

Interactive Learning Environments for education

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Introduction

It is becoming more and more common using various forms of games in management education and training.

Such games may include a variety of typologies, spanning from traditional board games and role-playing games, to more technologically advanced simulation models and even comprehensive computer-based management flight simulators (Maier and Größler, 2000; Crookall, 2012; Papathanasiou et al., 2019; Armenia et al., 2020).

In this context, a “label” that is frequently and increasingly used to identify the gaming experiences aforementioned is that of “Interactive Learning Environments” (hereafter ILEs).

Literature usually refers to ILEs as environments when:

- the interaction (Renkl and Atkinson, 2007) between a user (i.e., the “player” or the “learner”) and the learning environment is primarily devoted to knowledge acquisition (i.e., learning, Kim, 1993),
- specifically through an interactive process whereby knowledge is created through the transformation of experience (so-called “experiential learning», Kolb, 1984; Kolb and Kolb, 2012).



Therefore, an ILE provides a “space” where the player is called on to take an active role, operating interactively, and with the primary goal of learning through experience. In educational programs, the player usually takes on the role of a decision-maker, thereby facing the scenarios she/he is challenged with, analyzing the data and information at disposal, and subsequently making decisions to advance the game and understand the consequences of her/his actions. That is to say, as Isaacs and Senge (2000, p. 270) point out, the central purpose of an ILE “is to provide decision-makers with new opportunities for learning through conceptualization, experimentation and reflection that are not easily achieved in everyday management activities”.

In this regard, ILEs may be effectively used in education and management training as specific typologies of “serious games”, i.e., tools developed with a primary focus other than entertainment (Neill, 2009; Crookall, 2010; Barnabé, Giorgino, Guercini & Bianciardi, 2017).

Main goals and strengths of ILEs

ILEs provide free-risk and safe spaces where learning can be facilitated and decision-making supported. In these environments, players can experience firsthand the consequences of their decisions and actions, thereby living meaningful experiences that will increase both:

- their understanding of the domain under analysis, and,
- their skills/abilities to manage resources and make decisions in that domain.

Overall, ILEs can be effective educational tools and provide users with a range of learning opportunities since they are characterized by several strengths.

In detail, ILEs:

- a) provide fail-safe practice fields in which time and space are compressed;
- b) create learning and intuition;
- c) allow players to practice repeatedly with different scenarios and treatments;
- d) represent the main way to investigate how complex domains work;
- e) allow players to test their mental models, assumptions, and beliefs about the “real” world;
- f) provide advantages in terms of costs, safety, and legality.

Stated differently, Interactive Learning Environments can be seen as learning laboratories that help to sustain processes of learning not (always) achievable in real life.

For these reasons, ILEs are increasingly used in management education and training, being designed in different forms and to represent and analyze various domains.

In this regard, previous literature provides many examples of games and ILEs tailored on different contexts, such as (just to name a few):

- Defense and the military sector;
- Logistics and HRM;
- Healthcare;
- Environment and sustainability;
- Business and strategy;
- Education.

Notably, due to the impressive technological improvements that have been characterizing our world throughout the last few decades, an area of research and expertise that is expanding is the one devoted to the development, use, and analysis of computer-based ILEs.

Focusing on computer-based ILEs

There is an increasing interest in combining computer simulation models with other traditional teaching approaches to create learning laboratories, usually named *Interactive Learning Environments* (ILEs) for management education. In this regard, *simulation models* can play a fundamental role: while in the last decades, modeling and simulation have been generally seen as technical tools to be used to solve structured problems of prediction, optimization, and financial planning, recently they have reached a different consideration, being seen as instruments to support not only learning acquisition but also strategic thinking and decision-making skills, both individually and/or in teams.

Although differently defined by several authors (e.g., Papert, 1980 and Morecroft, 1988 used the term “Microworlds”, Schön, 1983 defined them “virtual worlds”, and Serman, 1992 and 2000 referred to them as “management flight simulators”), computer-based ILEs are usually structured to provide the users/players with the following elements:

- a graphical interface where the interaction between the model and the user takes place;
- one (or more) mathematical simulation model(s), linked to the graphical interface (a specific simulation software is usually used for this purpose);
- instructions at players’ disposal, such as a description of the simulations goals and/or the User’s guide;

- data and information at players' disposal, provided in the form of graphs, tables, and dashboards;
- media files linked with the main model, such as short videos or audio-files;
- modelling tools for more extensive interaction with the ILE.



