Coverage of ISO/IEC 29110 Project Management Process of Basic Profile by a Serious Game

Alejandro Calderón[1], Mercedes Ruiz[1], Rory V. O'Connor[2]

[1] University of Cádiz, Cádiz, Spain.
`{alejandro.calderon, mercedes.ruiz}@uca.es`
[2]Dublin City University, Dublin, Ireland.
`rory.oconnor@dcu.ie`

Abstract. The ISO/IEC 29110 standard aims to assist and encourage Very Small Entities (VSEs) in understanding, adopting, assessing and improving their software processes to their specific needs. Although the integration of international software standards in VSEs is a relevant topic, the learning/teaching process are a considerable challenge for industrial trainers, practitioners and VSEs. In this paper, we analyze the Project Management process of the Basic Profile of the ISO/IEC 29110 and propose a simulation-based serious game for supporting the learning/teaching process of the standard. The paper provides a mapping between the different stages of the game lifecycle and the Project Management process the standard. Moreover, we present the results of a preliminary study to assess the idea of using the proposed serious game for supporting software process education, which allows getting an initial positive evidence about the potential of the game for helping to understand the Project Management process of the standard.

Keywords: ISO/IEC 29110, Serious Games, Teaching Standards, Software Project Management, VSE

1   Introduction

Very Small Entities (VSEs) refer to "an enterprise, organization, department or project having up to 25 people" which have special characteristics that making their business styles different to SMEs (Sanchez-Gordón, O'Connor, Colomo-Palacios, & Herranz, 2016). Due to their small number of employees, VSEs often perform their management processes in an informal and less documented way, than larger organizations. For that reason, the ISO/IEC 29110 standard has been developed in order to assist and encourage VSEs in evaluating and improving their software processes (Laporte, Alexandre, & O'Connor, 2008), but the understanding and

integration of the standard's processes could be a difficult task for practitioners who are inexperienced in applying or adapting the processes, activities, tasks and outcomes of the international standards to their specific needs.

Teaching international software standards is a challenge that moves industry trainers to use new methods and techniques in order to reduce the time and effort invested for both practitioners and VSEs in the learning process of the standards (Aydan, Yilmaz, Clarke, & O'Connor, 2016). Serious games, designed with a different purpose than only entertainment, are powerful tools that allow participants to experiment, learn from their own mistakes and acquire experience and helps trainers to teach practical knowledge within a risk-free environment (Kosa, Yilmaz, O'Connor, & Clarke, 2016).

Taking into account the important of teaching international software standards to VSEs and the advantages of using serious games in the learning/teaching process, the main contributions of this paper are: (i) analyzing the use of serious games for software process, concretely for ISO/IEC 29110, (ii) providing a mapping between the different stages of a proposed serious game and the Project Management process of Basic profile of ISO/IEC 29110, and (iii) evaluating the idea of using the proposed simulation-based serious game to support VSEs for teaching practitioners in the standard.

The structure of the paper is as follows: Section 2 shows the background of this study. Section 3 describes the simulation-based serious game and assess the coverage of the Project Management process of ISO/IEC 29110 of our serious game. Section 4 discusses the idea of using the proposed serious game to support VSEs for teaching practitioners in the standard. Finally, Section 5 summarizes the paper and presents our conclusions and future work.

2   Background

2.1   ISO/IEC 29110

ISO/IEC 29110 (ISO/IEC, 2016; O'Connor & Laporte, 2017) is an international systems and software engineering standard that establishes lifecycle profiles for VSEs. The standard provides frameworks and guides for VSEs that do not have experience in applying or adapting the processes, activities, tasks and outcomes of ISO/IEC 12207 or ISO/IEC 15288 standards to their specific needs.

The standard defines processes according to different profiles, which have been designed to implement specific process for VSEs at different stages of development The "Generic Profile Group" of the standard is a collection of four profiles (Entry, Basic, Intermediate and Advanced) which are related either by composition of processes (i.e. activities, tasks, etc.) and is applicable to a vast majority of VSEs that do not develop critical systems or software products and have typical situations factors. Currently, only the Basic and Entry profiles have been published. The Basic profile contains the Entry profile and its purpose is to define software and systems

development and project management guide for describing a single application by a single project team of a VSE.

