

Institution: University of the West of Scotland
Unit of Assessment: 11
Title of case study: Economic, Societal and Policy Impact of ICTE Research Centre
<p>1. Summary of the impact (indicative maximum 100 words) The ICTE Research Centre at UWS has transformed the way advanced technologies are used as tools within education and training, covering a range of sectors across Europe, and has contributed to policy formation, economic impact and benefits to society. Focussing on Web 2.0 technologies and specifically serious games, underpinning technologies have been applied to a range of educational disciplines at all levels of education and within organisations. External engagement has ranged from the level of individual teachers to the level of regional and national policy, and individual partner organisations have benefited economically from adopting and adapting these underpinning technologies.</p>
<p>2. Underpinning research (indicative maximum 500 words) The group's 2007 paper (PAPER1) established that online students performed consistently better than students taught face-to-face. The paper highlighted that some learners preferred using certain media, particularly the younger generation, who had grown up in a technologically sophisticated environment. The research demonstrated that learning needed to be engaging to compete with other media-rich pastimes and that aspects of such activities could be used in teaching. This research led to the award of a Wellcome Trust grant to recommend changes to its public engagement policy through the use of modern technologies, principally games. Connolly's work (PAPER 2) included a first meta-analysis study for this grant that highlighted that out of 18,000 published papers, some 7,392 papers identified positive impacts of games on users aged over 14. However, only 129 papers reported empirical evidence about the impact of games on learning and engagement, with 70 providing methodologically stronger evidence of this impact. This was the largest study of its type and provided a strong basis for further work. A second study, for under 14s, produced similar findings: out of 20,000 published papers, only 112 reported empirical evidence of the impact of games in education, with 55 providing methodologically stronger evidence. Developing this broad theme of enquiry, the research group has received a number of European Grants and company specific grants/contracts (see Section 3) to further explore how serious games, Web 2.0 and advanced technologies can enhance learners' experiences, and what effects they have on engagement and achievement. One European project explored the use Alternate Reality Games (ARGs), a genre of games that use a variety of media to develop a story which is then dynamically adapted by participants' actions. In the past, ARGs have been used to market and promote products such as films, games and music, however, the ICTE group were one of the first research groups to explore their use within education. An additional paper, (PAPER 3), discusses the design, development and evaluation of an ARG aimed at encouraging secondary school pupils across Europe to learn modern foreign languages. The ARG was developed and implemented as part of an EC Comenius project involving 6 project partners, 328 secondary school students and 95 language teachers from 17 European countries. The collaborative nature of ARGs proved useful in getting students to work collaboratively to solve problems while learning. An evaluation of the ARG was conducted using an experimental design of pre- and post-ARG intervention. The majority of students who completed the test after playing the ARG either agreed or strongly agreed that they would be willing to play the game over a prolonged period as part of a foreign language course and also that playing the ARG enhanced their skills relating to cooperation, collaboration and teamwork.</p> <p>Key Researchers Professor Thomas M Connolly (Chair of ICTE Research Centre; Director of Institute of Creative Technologies and Applied Computing) Dr Liz Boyle Dr Ewan MacArthur</p>

Impact case study (REF3b)

Dr Thomas Hainey
 Dr Gavin Baxter
 Dr Mark Stansfield
 Dr Daniel Livingstone
 Dr Richard Beeby

3. References to the research (indicative maximum of six references)

PAPER 1: Connolly, T.M., MacArthur, E., Stansfield, M.H. and McLellan, E. (2007). A quasi-experimental study of three online learning courses in computing. *Computers & Education* 2007 Volume 49 Issue 2 Pages 345-359

PAPER 2: Connolly, T.M. Boyle, E.A., MacArthur, E., Hainey, T. and Boyle, J.M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education*, Volume 59 Issue 2 Pages 661-686

PAPER 3: Connolly, T.M., Stansfield, M.H. and Hainey, T. (2011). An alternate reality game for language learning: ARGuing for multilingual motivation. *Computers & Education*, Volume 57 Issue 1 Pages 1389-1415

PAPER 4: Stansfield, M.H. and Connolly, T.M. (2009). An Exploration into Key Issues Relating to the Adoption of Good Practices in E-Learning and Virtual Campuses, in *Transforming Higher Education through Technology Enhanced Learning* (Eds: Terry Mayes, Derek Morrison, Harvey Mellar, Peter Bullen, Martin Oliver). Higher Education Academy. ISBN: 978-1-907207-11-2.

