

# Involving Teachers in the Educational Video Games Design Process

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**Abstract.** Teachers usually have problems to find games properly designed to teach their subjects since the ones included in textbooks are not fun enough to catch the students' attention. They would like those games to be as fun as the ones which students play at home. The main problem is that designing an educational game is complex and people with different goals are involved. In order to allow teachers to participate in the educational video games design process more easily, we here present an approach with which teachers are able to describe the contents they want to include in the game. This educational contents organization eases the latter design of video games' challenges and allows relating both levels in order to obtain an approximate mark of the learning achieved.

## 1 Introduction and Related Work

Educational computing has been a focus of study for several years due to the incorporation of New Information and Communication Technologies (ICT) in learning processes, both in schools and at home [1]. A particular example of ICT being used as an educational tool is that of educational video games, which attempt to combine the advantages of using video games [2] with the learning of a particular subject in the educational curriculum. However, despite the motivating effect of video games in the classroom, students still demonstrate a lack of motivation.

Our research focuses on the video games with implicit educational content, where the educative contents are hidden. The efficiency of educational video games could be improved, in our opinion, through the use of a specific development method which easily allows the definition of both educational and recreational goals.

Many of the difficulties of using this kind of video games in classrooms come from a lack of fun games for specific educational contents. The design of these video games is complex and people from different areas are involved in it. This makes the development process difficult because teachers and game designers seem to talk *different languages*. The approach we here propose is based in an educational video games design process whose main goal is to maintain a balance between educational

and recreational tasks. And, in consequence, a derived objective is to fill the gap between teachers and designers, allowing them to *talk the same language*. We achieve this purpose by providing the specific content each of them needs to know from the other team. In this way, the video game obtained is more like a fun video game through which the player can learn the educational content hidden within.

There are several works which propose general recommendations or guidelines to design educational software. For example, Fernández Antelo and Cuadrado Gordillo [3] proposed a set of constructivist principles for the development of educational software (although not games in particular), highlighting that in this way it is possible to obtain educational results similar to those obtained by traditional teaching methods.

Although several proposals about design guidelines and architectures can be found in the field of educational video games, one of the most important is the platform ⟨e-Adventure⟩ [4], which integrates a design method and an architecture to support the design process. This framework is mainly focused on the development of educational tools, although it can also be used for non-educational video games [5].

The design of educational games using ⟨e-Adventure⟩ involves an interdisciplinary team comprised of game writers, artists and programmers who use specification languages and development environments specific to the ⟨e-Adventure⟩ platform. To support the design process, there are a set of guidelines designed to facilitate the integration of adaptive and measurable games in online learning environments [6].

Finally, Sauv  [7] presents an interesting philosophy to make the design of on-line educational video games easier, allowing the creation of different games starting from the same general structure.

While some guidelines for creating educational videogames do therefore exist, we believe there is a need for a more specific tool for teachers, with which they can easily indicate the contents to be taught.

In the section 2, we briefly describe the design process for educational contents that we propose within a broader design process covering all aspects of the educational video game. We focus on this aspect because it is usually the most neglected aspect in the development of educational games. And, undoubtedly, is one of the most important, since, along with didactic resources, integrates all aspects of teaching and learning. Finally, in section 3, we outline some conclusions and further works.

## 2 Educational Contents Design

The first step to design educational video games is defining which contents are going to be taught. In this process, teachers have a very important role and their task has to be facilitated in order to enhance their participation in the EVG design process. By involving teachers in this task, we think they will show more interest in using them.

For that reason, based on our set of models previously proposed [8], we have defined a process of educational design. This process is especially intended to promote the teachers' involvement and can be divided in two phases:

- Design of General Dictionary: Definition of Knowledge Areas, Educational Goals and Educational Tasks.

- Design of Educational Model: Instantiation of the General Dictionary.

First of all, Knowledge Areas must be established. A Knowledge Area is a collection of knowledge characterized by the homogeneity of the object of study. For each area, the teacher must indicate the name, the recommended age expressed as a range, and a general description of the Knowledge Area.

Next, the teacher must create the Educational Goals. An Educational Goal is an achievement that the student must accomplish at the end of the educational process as a result of their experiences in the video game. At this stage, the teacher must provide data about the Knowledge Area from those which have been previously defined. Next, a name needs to be given to the Educational Goal and the recommended range of ages must be established. This range must fall within the one indicated for the selected Knowledge Area. In addition, the teacher must provide a description of the educational content to be learnt in the goal. The explanation must be given in natural language and should clearly explain what students have to learn in order to succeed.

Figure 1 shows the definition of the Educational Goal: “Learning to Build Composed Words”, aimed at children between 10 and 12 years and located within the area of “Language and Literature”. A list of additional learning topics is included in the central field. This list is related to the Spanish educational law, but can be used in other contexts. For Spanish, we would include mathematical reasoning, the physical and natural world, information processing, social and civic competence, cultural competence, artistic competence, autonomy and personal initiative, and learning to learn as related competences.

Teachers must follow a similar process to establish Educational Tasks. An Educational Task is an instructive activity which will allow students to achieve one or more Educational Goals. Therefore, once we have introduced all the goals and tasks, the next step is relating them. One goal can be related to another as a sub-goal or one task can be related to another one as a sub-task. We can also relate a task to a goal, meaning that the task contributes to the achievement of the goal.

