

# A Multi-Agent Approach to Develop Courses in terms of Learning Objects with Videogames

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**Abstract.** Videogames have been identified as potential learning tools, then the videogames are considered here inside the main components of a learning object. It is possible the learning objects can be produced and saved in the repositories form different educative institutions, then some challenges are required to solve such as the research and use of this kind of educational contents. Current work proposes a multi-agent approach in order to help a tutor to develop online course in terms of learning objects with videogames coming from several distributed repositories located in different educative institutions. Finally, the performance of current proposal is presented throughout a case study.

**Keywords:** Videogames, Learning Objects, Multi Agent Approach, E-learning

## 1 Introduction

A videogame is an interactive computer program proposed for entertainment; it can run on various devices such as personal computer, consoles, cell phones, audio allowing users learn in a ludic manner. The videogame market is constantly growing; new developments occur almost every month, increasingly sophisticated and offer more possibilities to the player. Nowadays the videogames are using in multiple platforms creating a lot of mobile consoles. Then, the user can use the videogames consoles exploring academic resources in those devices. However, in the e-learning area, there are several works that offer few options for access educational resources with videogames [1, 4].

The learning objects are considered as educational resources that can be employed as a technology support of learning process, they are a digital pieces of knowledge to put together in order to form online courses [7]; an example is presented by Fig. 1 of a learning object to learn more about the world of chocolate from a practical side[3], the student is enrolled on a cooking course about advanced uses of chocolate in cooking.

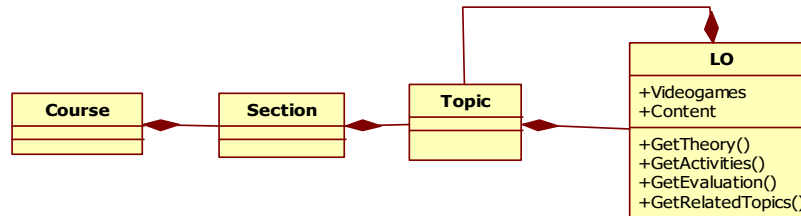


**Fig. 1** A learning object with videogame from e-adventure research project [3].



**Fig. 2.** Model of a learning object with videogame.

Current work considers here that videogames can be inserted in the content of a learning object such as evaluation, related topics, theoretical y practical knowledge (see Fig. 2). With this model, the student can put in practices the theoretical knowledge playing with the interactive videogames embedded in every learning object.



**Fig. 3-** Structure of an online course composed of learning objects with videogames.

In general, a course is composed of several sections (or modules), these are composed by one or several topics, and every topic can be represented by one learning object with videogames (see Fig. 3). In fact, the learning objects can be produced by several educative institutions to encourage the creation of digital materials from a large diversity of ludic scenarios under different platforms [8, 5].

Current work proposes some solutions to design and develop online courses in terms of learning objects with videogames. To this end, section two describes some common problems using videogames as educational resources. As an alternative solution, next section describes a multi-agent approach to develop courses in terms of learning objects with videogames. Section four presents an online course as a case study in order to show the feasibility of current proposal. Finally, some conclusions are presented, and some future works are proposed.

## 2 Problem Outline

Learning objects can be designed to be used in different courses, they are generally saved and accessed in repositories which offer a series of services such as display, search, and update. Several institutions use Learning Management System (LMS) to develop their courses with learning objects on various domains such as: data structure, programming, software engineering, medicine, etc. Examples of LMS are Talenlms[16], Claroline[14], and Moodle [15]; the creation of heterogeneous learning objects require the compatibility between LMS platforms, OS platforms and content of learning objects, but the compatibility is implicit to have portable devices such as mobile devices, handhelds, laptops etc... It is possible to identify some difficulties when learning objects include videogames, these difficulties are as follows:

- The learning objects with videogames needs to be portable and reusable across multiple platforms [11].
- It is necessary a better performance searching learning objects with videogames [4].
- The search of learning objects requires to be applying in local and distributed repositories [4].
- It requires a visualization of learning objects with videogames [3]
- It lacks criteria to evaluate the quality of this kind of learning of objects.

## 3 Conceptual Model

Given a large number of universities can produce online courses in terms of learning objects and saving these objects in their own repositories, these repositories in general support several queries with different criteria thanks to the information saved in the metadata. Next model specifies a teacher can develop a course in a transparent way searching and selecting learning objects from different repositories.

