain points by creating ion compounds to meet the mission requirements, and, therefore, learn solubility rules in a fun and engaging way. The pre-test and post-test results from high-school students with a chemistry background show significant improvement in the accuracy of predicting compound solubility after one game cycle. “Ionic Combinations” allows student players to learn and practice all five types of solubility rules equally and gain a robust and balanced enhancement from 19%-35% in learning solubility rules in all categories.

Keywords: Gamification, Chemistry, Compound Solubility, Board game, High school

Design of an Educational Game to Foster Self-regulated Learning

Nathalie Zetzmann, Tim Moritz Böhm and Franziska Perels
Saarland University, Saarbrücken, Germany

nathalie.zetzmann@uni-saarland.de
s9tiboeh@stud.uni-saarland.de
f.perels@mx.uni-saarland.de
DOI: 10.34190/GBL.21.054

Abstract: As academic achievement is an important goal of teaching and learning, it is important to provide mental tools to enable efficient learning. In this context, self-regulated learning (SRL) is an essential factor to apply adequate learning strategies which facilitate lifelong learning and academic achievement (Richardson, Abraham & Bond, 2012). Because digital games are highly motivating (Chang et al., 2017), they can be used to support learning processes and foster interdisciplinary

abilities such as SRL (Erhel & Jamet, 2013). Due to this, the educational game *Regulatia* was developed to promote SRL in pre-service teachers in the university setting. Multimedia principles for multimedia learning (Mayer, 2014) and for game-based learning (Mayer, 2019) were considered in game design. The design process followed the ADDIE approach and the theoretical content was based on Zimmerman's model of SRL (2000). In this educational game, players immerse themselves in the underwater kingdom *Regulatia* and have to help the little whale, *Balina,* to rescue her friend from the *Coral Tower*. Players have to find self-regulation keepers on each of six levels and solve their exercises. The exercises impart SRL-specific strategies and link game-design elements with learning content. In this paper, we provide an overview of *Regulatia's* theoretical background, design and and structure, all of which aim to promote SRL. Since the educational game is still under development, our goal is to create a functional prototype and evaluate its effectiveness to foster SRL in different higher education courses. The preliminary evaluation design is also reported in this paper. It is expected that especially in pre-service teacher training *Regulatia* could make important contributions to the acquisition of SRL by pre-service teachers and their students, given that teachers act as SRL-models for their students (Peeters et al., 2014).

Keywords: game-based learning, self-regulated learning, educational game, serious game, higher education

Abstracts Only

Using serious games to train students and assess language skills: The case of Subtitle Legends

José Ramón Calvo-Ferrer, José Belda-Medina and Miguel Tolosa Igualada
University of Alicante, Spain
jr.calvo@ua.es

Abstract: Video games have been extensively employed in educational contexts upon the premise that they engage students and provide instant feedback, which, according to some authors, makes them optimal teaching and learning tools (Cornillie, Clarebout, & Desmet, 2012). It is argued that, if properly designed, video games facilitate long-lasting learning (Rama, Black, van Es, & Warschauer, 2012) and establish low-anxiety environments (Melchor-Couto, 2017) that can reduce students' fear of making mistakes (Nemitcheva, 1995). Computer games are increasingly being implemented not only as educational tools in the classroom, but also as training devices in an array of environments such as healthcare (see Skiba, 2008), science and technology (see Liu, Rosenblum, Horton, & Kang, 2014), military (see Ricci, Salas, & Cannon-Bowers, 1996), and so forth. Their use is also frequent in L2 acquisition, since they replicate sociocultural conditions (Anderson, Reynolds, Yeh, & Huang, 2008) which may trigger the underlying cognitive processes that promote L2 acquisition (Hitosugi, Schmidt, & Hayashi, 2014). Also, data in video games has been successfully used to identify patterns and predict and assess learning outcomes (see Illanas et al., 2013). In line with this, the authors wish to discuss the game mechanics that allow for data analysis leading to assessment of learning and language proficiency in the video game Subtitle Legends, a video game for educational purposes based on error detection, which simulates an audiovisual translation context in which players need to watch short user-created animated videos and identify any discrepancies between what is heard (in any given language) and the subtitles (in a different language). When a discrepancy is detected, it may be solved by clicking on the most adequate resource (a bilingual dictionary if a word has been mistranslated, a grammar reference for a subject-verb inaccuracy, etc.). Research carried out suggests that the univocal correspondence between errors and resources provide useful insight into whether players have understood what has been heard in the video clips and read in the subtitles, showing how that corresponds with their language skills.

