Chapter 41
Flip-Game Engineering and Technology Methodology

Milagros Huerta Gómez de Merodio
University of Cadiz, Spain

Juan Manuel Dodero
https://orcid.org/0000-0002-4105-5679
Escuela Superior de Ingeniería, University of Cadiz, Spain

Nestor Mora Núñez
University of Cadiz, Spain

José Mª Portela Núñez
University of Cadiz, Spain

ABSTRACT

Flip-GET has been developed with the objective of optimizing engineering practicals. The innovative element of this methodology is the use of serious games, as a complement to the flipped classroom method, in the teaching-learning process of engineering studies. This methodology uses serious games to take advantage of the capacity of motivation that video games have for the current generation of students, who have been involved with digital content, software, and electronic devices. This methodology has been evaluated using the method of case studies and by an experimental evaluation carried out in different stages, each of which has been developed during an academic course. In the experimental evaluation of the methodology, the control group carried out the practicals dividing the students into subgroups, without using the Flip-GET methodology, while the experimental group performed them with the methodology.

INTRODUCTION

Today's students are no longer the people our educational system was designed to teach. This generation of students has grown up in a digital environment, surrounded by devices such as computers, digital tablets, smartphones, etc., (Fonseca, Conde, & García-Peñalvo, 2018).

DOI: 10.4018/978-1-6684-7589-8.ch041

Copyright © 2023, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

Most STEM students (Science, Technology, Engineering and Mathematics) are attracted by everything related to new technologies, including disabled people (Molina-Carmona, Satorre-Cuerda, Villagrá-Arnedo, & Compañ-Rosique, 2017). Especially those in which they, the students, are active participants (Freeman et al., 2014). In addition, the STEM teaching–learning process has evolved rapidly in recent times. According to Felder & Silverman (1988), the learning profiles of several engineering students are incompatible with the teaching styles of most teachers, leading to low student performance, faculty frustration and a loss to society of potentially excellent engineers.

For all these reasons, it is considered necessary to implement attractive learning environments and methodologies in the classroom.

In this chapter, the authors describe a methodology developed to solve a problem that is occurring in the practicals of engineering studies: the large increase in student numbers that is occurring in these studies leads to the ratio of students per job being higher than is desirable for carrying out practicals in an adequate way.

An analysis has been made of the different existing virtual experiences that can be implemented in the classroom. The use that teachers are making of these experiences has also been analysed. Among the virtual experiences, the most common are: alternate reality games, virtual simulation, serious games and virtual worlds. It has been proven that the use of serious games is increasing in the field of engineering education (Minovic, García-Peñalvo, & Kearney, 2016).

Ulicsak (2010) reports that the Serious Game (SG) is a successful tool for engineering students because, in addition to entertaining, it is useful to acquire skills and knowledge, as long as they are carried out properly. Therefore, this research has focused on engineering learning based on SG. In addition, analysing the teaching methodologies used currently, Flipped Classroom (FC) is a methodology that is increasingly used in the field of engineering (Toto & Nguyen, 2009, Sein-Echaluce, Fidalgo-Blanco, & García-Peñalvo, 2017). The following objectives have been established in order to improve the achievement of engineering practicals:

1. **Analyse the sustainability and effectiveness of the practicals that are currently being imparted in selected engineering studies.** With this analysis, it is possible to identify learning problems in the practical sessions, and thus to be able to find a solution to be developed by the teachers that is effective for students.
2. **Develop and implement a methodology to improve the effectiveness of face-to-face practicals.** The aim is to virtualize some practicals in order to improve their effectiveness and also to improve students' motivation. These virtualized practicals will be part of the methodology developed.
3. **Final evaluation to determine if the methodology helps students and/or teachers to improve the realization of on-site practicals.** In order to achieve this objective, an analysis will be carried out on whether the implementation of the developed methodology improves the motivation for the realization of the practicals, and if it helps the development of the competences in the subject.

In order to achieve the first objective, the current situation of engineering studies practicals has been studied and analysed for its sustainability and effectiveness. To this end, the first step was a systematic analysis of the literature on virtual educational experiences within engineering. From this analysis, the authors have concluded that the use of serious games (see KEY TERMS AND DEFINITIONS) is a promising solution for the virtualization of practicals.

31 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:
www.igi-global.com/chapter/flip-game-engineering-and-technology-methodology/315519

Related Content

A Practice-Based Analysis of Social Interaction in a Massively Multiplayer Online Gaming Environment
Giannis Milolidakis, Chris Kimbleand Corinne Grenier (2011). *Business, Technological, and Social Dimensions of Computer Games: Multidisciplinary Developments (pp. 32-48).*
www.irma-international.org/chapter/practice-based-analysis-social-interaction/53920

Avoiding Revenge Using Optimal Opponent Ranking Strategy in the Board Game Catan
Márton Attila Boda (2018). *International Journal of Gaming and Computer-Mediated Simulations (pp. 47-70).*
www.irma-international.org/article/avoiding-revenge-using-optimal-opponent-ranking-strategy-in-the-board-game-catan/210644

Design of a Multi-Modal Dexterity Training Interface for Medical and Biological Sciences
Shahram Payandeh (2016). *Handbook of Research on Holistic Perspectives in Gamification for Clinical Practice (pp. 524-551).*
www.irma-international.org/chapter/design-of-a-multi-modal-dexterity-training-interface-for-medical-and-biological-sciences/137846

Serious Games for Transformative Learning : A Communication Perspective on the Radical Binarisation of Everyday Life
Thomas J. Yannuzziand Bryan G. Behrenshausen (2010). *Interdisciplinary Models and Tools for Serious Games: Emerging Concepts and Future Directions (pp. 74-102).*
www.irma-international.org/chapter/serious-games-transformative-learning/41482

ARGuing for Multilingual Motivation in Web 2.0: An Evaluation of a Large-Scale European Pilot
Thomas Hainey, Thomas Connolly, Mark Stansfieldand Liz Boyle (2011). *Handbook of Research on Improving Learning and Motivation through Educational Games: Multidisciplinary Approaches (pp. 240-260).*
www.irma-international.org/chapter/arguing-multilingual-motivation-web/52498