Flexible Virtual Environments: gamifying immersive learning

Neil Gordon[1*] and Mike Brayshaw[2]

[1,2]University of Hull, Hull, England, HU6 7RX.
[1]n.a.gordon@hull.ac.uk
[2]m.brayshaw@hull.ac.uk

Abstract. The availability of Virtual Reality (VR) and Virtual Environment (VE) equipment (with the launch of domestic technologies such as the Oculus Rift, Microsoft Hololens and Sony Playstation VR), offer new ways to enable interactive immersive experiences. The opportunities for these in learning and training applications are immense: but create new challenges. Modern virtual learning environments are typically web or App based technologies, sometimes percvived as having little value added from a user perspective beyond improved User Interfaces to access some content. The challenge is how to usefully utilise VE capabilities in education, especially for computer mediated instruction. This paper will outline some of the issues, and opportunities, as well as some of the open questions about how to effectively use these in a higher education context, along with a proposed framework for embedding a learning engine within a virtual reality or environment system.

Three-dimensional technologies: from work-walls, through CAVES to the latest headsets offer new ways to immerse users in computer generated environments. Immersive learning [1] is increasingly common in training applications, and is beginning to make inroads into formal education. The recent rise in such off-the-shelf technologies means that Augmented Learning becomes a realistic mainstream tool [9]. Much of this use is built in game environments using game engines, where these serious games provide learning effects as an intended consequence of playing.

1 Introduction

The use of game mechanics in learning – known as gamification [6] – is becoming more established, with options such as multiple attempts at tests (akin to lives in a game), immediate feedback and reward (marks as a substitute for game scores) illustrate how game mechanics can reflect established and novel approaches to instruction [5]. Such mechanics are increasingly prevalent in modern Virtual Learning Environments (VLE), though these VLE systems are primarily web based 2-dimension information repositories along with some assessment engine and other learning tools.

This paper will describe what is needed to combine such technologies so they can be effectively utilised to support higher education teaching, where the computer based instruction is provided by a mix of suitable back-end intelligent and flexible learning system [2] alongside the immersive front end provided by the Virtual technology. An effective way to assess such systems can be offered through heuristic evaluation, as previously explored by the authors [2].

The paper concludes with a model for combining the computer-based instruction, gamification of the learning mechanics, along with the virtual environment itself to provide an engaging, practical and effective true virtual learning environment.

2 Of being virtual

The concept of virtual environments for work, education and relaxation is well established, though is evolving as new technologies improve the virtual experience. In the current context, there are some differing meanings of virtual that are explored in the following sections.

2.1 Virtual Environments

Virtual environments (VE) [7] have moved on from the large and research-lab headsets, to becoming a domestic home leisure device, with a variety of cheap smartphone based devices (Google Cardboard and Samsung Gear for example), through medium price games-console accessories (PlayStation VR), to more expensive headsets that require a high-spec PC to support them (Oculus Rift). Augmented devices such as the Microsoft Hololens and short-lived Google-glass prototype. These approaches to VE have provided individual views on virtual worlds, with a variety of

2.2 Immersive Learning

Immersive learning has been concerned with the use of virtual environments in learning and training: the latter being particularly effective where the focus is on realistic virtual environments [8] to support training.

NAG

And gamification

2.3 Virtual Learning Environments

Virtual Learning Environments (VLE) are the clicks-only version of traditional teaching and learning support. They do not typically have any visual approaches to virtualization, but use traditional GUI and more recently web technologies to support teaching and learning. The requirements of these is centered around traditional teaching and learning [3]. Often they borrow a direct classroom of school metaphor and map this into the virtual. In doing so they often implement a type of straight-jacket fot teachers and learners that force a certain type of pre-ordained interaction and fre-

quently tools have to be adapted to meet local needs rather than providing virtual support. We shall argue in this paper that flexibility needs to play a vital role in the way ahead and that part of that flexibility can be to add an element of gameplay.

2.4 Virtual Individual and Virtual Teams

Working in a virtual environment is an increasingly common experience. The nature of modern internet connectivity means that as an individual the ask of elearning can be undertaken at even off-planet location. For Immersive learning this might be either an individual or group experience. Single roles, for example managing a particular incident, can be created. The user interacts with others scenario based characters, which might be perceived like game non-playing characters and implemented via devices from state machines to artificial intelligenes. The problem of working alone, potentially far away from others or just alone becaues everyone else has gone to bed is loneliness and isolation. Motivating reasons why we might look to use the enclusivity of gamification as a means to address this.