Keywords: video games, training, assessment, language, translation

The Virtual Reality Engineering Summer Camp, Promoting STEM Pathways Through Innovative Technology

Fadi Castronovo[1], Bruce Simon[2] and Mario Flores[3]
[1]University of Brighton, Brighton, UK
[2]Institute for STEM Education at CSU East Bay, USA
[3]Mission College, USA

f.castronovo2@brighton.ac.uk
bruce.simon@csueastbay.edu
Mario.Flores@missioncollege.edu

Abstract: To promote high-school paths to undergraduate degrees in science, technology, engineering, and mathematics (STEM), the School of Engineering and the Institute for STEM Education at Cal State East Bay and Mission College at Santa Clara developed and hosted the Virtual Reality Engineering Summer Camp (VRES Camp). The camp took place in the Summer of 2019 and 2020. The Summer 2019 camp was hosted over two weeks at the Cal State East Bay campus. Meanwhile, due to CoVID19, the Summer 2020 camp was hosted online over one week. The camp recruited high school students from the Hayward Unified School District for the Summer of 2019, the Santa Clara Unified School District, and the San Jose's East Side Union High School District for 2020. The goal was to create a model summer high-school program that engages future undergraduate STEM participants as designers of immersive, interactive, and digital construction and architectural environments (i.e., virtual reality simulations). A further goal was to promote, inspire, and increase the pursuit and retention of STEM degrees; and foster interest in pursuing professional or graduate degrees through the acquisition of knowledge and skills. To achieve this goal, the VRES Camp challenged participants to design virtual models of built environments. Using engineering design processes, the participants got to engage in this fun and innovative field by exploring seminal and current simulation research, interacting with professionals and industry representatives, and designing and developing virtual models for the advancement of engineering structures and architecture. Based on multimedia learning theories, visualization, virtual reality, serious gaming, and active learning, the participants (as designers) focused on developing digital models that supported their acquisition of knowledge, skills, and behaviors necessary to pursue STEM degrees and professions. The VRES Camp's development was sponsored by the BROADCOM Foundation for the Summer 2019 and by the Department of Education Hispanic Serving Institutes STEM grant at Mission College. The presentation will report

curriculum material development, lessons learned from the camp implementation, and the participants' feedback.

Keywords Engineering Education, High School Summer Camp, Virtual Reality, Online Learning

So, Why DO Students Perform Better in Gamified Courses? Understanding Motivational Styles in Educational Gamification

Jared Chapman
Utah Valley University, Orem, USA

jared.chapman@uvu.edu

Abstract: Research on gamification's effects in educational environments has been a growing domain in recent years. As research has demonstrated the power of gamified systems to effectively motivate learners in educational settings, it has also become clear that not all individuals are motivated in the same way, or to the same extent, by the same gamified system. Patterns in individuals' attitudes and behaviors in online gaming are commonly known as player types. Nearly all player-type models were developed in online gaming settings, though they are sometimes applied to educational environments. Because online gaming and educational gamification are different in important ways, player-type models developed in online gaming are not optimal tools for describing the individuals' motivations in education, or prescribing best practices for educational gamification design. In this paper we address this gap by presenting a motivational-style model developed in a gamified educational setting. Using factor analysis on motivational data taken from gamified Organizational Behavior courses, we define a two factor space including the following motivational dimensions: 1) social vs. individual motivators and 2) utility vs. accomplishment motivators. Within this space, we describe four motivational profiles: Citizen—being motivated by social assignments like group work and peer review; Pragmatist—being motivated by completing traditional assignments and exams; Gamer—being motivated by game elements that show one's progress compared to their peers and provide social reinforcing feedback; and Achiever—being motivated by improving one's individual progress in a course. We also suggest best practices for designing educational gamification experiences optimized for students from each motivational type.

