Designing Effective Spaces, Tasks and Metrics for Communication in Second Life Within the Context of Programming LEGO NXT Mindstorms™ Robots

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ABSTRACT

Science education is concerned with the meaningful pursuit of comprehension, knowledge and understanding of scientific concepts and processes. In Vygotskian social constructivist learning, personal interpretation, decision-making and community cooperation fosters long-term understanding and transference of learned concepts. The construction of knowledge requires learners to be actively involved in the process of learning. For effective science learning to take place an instructor’s pedagogical approach must be anchored in meaningful contexts so that students have actual opportunities to experience science. This paper presents the early stages of a research project that attempts to assess and define effective measurements for evaluating strategies for communicating science by using LEGO robots and Mindstorms™ RCX controllers that are collaboratively constructed and programmed by students using virtual technologies while physically situated in different locations.

Keywords: Augmented Reality, Communication, Future, LEGO Robot, Science Metrics, Second Life, Virtual Reality, Virtual Worlds

INTRODUCTION

Science education is concerned with the meaningful pursuit of comprehension, knowledge and understanding of scientific concepts and processes. The effective science educator’s pedagogical approaches are anchored in meaningful contexts so that students ‘experience’ science and develop their ‘craft’ (Thornburg, 2002). Such ‘experiential learning’ provides learners
with opportunities to engage with problems that require the retrieval of prior knowledge, offer multiple perspectives of problems and solutions, and facilitate a challenging process which leads to an achievable outcome. Learning does not occur in isolation but involves communication, cooperation and collaboration with fellow learners and experts (Kolb, 1984). In this Vygotskian social constructivist learning perspective, personal interpretation, decision-making and community cooperation fosters long-term understanding and transference of learned concepts. The construction of knowledge requires learners (of science or other subjects) to be actively involved in shaping the learning process.

Research in the informed use of technology for educational purposes highlights the need to go beyond replication of traditional, didactic practices to an appropriation of digital communication (Warschauer, 1999) facilitated by a constructivist pedagogy (Jonassen & Land, 2000) to support purposeful tasks (Martin & Vallance, 2008). The convergence of instrutivism, constructionism, social and collaborative learning towards a ‘Conversational Framework’ (Laurillard, 2002) provides opportunities for learners to take, “a more active role in learning and for tutors to support learning activities in multimodal ways” (deFreitas & Griffiths, 2008, p. 17). Of course, all of this is not a revelation. Piaget, Dewey and Bruner all advocated the learner being an active participant in the learning process. In a study of the future of work, Thornburg (2002) concluded that today’s Digital Age learners will need to become active learners, effective collaborators who seek and contribute knowledge, and proficient users of online collaboration tools.

One class of collaborative tools gaining traction in Higher Education is virtual worlds. Virtual worlds are persistent computer-simulated environments that allow for three-dimensional representations of individuals and objects that can be manipulated and modified. Usually, individuals are represented through avatars that have varying degrees of similarity to human appearance. Some virtual worlds such as Second Life allow for extensive modification of avatars and enable users to build a wide variety of virtual objects. Avatars can walk, fly, sit down, dance, teleport throughout the virtual world and interact with those of other human participants. Users can utilize their avatars to communicate with other avatars using text, voice and gesture. Virtual worlds are increasingly evident in Higher Education courses, and yet the enthusiastic adoption and economic investment in virtual worlds such as Second Life often results in a mirror world; a world that mimics our physical state. For instance, many universities and other educational institutions are establishing a presence in Second Life and have begun to conduct classes and provide other services for students. However, they attempt to replicate the real world through the virtual building of traditional classrooms and activities that do not utilize the uniqueness of the virtual space and its tools. Innovative virtual collaboration requires a uniqueness of contribution by participants (personally or anonymously), synchronously and/or asynchronously (whichever is the most comfortable for the user) with a democratization of the process leading to a sum product greater than the individual contributions (Vallance & Wiz, 2007). This represents a move from the commonly seen replication of existing practice towards the exploitation of the unique pedagogical affordances offered by emerging technologies – a move from first to second order change (Cuban, 1992).

However, pragmatically and pedagogically, it would be a mistake for practitioners using technology to only consider educational opportunities in virtual spaces. For instance, working with the internet (e.g. broadcast World Wide Web, social networking) and virtual spaces (e.g. interactive Second Life) can represent an amalgamation of real world activities and virtual world activities from which the combined way of working will result in the development of a personal and group artifact that can be imported, modified and exported (e.g. printed out or posted to a Website). Such multiple media artifacts (documents, spreadsheets, slideshows, images, movies) can therefore maintain an in-
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