The ISO/IEC 29110 Basic Profile Management and Engineering Guide (ISO/IEC, 2011) provides Project Management and Software Implementation processes in order to be used by VSEs to establish processes to implement any development approach or methodology including, e.g., agile, evolutionary, incremental, test driven development, etc. based on the VSE organization or project needs.

The Project Management process of Basic profile aims to establish and perform in a systematic way the tasks of the software implementation project that allows fulfilling the project's goals in the expected quality, time and cost (O'Connor & Laporte, 2012). As we can observe in Figure 1, the Project Management process establishes four main activities: Project Planning, Project Plan Execution, Project Assessment and Control and Project Closure. These activities start with the development of the project plan using the customer's Statement of Work and end with the closure activity that provides the project's documentation and products in
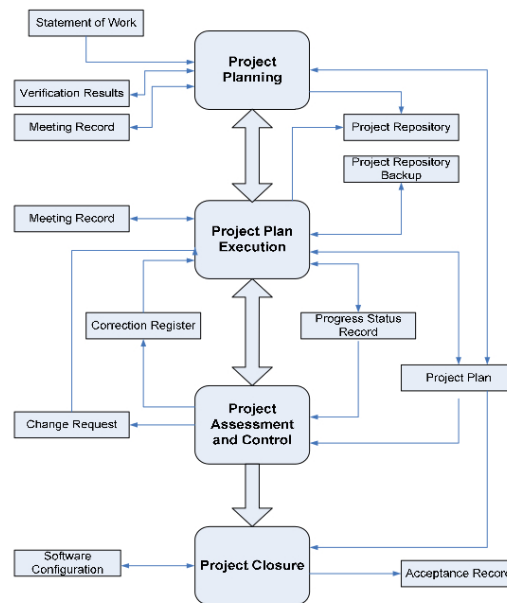
Figure 1. Project Management Process Diagram (ISO/IEC, 2011).

accordance with contract requirements.

2.2   Serious Games in Software Process

Software development is a critical activity that is supported by standards such as ISO/IEC 21500, ISO/IEC 12207 or ISO/IEC 29110, with the goal to help on the road of creating software systems, products or services with quality. These standards define a set of processes and activities needed to model and address a broader range

of issues that take place during the software development. Regarding the relevance of software process in the software development success, equal attention should be given to the training that practitioners and future software engineers receive in this scope.

As a consequence, in recent years an increased interest has been observed in the development and use of new methods and techniques to teach in a highly practical way, promote active and interactive learning, increase the motivation and engagement of learners and design new training strategies to train software process practitioners as skilled and qualified professionals. Among these new approaches, we can found the use of serious games (Kosa, Yilmaz, O'Connor, & Clarke, 2016). Serious games are designed for purposes other than mere fun or entertainment (Abt, 2002). They are powerful learning resources that allow participants to experiment, learn from their own mistakes and acquire experience, in a safe way within risk environments.

We can find several serious games in the field of software engineering education (Caulfield, Xia, Veal, & Maj, 2011), but if we focus on software process education, we can observe few initiatives in the literature. The following serious games for software process education are some examples:

- SimSE is a serious game completely developed as a software tool that is based on software project simulation. The game supports several development methodologies and focuses on the development of abilities for software process management (Navarro & Hoek, 2004).
- DesignMPS is a computer game designed to support the teaching of software process modelling by reinforcing relevant concepts and providing software process modelling exercises, in where learners play the role of a process engineer who must model a process (Oliveira Chaves, Gresse von Wangenheim, Costa Furtado, Ronaldo Bezerra Oliveira, Santos, & Favero, 2015).
- Problems and Programmers is an educational serious card game to teach learners about the software engineering process, which is designed as a competitive game where participants try to finish a software project (Baker, Oh Navarro, & Van Der Hoek, 2005).
- Go for it! is a non-technological educational card game for the ISO/IEC 29110 standard elements teaching. Using the game, players are encouraged to understand the project management process and to reinforce their project management knowledge (Sánchez-Gordón, O'Connor, Colomo-Palacios, & Sanchez-Gordon, 2016).
- Floors is a serious game that proposes a 3D interactive learning environment to introduce ISO/IEC 12207 where various processes of the standard are discussed and implemented (Aydan, Yilmaz, Clarke, & O'Connor, 2016).
- ProDec is a simulation-based serious game to teach and motivate software developers in learning and practicing the principles of software project management (Calderón & Ruiz, Coverage of ISO/IEC 12207 Software Lifecycle Process by a Simulation-Based Serious Game, 2016). (This will be discussed in more detail below).