Keywords: Motivation, Engagement, Influence, Gamification

Room2Educ8: A Conceptual Framework for Designing Educational Escape Rooms

Panagiotis Fotaris[1] and Theodoros Mastoras[2]
[1]University of Brighton, UK
[2]University of Macedonia, Greece

p.fotaris@brighton.ac.uk
mastoras@uom.edu.gr

Abstract: Traditional entertainment-focused Escape Rooms are growing in popularity worldwide, with more than 7,200 rooms being available in 105 countries across in 2019. Despite being a relatively new concept, escape rooms are becoming increasingly popular as a team building activity due to the fact that they require players to quickly adopt successful team strategies in order to progress through the game successfully. Increasingly, escape rooms are now also being used in academia as learning and collaborative tools, especially during the current pandemic where the need for effective virtual teamwork and computer-supported collaborative learning became imperative. An educational escape room is an instructional method requiring learners to participate in collaborative playful activities explicitly designed for domain knowledge acquisition or skill development so that they can accomplish a specific goal (e.g., escape from a room or break into a box) by solving puzzles linked to unambiguous learning objectives in a limited amount of time. From a pedagogical point of view, educational escape rooms are based on a social-constructivist approach; learners construct their own knowledge based on real-time experiences of advancing through several challenges in the game with the help of their peers. Research findings have established that educational escape rooms can create immersion as they combine the strengths of storytelling and gameplay, therefore eliciting high motivation and engagement and so promoting successful learning. Yet evidence demonstrates that there is little consistency in the approaches adopted in this emerging field. To address this, we propose a conceptual framework (Room2Educ8) to operationalise the development of physical and virtual escape rooms into academic and educational practices. This framework provides a methodology for designing educational escape rooms for learning and behaviour change. It provides heuristics for goals, objectives and constraints, participants, context, puzzles, documentation, briefing, debriefing, and evaluation. It delivers an easy-to-follow guideline to enable educators to embrace non-traditional learning techniques – thus escaping traditional classroom routine. We validate our concept through the use of a virtual escape room aimed at delivering participants a sound understanding of good cyber security principles.

Keywords: educational escape room, breakout game, game-based learning, teamwork, conceptual framework

Creating Gameful Experience in the Digital Era: A Double-Mediation Model

Mona Höyng
University of Duisburg-Essen, Duisburg, Germany

mona.hoeyng@uni-due.de

Abstract: In times of digitalization nowadays the use of games became an innovative approach for digital game-based learning (DGBL) in higher education. Particularly, with the integration of digital games in terms of business simulation games, students acquire management skills and competencies that are required later in the business world. While the effectiveness of these games has been investigated in past research, little is known about the gameful experience (GE) created and provoked among students when they play games. However, based on past research and derived from theory of experience, the creation of meaningful learning experiences within games, i.e., the GE, is a necessary precondition determining the students' learning and the effectiveness of games. Hence, when examining DGBL, the investigation of the GE among students is decisive. Consequently, the purpose of this study is to provide deeper insights into the GE and to empirically investigate whether and how these meaningful learning experiences within games, i.e., GE, among students are created. Grounded on theory of experience and flow theory, a double-mediation model was developed considering group engagement and flow sequentially double-mediating the relationship between instructional support and students' GE. Empirical data was collected from 337 students taking part in a team-based business simulation game at two different universities in Germany. Regression-based statistical analyses revealed that instructional support promoted students' GE. Besides, instructional support increased the level of group engagement and therefore, enhanced students' GE solely in terms of enjoyment, creative thinking, and absence of negative affect. However, group engagement did not mediate the relationship between instructional support and GE in terms of absorption and dominance. Furthermore, instructional support fostered students' flow intensity and thereby, their GE regarding all subdimensions. Likewise, the empirical results providing evidence that the relationship between instructional support and GE was further sequentially double mediated by group engagement and flow. Consequently, in the context of DGBL, meaningful learning experiences within games in terms of GE are

created and promoted though appropriate instructional support, as well as high levels of group engagement and flow among students

Keywords: Gameful Experience, Instructional support, Group engagement, Flow, Education, Learning.