Graphically, the relations between goals and task can be seen as a tree. Thus, the Knowledge Area is the top level of the tree. Once the complete tree has been generated, the Knowledge Area is completely defined and can be used by all users in the system. Moreover, based on this definition, teachers can adapt goals, tasks and relations to the group of students who will play, or even to individual students if they need a particular aspect to be reinforced or if they have a disability. These changes are reflected in the Educational Models, which also include an order relation between the elements they include. An Educational Model organizes a specific form of learning based on a subset of objectives and tasks.

To define an Educational Model the teacher may base it on a previous Educational Model or construct a new one. In both cases, it is necessary to specify data about the Knowledge Area to which the Educational Model relates, the name of the Educational Model to be created and the educational age range. In addition, a brief description of the contents being taught in the Educational Model must be included.

Once we have defined the main characteristics of the new Educational Model, it is

Fig. 1. Creating Educational Goals.

necessary to decide which goals, tasks and relationships it will include. To do this, teachers add, modify or delete goals and tasks in the Educational Model. In an existing Educational Goal, the options available are: 1) *Add a new sub-goal*, if the new goal is part of the previous one; 2) *Add a related goal*, if the new goal has an order relation with the previous one or 3) *Add itinerary*, if the teacher wishes to define the sets of tasks that users face to overcome the goal.

Finally, options available for a task are *Add simultaneous task*, if the task must be performed at the same time as the previous one or *Add next task*, if the task must be performed after the previous one. If some element is deleted the whole sub-tree behind the element is also deleted. Figure 2 shows the second step in the creation of a Educational Model, that is, the selection of a subset of tasks (drawn as ellipses) and goals (drawn as rectangles), and the definition of order restrictions on Educational Tasks and Goals. In the example, “Recognizing the Genre” is a simultaneous task to “Recognizing the Number”, but “Distinguishing Common Nouns” is a previous task to “Recognizing Genre and Number”.

Defining Educational Models is the last step in the educational design process, on which the present paper is focused. Then it will be required to design the playful part of the game: gameplay, narrative, storytelling, interaction mode, etc. and join the two parts: educational content and entertaining content [8]. Consequently, after defining all Stages and Levels of the video game as well as the Video Game Model, the only will have to do is defining the relationships between the educational and video game levels. To do this, we have to establish a relationship between the tasks in the leaf nodes in both trees: a) the educational tree with the Educational Goals and tasks, and b) the video game tree with the Video Game Challenges, Stages and Levels. In this

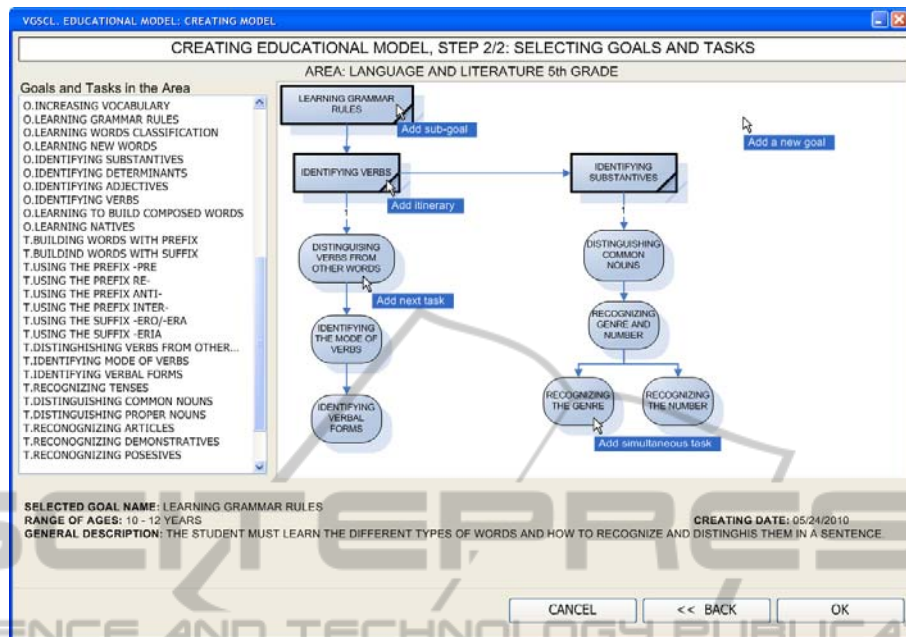


Fig. 2. Building a new Educational Model.

way, when the player passes a Stage in the video game, the related Educational Task is learnt.

### 3 Conclusions and Further Work

The field of educational video games is being studied by different research groups around the world (for example, [3; 6; 8]). The studies prove that using these kinds of tools is beneficial for students at both a personal and an educational level. In this work, we have presented an approach to enable teachers to be fully involved in the design of educational contents for the educational video games. That way, teachers are able to provide their expertise to the video game development and to split the contents suitably to be learnt gradually. In addition, those contents can be reused in other video games and, thanks to the relationship between educational and recreational contents, teachers can obtain an approximate assessment about the students' performance.

Nowadays, we are performing different test with a prototype that implement the presented educational design process in order to solve problems which teachers could find during its application. In addition, we are designing an educational video game about nutrition by using this process.

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