Retrieving Objective Indicators from Student Logs in Virtual Worlds

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ABSTRACT

Virtual Worlds (VWs) have been widely used to support learning processes. One main advantage is providing valuable data on student behaviour and interaction. Nonetheless, most platforms provide only limited access to student logs. Moreover, accessing logs usually requires technical skills most teachers do not have. In this context, the authors present a Domain Specific Language (DSL) designed to allow teachers to generate queries for retrieving valuable log information with a view to obtain evidence on learner behaviour and interaction; hence, to aid in the analysis of in-world behaviour and learning processes. Since this data is automatically retrieved, the teacher can easily run new queries to refine indicators or contrast hypotheses. The authors describe a case study carried out with undergraduate German language students using a VW-based video game. The results provide a set of indicators for analysing individual and group behaviour measuring student competence to communicate in the target language.

KEYWORDS

Assessment, Computer-Supported Foreign Language Learning, Domain Specific Language, Learning Analytics, Virtual Worlds

INTRODUCTION

The spread of Information and Communications Technologies (ICTs), coupled with blended teaching practices, challenges teachers and academic institutions to harness the potential of Virtual Learning Environments (VLEs) for enhancing learning processes (Bermúdez & Montoya, 2012). VLEs provide both teachers and learners with access to contents, services and applications anytime, anywhere and at any pace. The most widely used VLEs are Learning Management Systems (LMSs), Virtual Worlds (VWs) and Social Network Sites (SNS) (Hart, 2015). They can be used as independent resources or integrated in Personal Learning Environments (PLEs) that allow students to manage and control their own learning processes (García-Peñalvo, Conde, Alier, & Colomo-Palacios, 2014).

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In recent years, there has been an increasing trend exploring the motivational potential of video games to engage students in learning, especially beyond the classroom (Brom, Preuss, & Klement, 2011) — both through the use of off-the-shelf games (World of Warcraft, The Sims, etc.) (Reinders & Wattana, 2011) and the design of tailor-made educational games, or serious games (Wouters, Van der Spek, & Van Oostendorp, 2009). Examples can be found in a wide range of areas, from engineering and computer science (Rico, Martínez, Alamán, Camacho, & Pulido, 2011) to healthcare (Cruz-Benito et al., 2015) and foreign language learning (Berne, Gonzalez-Pardo, & Camacho, 2013). A review of the literature reveals that despite the widely recognised educational and motivational potential of video games, few empirical studies have directly investigated their impact on learning (Bellotti, Kapralos, Lee, Moreno-Ger, & Berta, 2013). The same applies to learning environments such as VWs (Second Life, Active Worlds, etc.) (Hew & Cheung, 2010). This may be explained by the fact that both off-the-shelf games and most VWs are created using proprietary software — hence do not allow teachers to design their own learning environments nor access student logs. Consequently, learner behaviour and interaction cannot be analysed (Cruz-Benito, Therón, García-Peñalvo, & Lucas, 2015), making it impossible to determine the correlation between interaction and learning outcomes (Moreno-Ger, Martínez-Ortiz, Freire, Manero, & Fernandez-Manjon, 2014).

Logs can offer valuable information for analysing student behaviour and interaction across different VWs (Fidalgo-Blanco, Sein-Echaluce, García-Peñalvo, & Conde, 2015; Gonzalez-Pardo, Rosa, & Camacho, 2014; Palomo-Duarte, Berne, Dodero, Ruiz-Rube, 2015). To this end, the authors first designed their own OpenSim (open-source software) VW-based game environment and then created a Domain Specific Language (DSL) to retrieve objective indicators for analysing foreign language learning in VWs. Furthermore, to customise learning analytics, the authors have defined Virtual World Query Language (VWQL), a generative computer language. VWQL is a formal language that can express written queries using simple syntax and domain-specific vocabulary (Kosar, Bohra, & Mernik, 2016). In this way, teachers with little or no technical know-how regarding databases or computer programming can easily retrieve objective indicators from interaction logs (Damyanov & Sukalinska, 2015). To facilitate this, the authors have developed EvalSim, a system that automatically processes queries written in VWQL. This system allows for using/applying a scalable approach, since indicators can be obtained from a large number of students and games. Queries express the design of measurement formulas and can be refined in order to obtain different indicators for analysing learner behaviour and interaction. Indicators could provide valuable information on learner performance in terms of a number of generic competences such as teamwork, planning, time management, interpersonal skills and leadership (Ilahi, Belcadhi, & Braham, 2014).

In the current paper, the authors present a case study in which EvalSim was used to retrieve information from an OpenSim 3-D VW-based game called Saturn. The game was designed for German language learning but can easily be used for other learning experiences. The paper is structured as follows: section two describes the theoretical background for using both video games and DSLs in foreign language learning. Section three presents the software architecture developed for analysing learner behaviour and interaction — followed by section four which describes the case study and presents results. Several examples of information queries launched during the experience are provided. Finally, in section five, the authors discuss results and present conclusions, along with proposals for future lines of research.

THEORETICAL BACKGROUND

This section provides some theoretical background regarding the use of VWs in foreign language learning as well as the use of DSLs.
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