

Adapting an Educational Game for Spanish Orthography to make it Adaptive and Accessible

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Abstract

This paper explains SAMO, an educational game for Spanish orthography. The game is an evolution of MITO, which was evaluated with real students. Using information obtained from this evaluation, which highlighted some shortcomings from the pedagogical and access point of view, a new game has been developed, using a new architecture, with a new teaching methodology and accessibility features.

1. Introduction

Electronic educational games are learning and recreational environments that try to increase learner motivation by embedding pedagogical activities into highly enjoyable interactions. On the other hand, in the last few years there has been a considerable growth in on-line educational data, and specifically educational games. Therefore it is becoming essential that these games be adaptive, since it is desirable that an educational game adapts to the student (in both presentation and content), and that it be accessible in order to provide equal access and equal opportunity to all users. Also, it is very important that educational games be accessible in order to be used in public schools.

Our work is focused in the design of an educational game for Spanish orthography for the web. Orthography has been chosen because the ability to write correctly is an essential skill throughout both educational and working life. The most significant difference between English and Spanish orthography, is that, in the case of Spanish, there are rules determining how words are spelt. There are many educational games to teach Spanish orthography on-line, like [1][2][3]. These games are focused to teach the rules. However, from the nearly 600 rules that exist, only a few are really useful (in the sense that they contemplate many words and few exceptions). So, in this work we design a new educational game for Spanish orthography not based on “teaching the rules” but in the ideas proposed in the Neuro-Linguistic

Programming Model for orthography presented in [4]: for our purposes, orthography will be used as a synonym for “correctly spelling the words”. Therefore our main goal will be to teach the strategies applied by good spellers. Solving exercises is not effective if the mental strategy is wrong, so it is fundamental to teach a mental process, which can be described as follows: when in doubt, good writers mentally search for the image of the word and try to visualize it. Good writing becomes then recalling the image of the word, previously stored in the mind. This visual recall of the word might be good enough to be sure of its correctness, but in some cases good writers clarify doubts by writing the word in different ways.

Next section briefly explain our previous work (MITO), an educational game for Spanish orthography which evaluation have caused the development of SAMO.

2. Previous Work

MITO (which stands for Multimedia Intelligent Tutor of Orthography) is a stand-alone application which focuses on helping children between 8 and 12 years old learn Spanish orthography [3]. The contents in MITO are divided into four modules, each one aiming to teach words corresponding to different sets of rules. A first formative evaluation of the MITO system has been performed [5]. This evaluation had two main goals: a) to determine the degree of acceptance of the game among the users it was aimed at, identifying relevant aspects that could improve learner motivation and b) to study the effectiveness of the game in helping children to learn orthography, identifying possible ways to improve the design and behavior of the system from an educational point of view. Regarding the motivational aspects, the initial results were very encouraging. Children did indeed become very engaged with the game, but regarding the effectiveness, results were not so good. This evaluation showed some weaknesses in the system: 1) Some of the exercises of MITO consist of students choosing between correctly and incorrectly written words. This kind of exercise based on identifying orthographical

mistakes must be given only to advanced students; 2) The design of the system does not encourage students enough to use feedback and help; and 3) The architecture and the user modeling techniques used are too simple and therefore the adaptive capabilities need to be improved.

3. SAMO

SAMO (which stands for Multimedia Adaptive System to teach Orthography, in Spanish *Sistema Adaptativo Multimedia para la enseñanza de Ortografía* – <http://www.lcc.uma.es/samo/>) to fix the errors detected in the evaluation of MITO. To improve its availability, SAMO is designed as a web-based game. Also, the new implementation makes SAMO *adaptive*, because the content is adapted to the user's knowledge (this will be dynamically inferred from the interaction with the system); and *accessible*, because the contents are more available to all users. The traditional ITS architecture is used to design the game:

Domain Model. When teaching orthography, the main goal is for students to be able to correctly write every word they normally use as well as new words they will learn in the future. In [6] authors did a study to find those words that statistically generate a higher number of mistakes, this is the *basic vocabulary*. They also found that there is a small set of rules that have many words and few exceptions, these are the *basic rules*. The domain model is initialized with the basic vocabulary and the basic rules, but it can be updated by the teacher adding new words and rules.