Although there are some initiatives that promote the use of serious games for software process education, only the non-technological proposal of Go for it! is

focused on understanding the ISO/IEC 29110 standard, but there is not any digital proposal that allows to acquire a basis understanding and put into practices the software project management processes of this standard. For that reason, in this work we analyze the capability of ProDec, a simulation-based serious game, to cover the project management process of the ISO/IEC 29110 standard and we assess the idea of using the proposed serious game as a potential learning resource to support learners and practitioners in the learning the ISO/IEC 29110 standard.

3   Coverage of ISO/IEC 29110

In this section, we introduce the main features of ProDec, comment on the different activities and tasks of the Project Management process of the Basic profile of the ISO/IEC 29110 standard and map these activities and tasks with the different stages and functionalities of ProDec.

3.1   Game description

ProDec (Calderón & Ruiz, ProDec: a serious game for software project management training, 2013) is a simulation-based serious game to teach and motivate software developers in learning and practicing the principles of software project management, as well as supporting the comprehension and knowledge acquisition of project management lifecycle processes and activities, in a risk-free environment.

As a simulation-based serious game, ProDec automatically generates a source code file with the equations of a discrete-event simulation model that simulates the execution of a project plan. During the simulation of the project plan execution, the serious game allows learners to practice their decision-making skills by controlling and monitoring the progress of the project execution in order to correct the potential deviations of the progress of the project.

As we can see in Figure 2, ProDec gameplay follows a three-stage lifecycle (Onset, Execution, and End stages) that allow learners to take contact with the main project management processes involved from the creation of a project plan until the closure of a project. The aim of the gameplay of ProDec is to successfully manage a software project, this means that players win when they are able to complete the project within
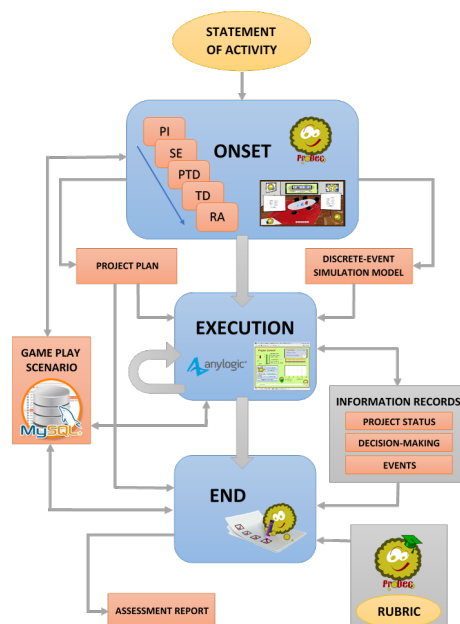

Figure 2. ProDec gameplay's lifecycle.

the time and cost constraints. On the other hand, the game is over when the project significantly overruns either the approved budget or the allocated time.

In the following subsections, we describe the different elements and functionalities associated with each stage of the gameplay's lifecycle and discuss their mapping with the project management processes and their activities of the Basic profile of the ISO/IEC 29110.

3.2 Project Planning Activity

The first activity in the project management process of the ISO/IEC 29110 is the Project Planning (PM.1). In this activity takes place the definition of all the planning details needed to manage a project. During this activity, taking into account the Statement of Work provided by the customer, the Project Plan is defined and accepted. With the goal to perform the Project Planning activity, the standard defines 15 tasks as we can see in Table 1[1].

Table 1. List of tasks of the Project Management Activity of the ISO/IEC 29110 (ISO/IEC, 2011).