PAPER5: Connolly, T.M., Stansfield, M.H. and Hainey, T. (2007). An Application of Games-based Learning within Software Engineering, *British Journal of Educational Technology* (BJET), Vol. 38, No. 3, pp. 416-428

PAPER 6: Connolly, T.M. and Stansfield, M.H. (2007). From eLearning to Games-based eLearning, *International Journal of Information Technology and Management*, Vol. 26, Nos. 2/3/4, pp. 188-208

Grant Information

Gala (FP7 Network of Excellence)

- Gala - FP7 Network of Excellence in Serious Games (started 1 October 2010), €5,650,000

EU Projects

- Learners, Teachers and Employers (LeTeEm) (supported through Lifelong Learning Programme; 2013–2015), €298,795
- Developing Entrepreneurial Spirit through Experience and Reflection in Vocational Education (supported through Lifelong Learning Programme; 2013–2016), €20,000
- Research_Game (supported through Lifelong Learning Programme; 2012–2014), €398,400
- Chermug (Continuing/Higher Education in Research Methods Using Games) (supported through Lifelong Learning Programme KA3 Transversal Action; 2011-2013), €531,354
- Ed2.0Work - European network for the integration of Web2.0 in education and work (supported through Lifelong Learning Programme Transversal Action; 2012-2015), €599,847
- StartUp_EU - Be a High Tech Entrepreneur) (supported through Lifelong Learning Programme Transversal Action; 2011–2013), €397,521
- aPLaNet (Autonomous 'Personal Learning Networks' for Language Teachers) (supported through Lifelong Learning Programme Transversal Action; 2010–2012), €431,850
- Web2.0ERC (European Resource Centre for Web2.0 Education) (supported through Lifelong Learning Programme Transversal Action; 2010–2012), €559,686
- e-CLIL (European Content and Language Integrated Learning) (supported through Lifelong Learning Programme Comenius Action; 2009–2012), €355,660
- ARGuing for multilingual motivation in Web 2.0 (supported through Lifelong Learning Programme Comenius Action; 2007-2009), €307,828

KTP Projects

- Web Delivery Platform for Incident Investigation (for Kelvin Consultants, 2008-2010), £118,709

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- eLearning in vocational engineering training (for EKGTA Ltd, 2008-2010), £107,536
- eLearning in analytical chemistry (for Crawford Scientific, 2005-2007), £81,100

Collaborative Research Projects

- Supporting Education in Virtual Worlds with VLE (Eduserve Foundation, 2008-2010), £71,716
- Sloodle Phase 2 (Eduserve Foundation, 2010-2013), £66,685
- Developing Virtual Environments for Skills Rehearsal (for Scottish Social Services Council, 2009-2010), £25,000
- Games-based Learning (GBL) for Software Project Lifecycles (for TPLD 2007-2008), £34,997
- Managed Learning Environment (for Healthcare Skills Ltd started 2007-2008), £34,415
- LMS Lite Technology Platform (for Crawford Scientific started 2006-2007), £34,933
- Games-based Learning (GBL) Technology Platform (for TPLD started 2006-2007), £34,967
- Wellcome Trust Project, Landscape Study of Computer Games & Serious Games (2008), £20,000

Schools Project

ThinknDrinkn (Renfrewshire Council-funded schools project on games-based learning), £2,000

4. Details of the impact (indicative maximum 750 words)

The ICTE Research Centre has created a range of impacts through its underpinning research in the field of serious games and advanced educational technologies, mainly stemming from clarifying and harmonising the contribution to learning of games and Web2.0. These impacts can be broadly categorised into headings of Policy, Economy and Societal Benefit.