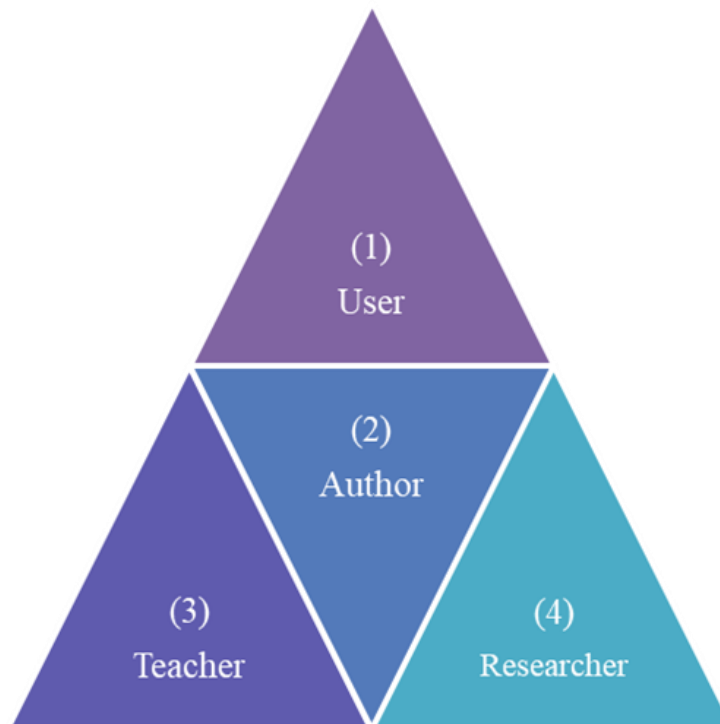
A wide range of software can be used to develop computer-based ILEs, and, similarly, various simulation paradigms (e.g., System Dynamics, Discrete Event Simulations, Agent-Based Modelling) may be used for this purpose.

However, particularly when combined with System Dynamics simulation models (Forrester, 1961 and 1968) such Interactive Learning Environments have proved their validity in a variety of different fields, being well suited to provide the basis for meaningful learning experiences about the relationships between the structure and the dynamics of complex systems (Lane, 1995; Spector and Davidsen, 1998; Davidsen, 2000; .Morecroft and Sterman, 2000; Meadows, 2007; Fischer and Barnabè. 2009; Alessi and Kopainsky, 2015). In this regard, a wide literature provides many examples of System Dynamics-based ILEs, developed and used to train learners in a variety of educational contexts (e.g., Sterman, 1992; Morecroft and Sterman, 2000; Davidsen and Spector, 2015; Barnabè and Davidsen, 2020; Armenia et al., 2020).

ILES from different perspectives

ILES can be effective training and educational tools. However, their understanding, usefulness, and scope of application may vary depending on the perspective of the people involved in the process (see Figure 1).

Figure 1: ILEs from different perspectives.



- 1) From the *user's perspective* - an ILE is a safe environment where a person can learn how to solve a complex problem and be challenged to make decisions as if they were in a real-world situation.
- 2) From the *author's perspective* - an ILE is a tool for communicating the results and key insights of her/his research to an audience, in an easy and straightforward way.
- 3) From the *teacher's perspective* - an ILE provides a way for an educator to interact with the students and also to learn about how the students learn, engaging them actively and keeping track of their improvements.
- 4) From the *researcher's perspective* - a learning environment provides a way to test hypotheses, observe behavior, and organize and run experiments.

In brief

Providing free risk and safe environments where the users interact each with other and all of them together with the underlying game, ILEs allow facing complex business problems, developing shared policies, revealing, and testing mental models and, last but not least, speeding up knowledge sharing and knowledge acquisition.

Stated differently, ILEs can facilitate decision-making, gain policy insights, and also learning having fun and being actively involved in the process!

With this said, is there an opportunity for ILEs in the field of Project Management?

Previous literature already provided good examples of how games and, more in general, ILEs can be effectively used to analyze project management-related operational and decision-making contexts (e.g., Rodrigues and Bowers, 1996; Lyneis and Ford, 2007; Sterman, 2000). Certainly, the

field of project management offers various characteristics that would favor the use of ILEs for training and educational purposes, to the extent that their joint use might seem as a wedding made in heaven.

Certainly, the PMBoG Project will provide an excellent opportunity to gain more knowledge and insights about the use of ILEs in the field of project management!

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