Task ID	Task Description
PM.1.1	Review the Statement of Work.
PM.1.2	Define with the Customer the Delivery Instructions of each one of the Deliverables specified in the Statement of Work. This task produce the planning details of the Delivery Instructions within the Project Plan.
PM.1.3	Identify the specific Tasks to be performed in order to produce the Deliverables and their Software Components identified in the Statement of Work. In this task all Project's Tasks are defined and documented.
PM.1.4	Establish the Estimated Duration to perform each task.
PM.1.5	Identify and document the Resources of the Project: human, material, toots, etc. In this task all the needed Resources of the project are identified.
PM.1.6	Establish the Composition of Work Team assigning roles and responsibilities according to the Resources. The Work Team is defined in this task.
PM.1.7	Assign estimated start and completion dates to each one of the Tasks in order to create the Schedule of the Project Tasks taking into account the assigned Resources, sequence and dependency of the Tasks.
PM.1.8	Calculate and document the project Estimated Effort and Cost.
PM.1.9	Identify and document the risks which may affect the project.
PM.1.10	Document the Version Control Strategy in the Project Plan.
PM.1.11	Generate the Project Plan integrating the elements previously identified and documented.
PM.1.12	Include Product Description, Scope, Objectives and Deliverables in the Project Plan.
PM.1.13	Verify and obtain approval of the Project Plan.
PM.1.14	Review and accept the Project Plan.

---

[1] Note: in the tables we show the tasks of the ISO/IEC 29110 standard that ProDec is able to cover by highlighting the cell in grey shadow.

PM.1.15	Establish the Project Repository using the Version Control Strategy.

Regarding ProDec gameplay's lifecycle (see Figure 2), the Project Planning Activity of the standard is covered by the Onset stage of the game. In this stage, players follow a process that guides them to create from scratch a software Project Plan taking into account the Statement of Activity provided by trainers.

At the beginning of the stage, players review and analyze the Statement of Activity in order to know the specifications of the software project to be developed (PM.1.1is covered). Then, they follow a process that allows them to define all the planning details to generate the new software Project Plan. This process is composed of five stages, which are the following:

- Project Information (PI). In this stage, players define and provide the general information of the project such as its scope, objective, specifications, etc. and the specific information of the project that is needed to start the size estimation stage such as the salary of the workers, the delivery date, the number of use cases, etc. This stage allows ProDec covering the tasks PM.1.2 and PM.1.12 of the ISO/IEC 29110 standard.
- Size Estimation (SE). In this stage, players perform the size estimation of the project using a method of function points-based estimation and calculate and document the estimated effort and cost of the project. This stage allows ProDec to cover the task PM.1.8 of the ISO/IEC 29110 standard.
- Project Team Definition (PTD). In this stage, players design and define the human resources of the project and establish the composition of the work team. This stage allows ProDec to cover the tasks PM.1.5 and PM.1.6 of the ISO/IEC 29110 standard.
- Tasks Definition (TD). In this stage, players define the project Tasks, estimate the duration of each of them, allocated the human resources for each Task and create the schedule of the project Tasks taking into account the estimated start and completion dates, the assigned human resources and the dependency of the Tasks. Taking into account the list of tasks of the Project Management Activity of the ISO/IEC 29110 standard through this stage ProDec is able to cover the tasks PM.1.3, PM.1.4 and PM.1.7.
- Risks Analysis (RA). In this stage, players identify and make a quantitative risk analysis. Hence, through this stage, ProDec is able to cover the task PM.1.9 of the standard.

Once this process is finished, players need to review all the provided data and accept the Project Plan in order to generate the Project Plan and allow ProDec the creation of a source code file with the equations of a discrete-event simulation model that simulates the project created. Then, the tasks PM.1.11, PM.1.13 and PM.1.14 are covered at the end of this process.

3.3 Project Plan Execution Activity

The Project Plan Execution Activity (PM.2) is the second activity in the Project Management process of the ISO/IEC 29110 standard. This activity executes the Project Plan documented in the previous activity. To perform this activity the standard defines 6 tasks related to the Project Plan monitoring, the Change Request and the Project versions management (see Table 2).

Table 2. List of tasks of the Project Plan Execution Activity of the ISO/IEC 29110 [2].

