Chapter 8
Using Sentiment Analytics to Understand Learner Experiences in Serious Games

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ABSTRACT

A serious game has been introduced as an alternative tool to support teaching and learning. It integrates entertainment and non-entertainment elements to encourage the voluntary learning of knowledge and skills. One of the essential entertainment elements in the serious game to motivate learning is the enjoyment element. However, studies on models to analyze this enjoyment element are still limited. Most models present isolated and specific approaches for specific games that cannot scale to other games. In this chapter, a generic enjoyment analytics framework is proposed. The framework aims to capture learners' enjoyment experience using open-ended feedback, analyze the feedback using sentiment analytics models, and visualize the results in an interactive dashboard. Using this framework, the lecturers would interpret the learners' experience towards the topic and the game and capture difficulties the learners may encounter during the game. It would help the lecturers to decide follow-up actions required for the learners to improve the learning.

1. INTRODUCTION

The serious game is defined as a (digital) game designed and created not with the primary purpose of pure entertainment but with the serious intention of using it in training, education and healthcare (Loh, Sheng, & Ifenthaler, 2015). It can be used as an alternative or interactive tool to improve skills/performance as well as to broadcast messages to the learners (Liu, Alexandrova, & Nakajima, 2011; Ma, Oikonomou, & Jain, 2011; De Freitas & Liarokapis, 2011; Loh, Sheng, & Ifenthaler, 2015). Serious game infuses

knowledge and skills into the game environment while maintaining the entertainment elements that keeping the learners engaged and interacted with the game. Learners who train and learn with a serious game will "play as they learn and learn as they play". Through the engagement and interaction with information, tools, materials and other learners in the serious game, learners would voluntarily learn and master their knowledge and skills (Kim, Park, & Baek, 2009).

Serious game has been implemented in various areas, including computer programming (Coelho, Kato, Xavier, & Gonçalves, 2011; Muratet, Torguet, Jessel, & Viallet, 2009), healthcare (Garcia-Ruiz, Tashiro, Kapralos, & Martin, 2011; de Freitas & Jarvis, 2008; Graafland, Schraagen, & Schijven, 2012), military applications (Lim & Jung, 2013), city planning (Gómez-Rodríguez, González-Moreno, Ramos-Valcárcel, & Vázquez-López, 2011) and supply chain management (William, Rahim, Souza, Nugroho, & Fredericco, 2018). According to a recent report, about 25% of the Global Fortune 500 companies, particularly from the United States, Britain and Germany, have already adopted serious games for their training and education (Loh, Sheng, & Ifenthaler, 2015). Main objectives for the implementation include broadcasting information related to a specific topic (i.e. refugees (United Nations High Commissioner for Refugees, 2021; United Nations High Commissioner for Refugees, 2005; Canadian Red Cross, 2021)), improving the skills and performance of the learners (i.e. python programming language (CodeCombat, 2021)), and testing and evaluating learner's skills as an assessment tool (William, Abdul Rahim, Wu, & de Souza, 2019).

Numerous studies have revealed the benefits of using serious game (Ma, Oikonomou, & Jain, 2011). The benefits include enhancing and encouraging engagement, curiosity, motivation, self-monitoring and problem solving (Ma, Oikonomou, & Jain, 2011; Rieber, 1996; Knight, et al., 2010; Kumar, 2000) to improving the learner's knowledge and skills for specific topics or subjects. The serious game would encourage active participation and interaction from the learners to eventually increase their understanding of particular knowledge and skills (Hou, 2015). The learners would gain experience implementing the new knowledge and skills by completing tasks and challenges in the game.

One of the serious game's essential entertainment elements is learners' enjoyment (Sweetser & Wyeth, 2005). Enjoyment comes from positive experience while playing the game. This enjoyment element helps to decide whether learners would or would not continue playing the game. In the serious game, the enjoyment element is also believed to intrinsically motivate learners to learn new knowledge and skills (IJsselsteijn, De Kort, Poels, Jurgelionis, & Bellotti, 2007; Sweetser & Wyeth, 2005). Enjoyment allows learners to encounter flow experience for a total absorption or engagement in the game (immersive). During the optimal flow experience, the learners are in a state where they are so involved in the game that nothing else seems to matter (Kiili, 2006). It encourages the learners to complete and win the game by achieving new skills and understanding new concepts voluntarily (Kiili, 2006).

However, studies on models for assessing learners' enjoyment and its impacts to improve the learners' knowledge and skills are still limited (Sweetser & Wyeth, 2005; Giannakos, Chorianopoulos, Jaccheri, & Chrisochoides, 2012). Most of the models present isolated and non-repeatable heuristics approaches for evaluating the enjoyment element. It may only focus on only one specific aspect or concept, such as the interface (game control and display), the mechanism (interaction and feedback in the game world), and the gameplay (game problems and challenges). The main challenges in developing the model are 1) collecting the inputs and feedback from the learners, 2) analyzing the inputs and feedback, and 3) interpreting the enjoyment based on these inputs or feedback. The results of the game alone may be minimal and may not be able to represent the learners' enjoyment in the game. Additionally, for existing games

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