Within **Education Policy**, our work on Web 2.0 provided a foundation for many partners to evaluate their educational policies. For example, in Estonia over 8,000 teachers are being trained in Web 2.0 using the framework that we have developed. This framework identifies Web 2.0 as being of key benefit in education and provides educationists with examples of best practice and practical advice on how to adopt and implement these technologies. The School Inspectorate of Education in Romania (ISJP) is applying our Web 2.0 framework to develop an educational support policy in their schools. According to the Inspectorate, these frameworks “... *have led to a change in policy for how the Inspectorate views the use of Web2.0 in schools*”. Further, as noted by the Director of Kindersite, an educational policy organisation, the ICTE group have contributed through its research to policy at a national and international level, including the “...*Departamento de Educación del Gobierno de Navarra, Spain; Ministry of Education, Turkey; Autonom Gemeentebedrijf Stedelijk Onderwijs Antwerpen, Belgium and outside of Europe, Senior advisor to the Minister of Education, Israel*” and we have trained thousands of teachers across Europe in the use of Web2.0/games using our frameworks.

Public policy has been supported through the FP7 Gala Network of Excellence, which exploits games for education and training, providing practice and advice to policymakers and to the games industry. Charged with harmonising research across Europe we have carried out systematic meta-analysis studies to identify the educational benefits of games, performed experiments to extend the knowledge of these benefits, and advised a wide range of stakeholders, including teachers/lecturers/trainers, school management, and decision and policymakers across Europe.

In terms of the **benefit to society**, at an international level the ICTE group has supported the introduction of high technology entrepreneurship education through the innovative use of serious games as an educational tool. More generally, the group has been involved in developing approaches to promote creativity, competitiveness, employability and the growth of an entrepreneurial spirit within young people, and helping them acquire the basic life-skills and competences necessary for their personal development, for future employment and for active European citizenship. Within the UK, the group is developing a next generation learning environment based on gaming technology and emotional artificial intelligence that the Scottish Social Services Council will use to train over 190,000 social services workers with professional practice skills, simulating a range of scenarios that might arise in their work. As noted by the Chief Executive of SSSC, “... *we are working with UWS, one of the leaders in the serious games field,*

Impact case study (REF3b)

and I am excited about this partnership and the potential our joint working has to shape learning now and for the future.”

A number of companies have also benefitted commercially from links with the research group, which sprang directly from its expertise and reputation within games research in Scotland. In the UK, the group has supported a range of commercial training companies, increasing their turnover by over £2million and creating over 50 jobs. UWS competitively secured projects with EKGTA (the employer-led training provider for the engineering industry), business and management consultancy Kelvin Consulting, online communications leader TPLD, and Crawford Scientific, a commercial training provider in analytical chemistry, as a result of its research. EKGTA benefited from the UWS framework in implementing its eLearning system and stated that its turnover increased by 26.2% following the project.

Similarly, Crawford Scientific benefited through the introduction of an eLearning business activity to an analytical chemistry equipment supplier, creating virtual labs and advanced interactivity to support their product sales and operation. This project led to a 20% increase in sales and an 80% increase into new markets within 2 years. It transformed the company from a reseller of equipment, providing a small amount of online learning, to a leading provider of high quality online learning in the chromatography field. The company believes that *“the work of Professor Connolly and his team has had a strategic impact on Crawford Scientific policies, significantly changing the way the company handles its corporate training operations transforming the training from traditional face-to-face provision into a worldwide training organisations high-quality, interactive online learning products with key global industry clients including Astra Zeneca, Pfizer, Reckitt and Benckiser and Glaxo SmithKline.”*

5. Sources to corroborate the impact (indicative maximum of 10 references)

Final evaluation from European Commission for ARGuing EU project
Final evaluation from European Commission for Web2.0ERC EU project
Corroborating statement from Kindersite Ltd, UK
Corroborating statement form Crawford Scientific, UK
Corroborating statement from Romanian School Inspectorate (ISJP)
Corroborating statement from University of Sofia, Bulgaria
Corroborating statement from Poznan University of Economics, Poland
Press release from Partnership with SSSC