Digital Gesture-Based Games: An Evolving Classroom

Alison McNamara, Independent Researcher, Limerick, Ireland

ABSTRACT

This study aims to provide an account of phase three of the doctoral process where both students and teachers’ views contribute to the design and development of a gesture-based game in Ireland at post-primary level. The research showed the school’s policies influenced the supportive Information and Communication Technology (ICT) infrastructure, classroom environments influenced a student’s ability to participate and teachers’ perspectives impacted upon whether they adopted games into their classrooms. While research has been conducted in relation to training schemes for teachers, it is agreed that they are the main change agents in the classroom. Therefore, this study focuses on the game itself and its design elements that support and enhance mathematics education within the Irish context. Practical guidelines for both the game, school’s policies and classroom environments are provided based upon the research for mathematics educators and practitioners of game-based learning strategies in their classrooms.

KEYWORDS

Game Based Learning, Gesture Based Technology, Information and Communication Technology (ICT), Mathematics Teaching and Learning Tools, Technology in Education

INTRODUCTION TO THIS STUDY

The study incorporated different disciplines and while doing so, developed a game-based learning solution for the Irish mathematics classroom. It is important from the outset to clarify the different disciplines involved in this research and to identify the main focus. The main focus is on the development of a gesture-based game and this ties in areas of other disciplines, as shown in the diagram below. The diagram shows that aspects of game-based learning (GBL), gesture-based technology (GBT), technology in the classroom and mathematics education were all involved in the design and development of a gesture-based game.

The research undertaken is timely given mathematics education in Ireland at the time the study was being pursued. The Irish mathematics curriculum underwent major changes in recent times (Brosnan, 2008). The curriculum was revamped and constructivist principles were emphasised. These included the need for mathematical discussion and justification to be part of the new curriculum, namely Project Maths. Project Maths was as a result of consultation with teachers a few years previously and the global decline in students undertaking higher levels of mathematics (Watt et al., 2012). The country was facing a deficit of mathematics graduates for the economy to thrive in terms of Science, Technology, Engineering and Mathematics (STEM). It is a well-known phenomenon known as the leaky STEM pipeline (Watt et al, 2012).

As a result of these new changes in the curriculum, teacher resources were made for the curriculum and interests were raised in terms of gamification1 as well as GBL. GBL has gained tremendous support
with respect to its benefits. Researchers purported findings such as increased levels of motivation (Annetta, Minogue, Holmes, & Cheng, 2009), flow, improved mathematics achievement (Bai, Pan, Hirumi, & Kebritchi, 2013), engagement, improved attitudes towards schooling and interest (Miller & Robertson, 2011). These proclaim a vast array of benefits, although, there are challenges ahead for game-based learning. Games need to confront the many demands they have on them today with as many genres as games themselves. Games are composed of many genres and just like the film industry is expanding rapidly as studios are investing in greater numbers. Games with a specific purpose also known as serious games face more challenges. Serious games in mathematics need to tie together mathematics, interaction with players and an immersive experience while also straddling specific learning outcomes when used within the classroom. Schools and classrooms are summoned to contest in terms of emerging technologies and the rapidly changing environment (Philips, Kennedy, & McNaught, 2012). Advantages are realised when the game is designed proficiently, as determined by Pivec and Pivec (2011). According to Pivec and Pivec (2011), games need to be designed correctly, need to be used in the appropriate environment and finally, employ a suitable pedagogical framework. This article offers recommendations for the classroom and school while mentioning the most suitable pedagogical framework, its main focus is the game design. Therefore, the following section discusses existing games in mathematics education and their potential benefits within the classroom environment.

**Study Purpose**

Game-based learning (GBL), gesture-based technology (GBT), technology in the classroom and mathematics education are knitted together in this research. We postulate that the feedback from the teachers and students regarding game design makes this game more likely to be used within their classrooms. Therefore, the research question posed is:

What design features inform the creation of a Gesture-Based game in the mathematics classroom?

**BACKGROUND TO THE STUDY**

Ireland has undergone major reforms in terms of the mathematics curriculum with the introduction of a new curriculum, Project Maths. This curriculum has encouraged teachers to adopt constructivist and collaborative teaching practices. Even after its development in 2011, teachers are being encouraged to use alternative teaching approaches that encourage more discussion and collaboration in the mathematics classroom. The practices are still not appearing in the mathematics classroom (Brosnan, 2013).

The introduction of Project Maths has brought attention to the need to change some teaching strategies. There are system-level contradictions in terms of the existing practices being carried out in schools even with the focus on ‘real life’ application in mathematics. Heretofore, textbooks were the main resource for teachers in schools. Therefore, focusing on alternative resources to provide support for the teaching and learning of mathematics is a need in this context.

Gesture-Based Technology and games can offer a useful resource and evidence in other subjects exists that there is potential in the classroom. International research tends to focus on different subject choices such as English literacy (Homer, Kinzer, Plass, Letourneau, Hoffman, Bromley, Hayward, Turkay and Kornak, 2014). Digital games started to gain market traction in the 1980s (Gros, 2015). For games to be thought of as good in terms of having good gameplay, it needs to be social and have a goal (Beavis, 2015).

**Games and Other Subjects**

Admiraal, Huizenga, Akkerman, and Dam (2011) investigated the relationship between GBL as an educational design. They researched three research questions: (1) how can game activities of student teams be characterized and how do these relate to the concept of flow? (2) to what extent do game activities affect team game performance? (3) to what extent do game activities affect student learning?
The GeoGebra Institute of Torino, Italy: Research, Teaching Experiments, and Teacher Education
[www.igi-global.com/chapter/geogebra-institute-torino-italy/72094?camid=4v1a](www.igi-global.com/chapter/geogebra-institute-torino-italy/72094?camid=4v1a)

A Theoretical Framework for Serious Game Design: Exploring Pedagogy, Play and Fidelity and their Implications for the Design Process
Pauline Rooney (2012). *International Journal of Game-Based Learning* (pp. 41-60).
[www.igi-global.com/article/theoretical-framework-serious-game-design/74746?camid=4v1a](www.igi-global.com/article/theoretical-framework-serious-game-design/74746?camid=4v1a)