Task ID	Task Description
PM.2.1	Monitor the Project Plan execution and record actual data in Progress Status Record.
PM.2.2	Analyze and evaluate the Change Request for cost, schedule and technical impact.
PM.2.3	Conduct revision meetings with the Work Team, identify problems, review risk status, record agreements and track them to closure.
PM.2.4	Conduct revision meetings with the Customer, record agreements and track them to closure.
PM.2.5	Perform backup according to the Version Control Strategy.
PM.2.6	Perform Project Repository recovery using the Project Repository Backup, if necessary.

The Project Plan Execution Activity (PM.2) is covered by the Execution stage of ProDec gameplay's lifecycle. This stage of the gameplay process consists of executing the Project Plan created during the Onset stage. In this stage of the gameplay, the Discrete-Event Simulation Model is launched and players start the monitoring of the project. For that reason, the game provides several screens where the progress of the project is presented and shows the value of the Earned Value Analysis indicators in every moment. Hence, players need to put into practice their knowledge for understanding all the information provided and discussing within their team (if the game is playing by teams) for monitoring the progress of the project. Through these activities of the Execution stage, ProDec is able to cover the tasks PM.2.1 and PM.2.3 of the ISO/IEC 29110 standard.

3.4 Project Assessment and Control Activity

The third activity of the Project Management process of the ISO/IEC 29110 standard is the Project Assessment and Control Activity (PM.3). In this activity, the progress of the project is assessed against the commitments of the documented project and it establishes actions to correct the problems, deviations or identified risks related to the accomplishment of the Project Plan. The standard defines 3 tasks within this activity, which are listed in Table 3.

Table 3. List of tasks of the Project Assessment and Control Activity of the ISO/IEC 29110 [2].

Task ID	Task Description
PM.3.1	Evaluate project progress with respect to the Project Plan.
PM.3.2	Establish actions to correct deviations or problems and identified risks concerning the accomplishment of the plan, as needed, document them in Correction Register and track them

	to closure.
PM.3.3	Identify changes to requirements and/or Project Plan to address major deviations, potential risks or problems concerning the accomplishment of the plan, document them in Change Request and track them to closure.

The Project Assessment and Control Activity (PM.3) is also covered by the Execution stage of ProDec gameplay's lifecycle. During this stage, players not only perform the monitoring the project but also control its progress by correcting the potential deviations against the Project Plan with the goal of ending the project within the time, cost and quality established. Players need to evaluate the different screens presented by the game in order to get the needed information to identify the problems, deviations or risks that could be affecting the adequate progression of the Project Plan. Then, ProDec covers the tasks PM.3.1 and PM.3.3 of the standard. If a corrective action is needed, the game provides a set of actions that allows players to make decisions to control the progress of the project such as manage the Schedule of the Tasks of the project or the Work Team. Through this decision-making, the game is able to cover the task PM.3.1 of the ISO/IEC 29110 standard.

On the other hand, during the whole of the Execution stage, the game records information about the status of the project, the decision-makings and the events occurred. Hence, the game store automatically all the needed information to monitor, track and control the execution of the Project Plan.

3.5 Project Closure Activity

Finally, the last activity of the Project Management process of the Basic profile of the ISO/IEC 29110 standard is the Project Closure Activity (PM.4). This activity is composed of 2 tasks that consist of providing the project's documentation and products according to the contract requirements (see Table 4).

Table 4. List of tasks of the Project Closure Activity of the ISO/IEC 29110 [2].

Task ID	Task Description
PM.4.1	Formalize the completion of the project according to the Delivery Instructions established in the Project Plan, providing acceptance support and getting the Acceptance Record signed.
PM.4.2	Update Project Repository.

Regarding the ProDec gameplay's lifecycle, this activity is covered by the Execution and End stages. At the end of the Execution stage, the game shows the results of the simulation of the execution of the project. In this step of the gameplay players can accept the results of the game scenario or can run the simulation again as many times as they want until they agree with the achieved outcomes, this is until they win the game or get a solution close to the winner solution. Therefore the task PM.4.1 can be covered in this stage of ProDec gameplay's lifecycle.