Student Model. For each student, SAMO stores their profiles containing static data provided by them when they register in the system. The student model also stores some dynamic data gathered during the student interaction with the system. Specifically, for each word shown to the student two counters are stored: how many times this word has appeared in an exercise, and how many times the student has written this word correctly. When this counter reaches a predefined value, SAMO considers that the student has learnt the word, but it can still be shown to the student for revision purposes.

Pedagogic Module. SAMO organizes exercises in different levels, so for each student SAMO enables those exercises that are appropriate for their level. Next, the pedagogic module has to select a list of words to be shown. It has to look in the student model and will choose randomly among the words that belongs to the student level and that are unknown. If the pedagogic module detects that the student is not obtaining the correct answers after a few attempts, it will decrease the student's level. On the other hand, if

the students learn all the words in their level, the pedagogic module will increase their level and it will enable new words. If students get through all the levels, they can play in "revision" mode, with all the exercises and all the words available.

Exercise Library. The exercise library includes templates, so that the same type of exercise can be used in different levels of the game just by using different words or rules. There are different kinds of exercises since SAMO has different learning goals: 1) *Visual strategies*, using exercises that are not specific to orthography, but help to improve visual memory; 2) *Basic orthographic skills*, using exercises where the student has to write words, and 3) *Basic rules*, using exercises where the student has to apply a rule to select the correct word.

Help Module. The help module is represented by a character within the game that provides help messages and feedback when necessary. For each exercise, this character shows a message explaining how to play. As the student makes progress, the character informs them of their performance. There are also specific messages for particular games, i.e. messages explaining rules. All the messages are shown by text and audio.

Regarding accessibility, the works about accessibility from IGDA [7] and MediaLT [8] define a list of characteristics that games must fulfill to be fully accessible. These features are included in SAMO as far as possible and appropriate. Finally, since SAMO is a web application, the web content will conform to W3C's "Web Content Accessibility Guidelines 1.0", level Double-A [9]. This will be reinforced with the use of validated XHTML 1.0 and CSS 2.0.

3.1. The game

When a student registers in SAMO and logs in Fig. 1 is shown.



Fig. 1 Screenshot of the main menu

The main elements are: user name and avatar, scores and available games. In the score frame, users can see their total points; the score obtained in the last game and his/her position in the ranking. By clicking on the medals, the user can see all the rankings: there is a list for each game and a global list. These lists have been included since it is one of the most successful features regarding motivation. The help character is always “ready to help”: it will explain the exercises and will show the feedback messages, etc. All the messages are in text and audio format.

When the student begins to play, a screen as in Fig. 2 is shown. On the left side there is a blackboard, which is the “working area”. The help character is explaining the exercise that, in this example, is about homophonic words (words that have the same sound and a different spelling). There is a sentence with a missing word and the student has to choose the right one. On the right side, there is a frame with user information. The results of the previous game are included since it is very motivating for students: they want to finish the exercise faster and with fewer mistakes each time.



Fig. 2 Screenshot of an exercise

In order to make this application easy to use for all users, there is a “virtual keyboard” to be used in those exercises where it is necessary for the student to write something. Fig. 3 shows an exercise where the students have to click on the speaker to hear a word, then they have to write it. This can be done using the usual keyboard or using the “virtual keyboard” selecting the letters with the mouse.



Fig. 3 Screenshot of an exercise with the “virtual keyboard”

4. Conclusions and Future Work

MITO and its evaluation were very useful to our group for fixing the guidelines that a good educational game should have in two ways: how to teach with games and how to make them accessible. We used this knowledge to design SAMO: 1) New architecture, 2) Accessibility features; and 3) New teaching methodology: we have changed our view of how orthography must be taught. Instead of exercises focused on learning the words “by learning the orthographic rules”, we design exercises to “learn the words using visual strategies”. Finally, to point out that all the multimedia aspects (pictures, sounds, characters, etc.) have been designed by project developers to avoid copyright problems.

5. Acknowledgment

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