Middle School Students' Political Interest, Efficacy, and Commitment During Game Play

Veronica Szczygiel
Fordham University, New York, USA

vszczygiel@fordham.edu

Abstract: Individuals ages 18-29 are the least participatory adult age group in terms of voting and other traditional political activities (The Center for Information & Research on Civic Learning & Engagement [CIRCLE], 2013; CIRCLE, 2016; CIRCLE, 2019a; Prior & Bougher, 2018; Torney-Purta, 2002; United States Census Bureau, 2014). Research has shown that classroom games and simulations can increase political interest and political efficacy, which have been positively linked to students' commitment to future political participation (Bernstein, 2008; Darr & Cohen, 2016; Fliter, 2009; Gehlbach et. al., 2008; Kahne et. al., 2006; Kalaf-Hughes & Mills, 2016; Lightcap, 2009; Lo, 2015; Mariani & Glenn, 2014; Neys & Jansz, 2010; Saiya, 2016; Shellman & Turan, 2006). However, research has mainly used undergraduate and high school students as participants, despite that middle school-aged adolescents have been found to show capacity for understanding political issues and comfort with games, as they make up the majority of video game players (Blumberg et. al., 2013; Blumberg et. al., 2019; Lin, 2013; Patterson et. al., 2019; Torney-Purta, 2002; Quintelier & Hooghe, 2013). This study examined how a non-digital simulation game titled "Island Survival," which was designed by the researcher and based on William Golding's *The Lord of the Flies*, impacted middle school students' political interest, political efficacy, and commitment to future political participation. Pre- and post-game surveys and daily experience sampling methods data showed that game play resulted in a significant, negative change in all three variables. However, results also showed that students experienced a heightened awareness of political impact, a deep commitment to voting in particular, and a perception that politics is a stressful environment.

Keywords: middle school; political interest; political efficacy; commitment to future political participation; simulation game

Learning About Learning by Making Board Games: Dialogical Perspectives from L1 Teacher Education

Stina Thunberg, Caroline Graeske and Martha Andersson
Luleå University of Technology, Lulea, Sweden

stina.thunberg@ltu.se
caroline.graeske@ltu.se
martha.andersson@ltu.se

Abstract: The Swedish curriculum for primary school emphasizes the importance of learning and play. How can teacher students learn about teaching by becoming designers of board games for learning? Recent research shows potential in board games for learning purposes as engaging social spaces for communication and dialogue of high relevance to L1 education (Bayeck, 2020). Based in the curriculum and research, we wanted to design for playful learning in teacher L1 education using board games' construction as a dialogical setting. The paper presents a pilot study's findings in an educational design project with a dialogical setting (McKenney & Reeves, 2018). The aim is to explore and stimulate playfulness and learning in L1 teacher education. The research questions are: What are the students' main perspectives made about learning during the design? Which design elements support a learning dialogue? What design principles be stated for further development? The research method used is qualitative thematic coding (Mason 1996). The design was tested as a part of two L1 courses for primary (year 0-3 and 4-6) teacher students; 62 students choose to participate. The design contained an introduction, two game workshops, and a finishing board game competition. The sessions took place online in Zoom in November and December 2020 and the finishing reports was submitted in January 2021. The students worked in groups online to create a board game to participate in the final contest. The empirical material is 186 written reflections after each session and 124 reports in a feedback process, and 62 final reports about the game's didactical concept. Preliminary results are that the game-making process in the study groups during workshops sustained and nourished playfulness, creativity, and didactic design thinking. On the other hand, the finishing game competition only supported learning for some of the students, while others were left with a sense of emptiness.

Keywords: Teacher education, Board games, Learning design

Behaviour and Solution Patterns in Chemical Engineering Education Game Log Data

Chioma Udeozor, Fernando Russo Abegão and Jarka Glassey
Newcastle University, UK

chioma.udeozor@newcastle.ac.uk

Abstract: Digital games are interactive making them highly engaging for players. The adoption and use of digital games in higher education is on the rise with many researchers and educators developing and deploying these in classrooms. As a relatively new pedagogical tool based on technology that is in continuous evolution, some aspects of game-based learning, such as measurement and assessment of learning, are still under research. Although the assessment of performance and learning in digital games is commonly performed with pre- and post-game tests, interest is growing in the use of gameplay log data as an alternative and valid means of measuring the performance of students in digital games. A few studies have utilized log data to measure the performance of students in general knowledge and skills, but limited studies exist where game log data were used to measure domain-specific competencies. This empirical study describes the use of game log data for measuring the behaviours and performance of engineering students in the CosmiClean game, a serious game designed to teach the principles of separation and recycling operations. Using quantitative research method, unstructured game log data from first year engineering students from two European institutions were used to carry out sequential behavioural pattern analysis and performance assessment of students in the game. The results showed that the behavioural patterns of students varied across levels of game play with highest variations in gameplay strategies observed in the first levels of the game, indicating exploratory gameplay behaviour. For performance assessment, students were clustered based on their performance. The clusters of solutions identified in the data showed different gameplay strategies as well as the efficiency of the solutions of each student. These findings would be particularly useful to game designers, educators and researchers in the field of game-based learning as they provide better understanding of gameplay behaviours, strategies and performance of students in a game-based learning environment. These should inspire better design approaches for learning games as well as highlight some considerations when using digital games for performance assessments.