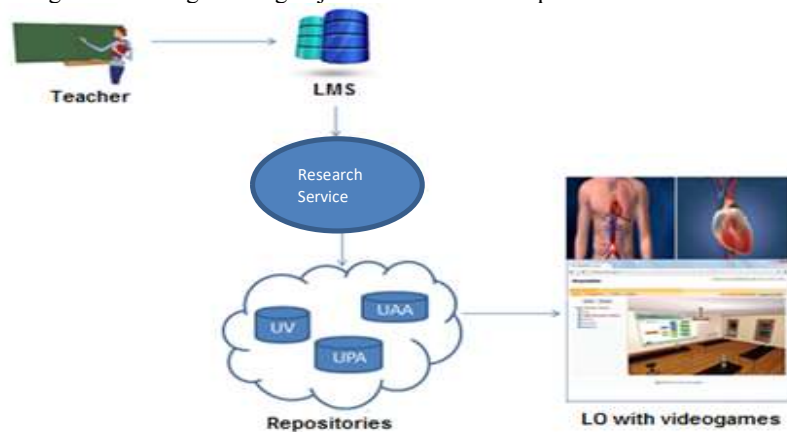


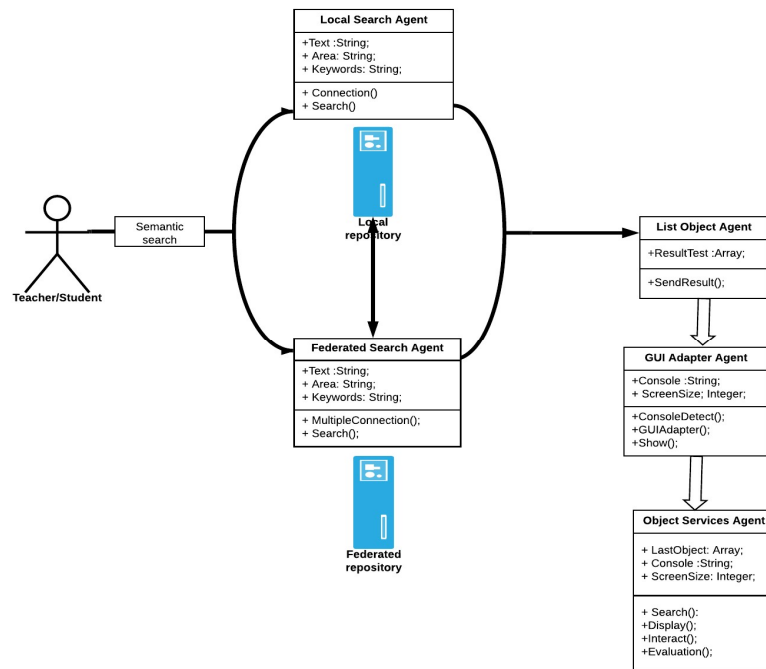
Fig. 4 Development of online courses in terms of learning objects with videogames

Open source learning management systems can be extended in a such way a teacher can find and select learning objects in order to develop online courses (See Fig. 4). Tanks to the connection of repositories (current work has used the repositories of universities of UAA, UPA and UV in México), it is possible to reuse the academic contents and offer online course in terms of learning objects. In addition, all the learning objects in the repositories should be filter by multiple agents asking and getting learning objects with videogames. Then, the students can use the learning objects with videogames accessing these courses under different platforms such as pc, lap and mobiles devices.



**Fig. 5.** Access of learning objects with videogames coming from different repositories.

The architectural model of Fig. 5 considers the learning objects can be produced by several teachers of different institutions where several digital content can be found by a research in several repositories, current work has used the repositories of universities of UAA (Universidad Autónoma de Aguascalientes), UPA (Universidad Politécnica de Aguascalientes) and UV (Universidad Veracruzana) in México. In addition, the model specifies the use of videogame console to access and display different learning objects with videogame from different repositories [2, 3, 11]. The user interface of a videogame console (such as psp, itouch, pc and switch) can display the content of a learning object.



**Fig. 6.** Relations of agents to search learning objects with videogames

With the multi-agent approach is possible to access to a large collections of learning objects from different repositories located in different Mexican institutions. They can share their academic resources. Here, each agent is specified in terms of classes with attributes and functions and the interactivity between the agents; this framework give us the opportunity to launch each agent, with this performance is incremented of a local search and a federated search.