Alternatively more than one person can be immerse within the same shared space and when they are in confederation with each other make up a virtual team. This can immediately overcome some of the problems of working alone. Teams also provide an important new angle on learning from a pedagogic angle in that the task has to be managed and shared. An often frustrating thing in its own right. The gamification of this process potential provides immediate and sharable goals and motivations for the team. We naturally frequently compete as teams, so to do so in an immersive environment builds upon our background experiences and shared desires for success.

3   A framework for virtual environments in Higher Education

Fig. 1 links the various aspects as a framework for supporting learning and teaching, as well as training.
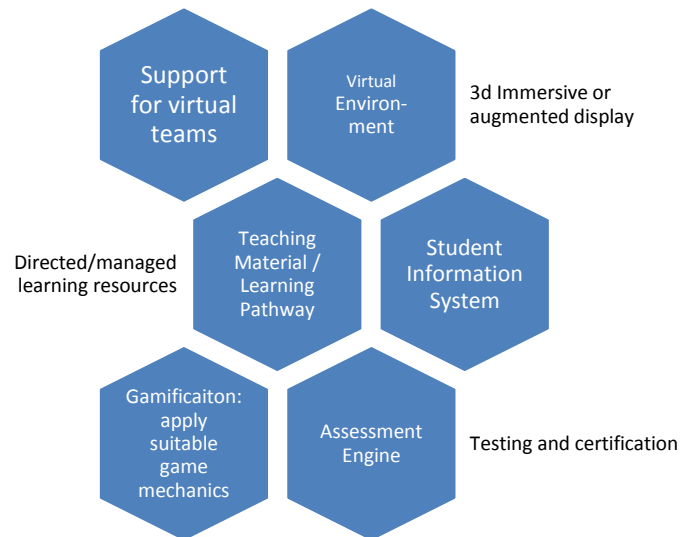
NAG Expand framework and gamification

Fig. 1. A framework for a virtual environment for virtual learning.

4   Issues in Virtual Environments

4.1   Sense of presence

One key issue is getting a believable interaction – users have to believe in the surroundings and what they are seeing. Most existing VR require a buying in to the reality by the user. Indeed some do not feel reel unless the user aceepts them and buys into the story. In the game context this is often more easy to do where the element of the VR that we are interested in is the most important part. Take for example <game> the legs and body of the characters are very crudely and unrealistically rendered, but this doesn't matter. What is of interest here is the game elements of the interaction – the rest of mere unimportant details to the task in hand – that of playing and winning the game. In gamifying immersive learning we can play a similar trick, where the game and the game dynamics are used to make any short coming of presence easier to overlook, as the game makes new goals more important.

4.2   Modalities

4.3   Evaluation

Heuristic evaluation…

4.4　Motivation and engagement: Gamification

4.5　Standards for interaction (Learning Technologies Interoperability)

5　Conclusions

1. Appelman R (2005) Designing experiential modes: A key focus for immersive learning environments. TechTrends, 49:3 pp.64-74.
2. Gordon N (2014) Flexible Pedagogies: technology-enhanced learning. Technical Report, *The Higher Education Academy.*
3. *Gordon, N. A., Brayshaw, M (2015). Requirements Capture Analysis for MOOCS in Higher Education. In Furthering Higher Education Possibilities through Massive Open Online Courses (pp. 107-124). IGI Global.*
4. Gordon,N, Brayshaw M, Aljaber T (2016) Heuristic Evaluation for Serious Immersive Games and M-instruction. In: *International Conference on Learning and Collaboration Technologies*. Springer International Publishing, pp 310-319.
5. Gordon N, Brayshaw M, Grey S. (2013) Maximising gain for minimal pain: Utilising natural game mechanics. *Innovation in Teaching and Learning in Information and Computer Sciences* 12(1): 27-38.
6. Groh, F. (2012). Gamification: State of the art definition and utilization. Institute of Media Informatics Ulm University, 39.
7. Hale, K. S., & Stanney, K. M. (2014). Handbook of virtual environments: Design, implementation, and applications. CRC Press.
8. Herrington, J., Reeves, T. C., & Oliver, R. (2007). Immersive learning technologies: Realism and online authentic learning. Journal of Computing in Higher Education, 19(1), 80-99.
9. Kidd SH, Crompton H (2016) Augmented Learning with Augmented Reality. *Mobile Learning Design*, Springer Singapore, pp. 97-108.