Chapter 3
Adopting a Role-Model, Game-Based Pedagogical Approach to Gender Equality in STEAM:
The FemSTEAM Mysteries Digital Game

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ABSTRACT

The aim of this chapter is to discuss the use of serious games in STEAM education and to present FemSTEAM Mysteries, a serious game that was developed in the context of an EU-funded project. The game is intended for teenagers (age 12-15) and its goal is to promote gender equality in STEAM by inspiring all students to pursue STEAM careers, and to enhance the acquisition of key skills and competences for STEAM studies. It is based on role-model STEAM pedagogy and introduces students to important STEAM researchers and professionals in ways that challenge gender stereotypes as well as stereotypes about the characteristics of scientists and artists. The chapter presents the design and theoretical framework of the game which is based on both bibliographical and field research that was carried out in the context of the FemSTEAM Mysteries project.

INTRODUCTION

It is a common ground, supported by international surveys (e.g., European Institute for Gender Equality, 2018; OECD, 2020), that females are underrepresented in scientific fields during school and university education, and career development. Girls appear to lose interest in STEM subjects with age (AT Kerney, 2016), and by the time they reach late adolescence they become reluctant to follow STEM careers (under 35% enroll in scientific fields at European level) and instead tend to choose the fields of education, health, and welfare (OECD, 2020). Women's underrepresentation in STEM fields limits their opportunities for employment in engineering- and technology-related professions, which are in great demand and have higher pay-levels (EIGE, 2018; OECD, 2016) and, therefore, it perpetuates economic gender inequalities. Also, it deprives STEM fields from the breath of human resources which can lead to research-based innovations that support economic development (European Commission, 2019).

In this chapter we discuss how serious games can serve the goals and pedagogical approaches of STEAM education, and, more specifically, explain how they can be used to promote gender equality in STEAM. The chapter will focus on *FemSTEAM Mysteries,* which is a serious game that was developed in the context of an EU-funded project (Nov 2020-Oct 2022) with the aim to challenge gender stereotypes about STEAM careers and to inspire more students, particularly females, to pursue studies in STEAM. After examining the use of serious games in education, we discuss the theoretical framework and key findings from field research that guided the development of the *FemSTEAM Mysteries* game, and then present its design and gameplay.

SERIOUS GAMES IN STEAM EDUCATION

Learning games are digital games that aim at supporting specific learning goals (Klopfer, Osterweil, & Salen, 2009). They differ from entertainment games because, although the latter can be utilized in the classroom and can support knowledge learning, let alone the development of a wide range of skills (Boyle et al., 2016; Prensky, 2005), their primary purpose is entertainment. "Serious games" is another term that is used to characterize lerning games, although there are diverse views about its exact meaning (Blumberg, Almonte, Antony, & Hashimoto, 2013). The term may refer to games which are designed to be used for educational and training purposes but differ from "drill and practice" edutainment games whose purpose is also educational, because serious games engage students more actively and support higher levels of learning than knowledge acquisition through repetition (Ke, 2016). According to a broader definition of serious games however, the category includes even commercial off-the-shelf games such as *World of Warcraft* or *SimCity* (Blumberg et al., 2013) that may also teach players knowledge and skills and can be integrated in classroom learning (Van Eck, 2009). "Game-based learning" is a term that refers to the use of a fully-fledged serious game in the learning process, not to be confused with the term "gamified learning", which involves augmenting the learning process by adding game elements (Sailer & Hommer, 2020).

Serious games have all the characteristics of other types of digital games, such as rules and constraints, challenge, constant feedback, competition, autonomy, and fantasy (Alessi & Trollip, 2001), most of which are considered to contribute significantly to their motivational appeal (Blumberg et al., 2013; Wouters, Van Nimwegen, Van Oostendorp, & Van Der Spek, 2013). In addition, modern serious games capitalize on computer technology and state-of-the-art graphics to provide interactive simulations

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