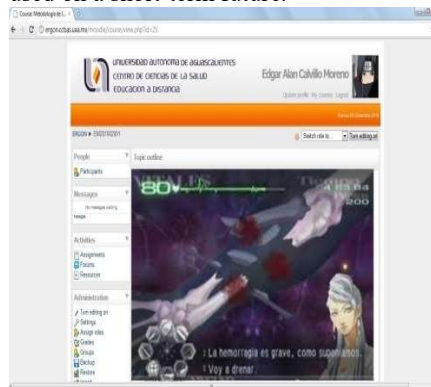
The Fig. 6 presents the components of system with multiple agents in each activity. The *Local-Search Agent* works only in the local repository creating queries, the *Federated-Search Agent* this agent work in the federation of learning objects, when this two agents finish their work then the list objects agent get all the results and send to the GUI-Adapter Agent, this agents try to detect the final dispositive to adapt the information generated by the previous agents. Finally, we have the *Object Services Agent*, this agent works with the main functions of a learning object such as the visualization, accessing, interaction (in this space we have the interactivity of a videogame) and evaluation. This community of agents is called “social network games”.

## 4 Case Study

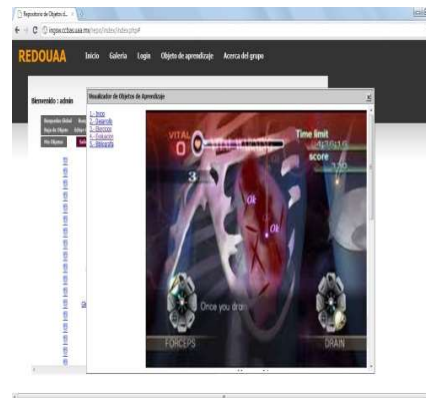
This case study shows a medicine course saved in the Moodle platform of UAA, where a teacher can select some learning objects requesting from distributed repositories in some Mexican universities. A teacher can launch a query of learning object using key words, then two agents start the search, one agent searches in the local repository and other agent searches in a federated repository, then an agent takes all the results and prepare all the information in a unique list of learning objects. In this step the user doesn't know the platform, then an agent detects the platform where is the client, once is identify send all the aspects to run in this platform to the final agent who gives all the services like search, display, interact and evaluation [12].

The use of technologies in the medicine field have been risen exponentially, now the medicine students can learn playing for example to put in practice surgical cuts since this delicate task requires a lot of practice, the videogame specify basic movements in a surgery.

Note in Fig.7.1 shows a learning object with a videogame from [13], it is used to learn and play about the reconstruction of an arm, indicating the areas to be sewn for optimum operation within the time available shows a standard of health score indicating the user's progress. This type of interface helps to start with a theoretical knowledge that can be used on a short-term future.



**Fig. 7.1** Course online in the domain of medicine using learning objects with videogames from [13]



**Fig. 7.2** A medical learning object with a videogame to learn and play about a heart surgery [13].

The Fig. 7.2 shows a type of surgery that requires a reconstruction of an arm; this process can be assisted by Aid that presents the video game involving a series of messages that help to improve their learning.



**Fig. 8.** Videogame “Under the knife” [13] to play and learn about a heart surgery.

The Fig. 8 shows how the agents send as result, this learning object is got by two agents, one searching in a local repository and the other agent work in the distributed repositories, then all identified information by the two agents is taken by the list objects agent, creating an uniform list of objects, this list of objects are taken by the Graphical User Interface adapter agent that detect a play station, sending all the display sizes and list of objects at the last object services agent finally we have the game in the form of exercise with a theme of human cell, allowing the user to drag the elements that are relevant to each of the boxes in white, this is done interactively allowing the user to learn based on practices and games, this is done interactively allowing the user to learn based on practices and games.

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**Fig. 9.** Metadata of learning object to learn about the arm surgery.

The metadata is specified under the standard SCORM (see Fig. 9) with the purpose that despite being the subject of learning in the form of videogame, it can be used by other search across different repositories in educational institutions as well as the successful execution in a mobile device.

## 5 Conclusions

This paper proposes the use of multi-agent approach in order to compose online courses in term of learning objects with videogame. The multi-agent approach helps to make an easy use of several services throughout a graphical user Interface under mobile devices; all services in particular the search of learning objects in several repositories. The proposed model for a learning object with videogame is composed here of five components such as: theoretical knowledge, evaluation, related subjects and practical knowledge in terms of interactive videogames. Some sections have described learning object where the students can use videogames to learn and put in practices the theoretical knowledge in medicine area. This improves the maintenance, access and reuse of learning objects. In such a way that end users (in particular teachers and students) can transparently identify and respectively access the learning objects of a course from a content management system which will be connected to several repositories distributed in different educational institutions. Current wok presents the results from a case study with good performance in the connection between different repositories institutions and a good compatibility between different kinds of mobiles devices.

Future work is diverse such as the study of copyright, the accessibility and the learning objects repository policies. Another topic to study an intelligent virtual environment as a multi-agent system enables to support collaborative learning with learning objects and videogames.

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