Keywords: Serious game, log data, performance, engineering, recycling, separation operations

Children's Metacognitive Comprehension of Video Games as Multimodal Texts

Sam von Gillern[1] and Carolyn Stufft[2]
[1]University of Missouri, Columbia, MO, USA
[2]Berry College, USA

svongillern@gmail.com
cstufft@berry.edu

Abstract: The purpose of this study was to investigate how middle-school children engaged in metacognitive comprehension processes when analyzing video games as multimodal texts, particularly as relates to the games' semantic and syntactic features (Block, 2004). Our conceptual framework consists of two components: The Gamer Response and Decision Framework (Author, 2016) and the concept of metacognition. Together these components provide a lens of the ways that our participants engaged in metacognitive processes in conjunction with video game literacies. The Gamer Response and Decision (GRAD) Framework (Author, 2016) draws from Rosenblatt's Reader Response Theory (1994) and posits that readers/gamers all have unique backgrounds and experiences that influence the way they interpret and interact with books/video games. Additionally, this study focuses on two specific metacognitive processes: semantic processes and syntactic processes (Block, 2004). Semantic processes involve understanding textual meanings, and syntactic processes involve textual structure (Bauserman, 2005). Our descriptive case study follows a qualitative approach (Merriam & Tisdell, 2016) in which we analyze 124 written reflections from 31 middle-school students via template analysis to examine how they engaged in metacognitive literacy practices to interpret multimodal symbols in video games and how these interpretations influenced their decision-making processes during gameplay. The games students played were Minecraft, Minecraft: Story Mode, and LEGO: Worlds. Results from the analysis of children's written reflections indicate that the middle-school students engaged in metacognition related to semantic and syntactic processes with a variety of multimodal symbols present in video games including dynamic visuals, abstract symbols, oral language, written language, audio representations, and tactile experiences. Overall, this study demonstrates the ways that middle-school children engage in metacognitive comprehension processes related to the semantic and syntactic features of video games as multimodal and interactive texts via reflective writing. Given that video games are one of the most popular forms of media for today's youth, it is critical that we develop understandings of how children engage with and learn from video games, as it represents a highly salient

digital literacy practice for countless young people around the world (Abrams & Gerber, 2014; Alberti, 2008; NPD Group, 2020).

Keywords: Video games, literacy, digital literacies, comprehension, game-based learning

Additional Materials

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 ACIL

Academic Conferences International

Facilitating excellence in scholarship through double blind peer reviewed conferences on eight topics

Vision and Mission

Our vision is that there is an ever increasing need for high quality research in most if not all aspects of 21st century society. Universities are the primary provider of quality research education.

Quality research education requires the participation of both established faculty, newly appointed staff and research students. There is also the requirement for academe to reach out to the general society as comprehensively as possible.

As the university sector becomes increasingly focused on research excellence there is a need to provide more fora, primarily in the form of peer reviewed conferences, for academics to exchange ideas, questions, problems, and achievements concerning their personal research activities. These fora provide opportunities to exchange ideas, to experience critiques and to obtain some recognition for individuals' progress towards research excellence. The more international the forum the more effective it is.

Although publishing in highly rated indexed academic journals is still the most prized form of academic communication, the conference medium has become a significant outlet for research findings as well as an important facilitator to achieving this goal. All papers submitted to ACIL conferences are double blind peer reviewed and accepted papers are published in a book with an ISBN and ISSN. These conference proceedings are indexed by a number of authorities, including WOS, Scopus, Proquest, etc.

