

Chapter 25

Assessment Integration in Serious Games

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ABSTRACT

Serious Games (SG) are developing a reputation with some educationalists as a useful supplementary approach for teaching and learning. Two important issues for SG application developers and educationalists are how the learning is assessed and how assessment is integrated into a SG application. This chapter presents the results of a systematic literature review on assessment integration in SG and highlights the state of the literature in this area by outlining important papers to act as a guide for educationalists tackling this important issue. This chapter defines assessment and discusses formative and summative assessment and embedded and external assessment. A discussion of traditional assessment approaches and assessment approaches in SG are presented along with a discussion of existing frameworks for the integration of assessment into a SG application. The chapter presents a number of examples of assessment in serious games.

INTRODUCTION

Serious Games (SG) have gained interest from educationalists and have been used in some of the following areas to motivate and engage: Maths (Habgood, 2007; Ke, 2006), Languages (Johnson and Wu, 2008; Rankin, Gold and Gooch, 2006) Technologies (Sheng et al., 2007) Sciences

(Squire, Barnett, Grant and Higginbotham, 2004; Dede, Clarke, Ketelhut, Nelson and Bowman, 2005), Health and Wellbeing (Lennon 2006; Beale, Kato, Marin-Bowling, Guthrie and Cole, 2007), Social Studies (Piper, O'Brien, Morris and Winograd, 2002; Paul, Messina and Hollis, 2006), Expressive Arts (Wagner, Schmalstieg and Billingham, 2006; Robertson and Oberlander, 2002)

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and Religious and Moral Education (Paiva et al., 2005). SG developers and educationalists have to address various issues surrounding assessment when developing or utilising serious games for learning and teaching. One issue is related to the type of assessment to be adopted with the serious game, for example, formative and/or summative assessment. Another issue is whether the assessment should be embedded in the serious game or external to it. A third issue is what particular form should this assessment take, for example, selection of a course of action, multiple choice questions, solving puzzles, performing particular tasks in the correct sequence or fully integrated and identified as a natural part of the gameplay. A further issue would be whether there are any recognised models and/or standards that could be used for the integration of assessment into the game. Additional issues around assessment include the wide range of potential outcomes, the difficulty in measuring abstract skills such as teamwork and leadership and identifying cheating (BinSubaih, Maddock and Romano, 2009). Each of these issues presents particular problems. This chapter will discuss the various types of assessment and will then present the findings of a systematic literature review to find studies that have addressed these problems.

LEARNING OUTCOMES AND ASSESSMENT

Learning Outcomes

According to the European Qualifications Framework (EQF) (Education and Culture DG, 2008) learning outcomes means statements of what a learner knows, understands, and is able to do on completion of a learning process. They are defined in terms of knowledge, skills and competence:

- **Knowledge:** Means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles,

theories and practices that are related to a field of work or study. In EQF, knowledge is described as theoretical and/or factual;

- **Skill:** Means the ability to apply knowledge and use know-how to complete tasks and solve problems. In EQF, skills are described as cognitive (involving the use of logical, intuitive or creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools or instruments);
- **Competence:** Means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In EQF, competence is described in terms of responsibility and autonomy.

Assessment

Good assessment serves multiple objectives and benefits a number of stakeholders. Kellough and Kellough (1999) identified seven purposes of assessment:

1. Improve student learning.
2. Identify students' strengths and weaknesses.
3. Review, assess and improve the effectiveness of different teaching strategies.
4. Review, assess and improve the effectiveness of curricular programs.
5. Improve teaching effectiveness.
6. Provide useful administrative data that will expedite decision making.
7. Communicate with stakeholders.

Traditional forms of assessment include some of the following approaches: written exams, presentations, demonstrations, multiple choice tests, practical course works (individual or group based), quizzes, aural examinations, oral examinations and dissertations. Weng et al. (2011) state that "traditional assessments are usually conducted at

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