

## Colloquium

### **Serious games—engaging training solutions: A research and development project for supporting training needs**

**Sara de Freitas and Steve Jarvis**

*Addresses for correspondence: Dr Sara de Freitas, London Knowledge Lab, Birkbeck College, University of London, 23–29 Emerald Street, London WC1N 3QS, UK. Tel: +44(0)20 7763 2117; fax: +44(0)20 7242 2754; email: sara@lkl.ac.uk. Steve Jarvis, Vega Group PLC, 2 Falcon Way, Shire Park, Welwyn Garden City, Herts AL7 1TW, UK. Tel: +44 (0)1707 362602; Fax: +44 (0)1707 393909; email: steve.jarvis@vega.co.uk*

The potential of serious games to help increase the effectiveness of training and learning has been a subject of debate in much of the literature recently published in the field of learning. (Kirkley, Tomblin & Kirkley, 2005; Mayo, Singer & Kusumoto, 2005). While the literature-based evidence for research into the field of game-based learning is increasing, many of the studies being conducted have not produced firm conclusions; this has led to a lack of high quality empirical evidence (Hays, 2005). However, early indications in the literature demonstrate that information and communications technology-based simulations—and, more recently, games-based learning—show some initial evidence of accelerating learning, increasing motivation and supporting the development of higher order cognitive thinking skills (eg, de Freitas & Levene, 2004; Delanghe, 2001; Garris, Ahlers & Driskell, 2002; Green & Bavelier, 2003; Hays, 2005). This evidence, coupled with a generational acceptance of games as a significant part of everyday life (Gee, 2003; Prensky, 2001), has led to a wide interest in how games, in particular, immersive digital games, can be applied effectively in learning and training contexts.

This interest is leading to a plethora of new research and development initiatives in the field, although there are dangers that the patterns of virtual reality (VR) usage for training—with large investment and negligible return on investment over the period—will be replicated in the games arena (Stone, 2005). While there are significant differences between serious games and VR development, not least the wide and often free availability of software development kits (Darken, McDowell & Murphy, 2005), it is important to recognise the limits of games' effectiveness where learning outcomes and the learner specification are not taken fully into account at the development stage. One of the ways to ameliorate this tendency is to invest time during the predevelopment phases of games development.

In an attempt to develop and test empirical evidence of the effectiveness of game-based learning, a 4-year £2 million research and development programme partly funded by the UK Department of Trade and Industry Technology Programme is developing a series of

game demonstrators and evaluation techniques to measure the effectiveness of game-based learning. The Serious Games–Engaging Training Solutions (SG-ETS) project is one of the first to bring games developers and pedagogic expertise together, and includes experts in game-based learning and human factors at three leading research universities; University of Birmingham, University of London and University of Sheffield; TruSim (a division of Blitz Games), one of UK’s foremost computer games development companies having the expertise to develop engaging games; and VEGA Group PLC, one of UK’s leading learning companies.

The success of the SG-ETS project will be defined by the achievement of the following high-level objectives:

- to produce an effective and efficient process for selecting and developing serious games as part of a blended learning solution (important for the commercial exploitation of serious games);
- to publish significant research output related to serious games development that is seen to be innovative and that determines how to harness the engagement in video games for game-based learning; and
- to produce a minimum of three serious games prototypes for a minimum of three clients from different sectors with each prototype addressing a learning need that helps solve a priority business problem.

This new study builds upon the work being undertaken by the SG-ETS partners and aims to develop demonstrators to support targeted learner groups with interactive and engaging game-based learning environments. As part of this, an analysis of different learner groups will be undertaken. The first case study will consider infection control in acute healthcare. The case study follows a human-centred approach to the development process based upon a rigorous method of requirements elicitation (including workshops, surveys and interviews) from each targeted learner group. Dedicated serious game prototypes will be developed based upon learner requirements and the specific business need.

The aim of the research is to describe a framework and a development process that together will help to ensure that the specified serious game does in fact satisfy the needs of the target learner group (or target audience). The work describes an approach to the analysis within the defined process that effectively profiles the learner within the learner group with respect to game-based learning, while taking account of relevant, serious games research. Together, the framework, development process and learning plan for each demonstrator will provide an end-to-end solution that may then be used with each other demonstrator to ensure that the evaluation evidence produced may support improvements, provide empirical evidence of the success of game-based learning and support similar developments being undertaken in other research projects.

The broad research aim of the SG-ETS project is to answer the following key questions:

- Why video games are so compelling and how to ensure that serious games retain this engagement?
- What are the instructional design principles for effective learning with serious games?
- What are the characteristics of people that are relevant to the use of games for learning?
- What types of learning objectives are best satisfied with games?
- What is the optimum process for the selection of cost-effective learning interventions for given learning needs that includes serious games?
- What is the most effective strategy for assessment and evaluation that will ensure that the learning objectives are achieved through use of the game and other supporting learning?
- How should games-based learning support collaborative training and how to best exploit multiplayer games?

The first demonstrator will be aimed at the problem faced by infection control in hospitals and how best to support effective training of medical and support staff in this context. The research team anticipates important findings and presented their preliminary findings at the Interservice/Industry Training, Simulation and Education Conference in December (de Freitas & Jarvis, 2006).

## References

- Darken, R. P., McDowell, P. & Murphy, C. (2005). *Open source games engines: disruptive technologies in training and education*. Paper presented at Interservice/Industry Training, Simulation and Education Conference, 2005, Orlando, Florida.
- Delanghe, F. (2001). Validating small arms simulation. *Military Training and simulation News*, 6, 31–34.
- de Freitas, S. & Jarvis, S. (2006). *A framework for developing serious games to meet learner needs*. Paper presented at Interservice/Industry Training, Simulation and Education Conference, 2006, Orlando, FL.
- de Freitas, S. & Levene, M. (2004). *An investigation of the use of simulations and video gaming for supporting exploratory learning and developing higher-order cognitive skills*. IADIS International Conference in Cognition and Exploratory Learning in the Digital Age, 15–17 December. Lisbon, Portugal.
- Garris, R., Ahlers, R. & Driskell, J. E. (2002). Games, motivation, and learning: a research and practice model. *Simulation & Gaming*, 33, 4, 441–467.
- Gee, J. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave-Macmillan.
- Green, C. & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, 423, 6939, 534–537.
- Hays, R. T. (2005). *The effectiveness of instructional games: a literature review and discussion*. Technical Report 2005–2004 for the Naval Air Center Training Systems Division: Orlando, FL.
- Kirkley, S. E., Tomblin, S. & Kirkley, J. (2005). *Instructional design authoring support for the development of serious games and mixed reality training*. Paper presented at Interservice/Industry Training, Simulation and Education Conference, 2005, Orlando, Florida.
- Mayo, M., Singer, M. J. & Kusumoto, L. (2005). *Massively multiplayer (MMP) environments for asymmetric warfare*. Paper presented at Interservice/Industry Training, Simulation and Education Conference, 2005, Orlando, Florida.
- Prensky, M. (2001). *Digital-game-based learning*. New York and London: McGraw Hill.
- Stone, R. (2005). Serious games. *Defence Management Journal*, 31, 142–144.