Once players agree with their solution and accepts the outcome of the gameplay, ProDec begins the End stage. In this stage, ProDec using the information records

generated during the Execution stage and the assessment rubric provided by the trainers through the administration tool it concludes with the generation of a detailed report. This Assessment Report allows players to get the lessons learned from their performance during the game. These lessons help players analyze the events occurred along the game to learn from their own mistakes, acquire decision-making skills, make new ideas for future plays or even get the enough knowledge for improving the life cycle process of the project.

4   Discussion

Regarding the Project Management process diagram (Figure 1) and the ProDec gameplay's lifecycle diagram (Figure 2), we can observe the similarities and do a visual mapping between both processes. In fact, as we have analyzed during the previous section ProDec is able to cover 19 tasks of the 26 tasks that the ISO/IEC 29110 standard defines for the Project Management process of the Basic profile. That means ProDec support players to take into contact with at least 70% of the whole Project Management process.

On the other hand, the tasks, ProDec cannot currently cover, are related to the Change Request, Version Control Strategy and Project Repository management and the interactivity with the Customer (meetings, revisions, etc.). Nevertheless, during a gameplay, all the information related to the gameplay scenario and players' progression inside it is stored in the Gameplay Scenario database. Then, we can conclude that ProDec could indirectly provide supporting for tasks related to Project Repository and Version Control Strategy. In addition, the trainers could perform the role of Customers during the gameplay scenario in order to cover the tasks that need the Customers' presence. Hence, ProDec could cover almost the whole of the Project Management process of the Basic profile of the ISO/IEC 29110 standard.

The idea of using ProDec for supporting software process education have been assessed by a group of undergraduate and graduate students as part of a Computer Engineering Degree and Master degree from the University of Cadiz and some practitioners of the software engineering scope that work in VSEs. A total of 21 participants performed a practical session with ProDec in order to assess its educational potential as a learning resource. Participants were invited to complete a post-game questionnaire to obtain their feedback on their player experience and perceived learning with the use of ProDec. The post-game questionnaire is composed of 59 items rating in a Likert-like scale (-2, -1, 0, 1, 2), where 2 means strongly agree and -2 strongly disagree. Table 5 shows a summary of the achieved outcomes related to the perceived learning of different areas of knowledge that players put into practice during the game plays.

Table 5. Results of the perceived learning ProDec's assessment.

Knowledge areas	Median	Mean	Knowledge areas	Median	Mean
Plan Project	1	1.30	Project Tasks	1	1.22
Size Estimation	1	1.13	Risks Analysis	1	0.9

Work Team	2	1.37	**Controlling and Monitoring the Project**	1	1.30

As we can observe the assessed areas of knowledge rate a median value equal or greater than 1 and an average value among 0.9 and 1.37. These values mean that participants agree on ProDec helps to understand and put into practice the concepts and practices related to these knowledge areas of the software project management. Moreover the score related to the player experience reaches a median value of 1 and an average of 0.82 allowing us to know that participants consider that ProDec can be a potential learning resource not only in terms of learning goals but also in terms of usability, relevance, confidence, challenge, satisfaction, focused attention, social interaction and fun that it is able to provide.

5 Conclusions and Further Works

Although the use of international software standards is an important topic in software systems, products or services with quality and improve the software process, the learning/teaching process of them is not easy and it turns into a challenge if we focus in VSEs and practitioners that have never taken contact with them.

The ISO/IEC 29110 standard is intended to be used by VSEs that do not have experience in applying or adapting ISO/IEC 12207 or ISO/IEC 15288 standards to their specific needs. Taking into account this standard, in this work, we have analyzed the capability of ProDec, a simulation-based serious game, for covering the Project Management process of the Basic profile of the ISO/IEC 29110 standard and we have evaluated the idea of using the serious game to support and carry out the learning/teaching process of the standard.

ProDec has a gameplay's lifecycle that shares a high level of similarity with the Project Management process of the standard, being able to cover directly more than 70% of the tasks defined by the standard and indirectly almost 100% of the Project Management process, if we perform some adaptations. This coverage of the standard and the preliminary outcomes of the effectiveness evaluation of ProDec in terms of player experience and perceived learning give us positive evidence about the potential idea of using ProDec as a learning resource for supporting software process education and help practitioners of VSEs understanding and practicing the Project Management process of the Basic profile of the ISO/IEC 29110 standard.