Our mission is to facilitate the creation of global academic research communities by providing all the administrative and management functions required to deliver a comprehensive academic conference experience.

This is supported by the provision of seminars, workshops and the publishing of suitable books, monographs and proceedings.

It is also supported by 5 academic journals three of which are indexed by Elsevier Scopus.

ACIL's conference activities

For over 20 years we have facilitated conferences globally. Originally our focus was only on ICT. Over the years we have broadened the scope, but there is still a strong leaning towards ICT. Currently there are 16 conferences run in various parts of the world which are attended by approximately 1,500 conference participants annually. Global reach is one of the dimensions that differentiates us. At any given conference there are regularly participants from 30 or more countries. Some of the conferences are accompanied by master classes in their associated field which are run on the day before the conference.

Seven conferences are associated with Excellence Awards for which we appoint judges, accept nominations, conduct evaluations and award prizes. The Games Based Learning Conference runs an established annual competition. Details of these events are contained in our website at www.academic-conferences.org

Contact information

If you would like to host a conference, facilitate a workshop or have a book published please contact louise@academic-conferences.org

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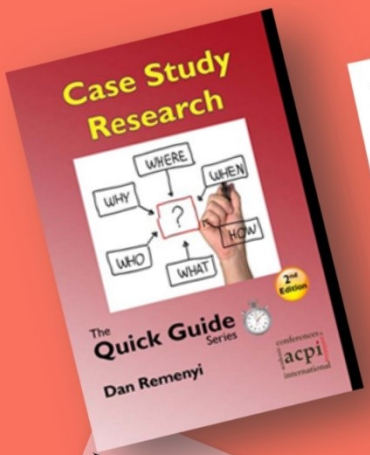

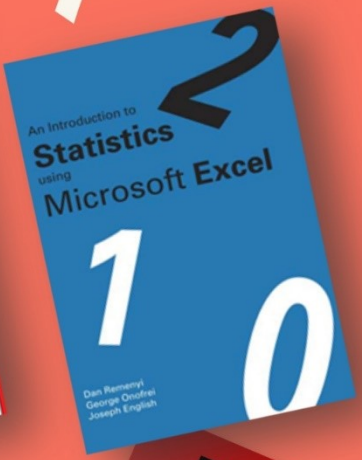

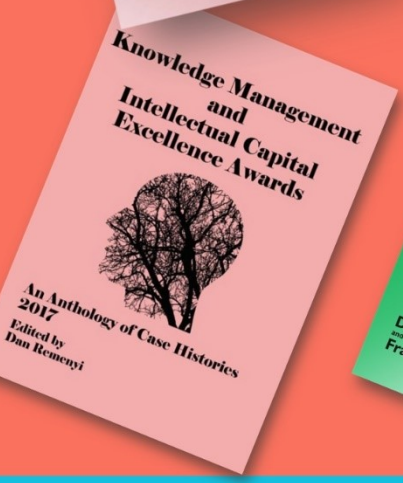

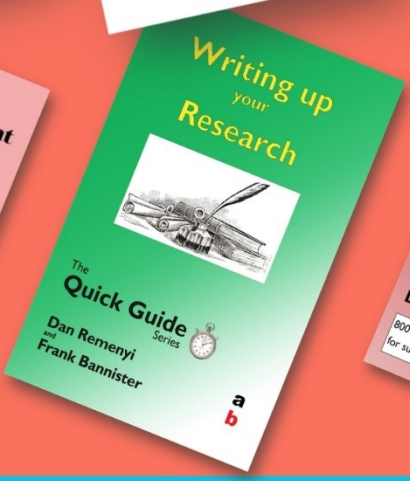

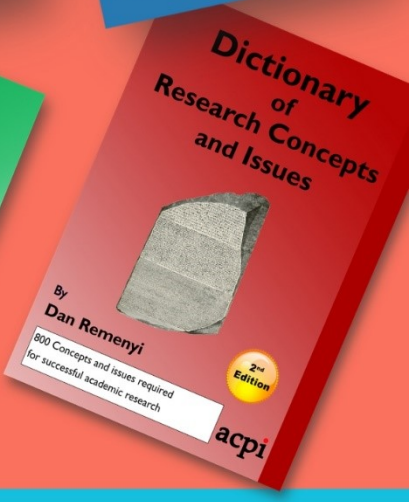

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