Our aim is to create a learning tool to support the learning/teaching process of software process education and help practitioners to understand and adopt the international software standards such as ISO/IEC 29110 and ISO/IEC 12207. For this reason, our future works are related to perform evaluations of the game with VSEs in order to get the necessary feedback for improving and adapting it in order to provide a complete coverage of the software project management processes of the main international software standards.

Acknowledgements

ReferencesAbt, C. (2002). *Serious Games.* Lanhan, MD: University Press of America.

Aydan, U., Yilmaz, M., Clarke, P. M., & O'Connor, R. V. (2016). Teaching ISO/IEC 12207 software lifecycle processes: A serious game approach. *Computer Standards & Interfaces* .

Baker, A., Oh Navarro, E., & Van Der Hoek, A. (2005). An Experimental card game for teaching software engineering processes. *Journal of Systems and Software, Software Engineering Education and Training* , 3-16.

Calderón, A., & Ruiz, M. (2016). Coverage of ISO/IEC 12207 Software Lifecycle Process by a Simulation-Based Serious Game. *Proceedings of SPICE*, (pp. 59-70). Dublin, Ireland.

Calderón, A., & Ruiz, M. (2013). ProDec: a serious game for software project management training. *Proceedings of the 8th ICSEA*. Venice, Italy.

Caulfield, C., Xia, J., Veal, D., & Maj, S. (2011). A Systematic Survey of Games Used for Software Engineering Education. *Modern Applied Science , 5* (6), 28-43.

ISO/IEC. (2016). ISO/IEC TR 29110-1:2016 - Systems and software engineering - - Lifecycle profiles for Very Small Entities (VSEs) -- Part 1: Overview.

ISO/IEC. (2011). ISO/IEC TR 29110-5-1-2:2011 - Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 5-1-2: Management and engineering guide: Generic profile group: Basic profile.

Kosa, M., Yilmaz, M., O'Connor, R., & Clarke, P. (2016). Software Engineering Education and Games: A Systematic Literature Review. *Journal of Universal Computer Science , 22* (12), 1558-1574.

Laporte, C., Alexandre, S., & O'Connor, R. (2008). A Software Engineering Lifecycle Standard for Very Small Enterprises . In R. O. al. (Ed.), *Proceedings of EuroSPI . 16*, pp. 129-141. Springer-Verlag.

Navarro, E. O., & Hoek, A. v. (2004). SimSE: An Interactive Simulation Game for Software Engineering Education. *Proceedings of the 7 th IASTED International Conference on Computers and Advanced Technology in Education.* Kauai, Hawaii.

O'Connor, R., & Laporte, C. (2017). The Evolution of the ISO/IEC 29110 Set of Standards and Guides. *International Journal of Information Technologies and Systems Approach , 10* (1), 1-21.

O'Connor, R., & Laporte, C. (2012). Software project management in very small entities with ISO/IEC 29110. *Proceedings of EuroSPI* (pp. 330-341). Springer Berlin Heidelberg.

Oliveira Chaves, R., Gresse von Wangenheim, C., Costa Furtado, J. C., Ronaldo Bezerra Oliveira, S., Santos, A., & Favero, E. L. (2015). Experimental Evaluation of a Serious Game for Teaching Software Process Modeling. *IEEE Transactions on Education. , 58* (4), 289-296.

Sánchez-Gordón, M. L., O'Connor, R. V., Colomo-Palacios, R., & Sanchez-Gordon, S. (2016). A Learning Tool for the ISO/IEC 29110 Standard: Understanding the Project Management of Basic Profile. *Proceedings of SPICE* (pp. 270-283). Dublin: Springer International Publishing.

Sanchez-Gordón, M.-L., O'Connor, R. V., Colomo-Palacios, R., & Herranz, E. (2016). Bridging the Gap Between SPI and SMEs in Educational Settings: A Learning Tool Supporting ISO/IEC 29110. *Proceedings of EuroSPI* (pp. 3-14). Springer International Publishing.