Technology and Special Educational Needs: Let's Play "Doing Good Deeds!"

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***Abstract*— "Doing Good Deeds!" is a game directed to children with special needs, in pre and elementary school age that aims to promote the development of social skills in different contexts. Structurally, this game has available a set of Avatars that players can choose to represent them. To adapt the game to each child, an administration module was developed, corresponding to the back office of the game, which allows the educator to create or change contexts, difficulty levels and sequences. This module includes also the visualization of the user performance, in particular the duration of each game, the number of attempts with and without success, allowing the educator to analyze the progress of each player.**

Keywords*— *Special Education Needs; Social Competencies; Serious Games; Children.

I. INTRODUCTION

This work is focused on the contribution of new technologies in the teaching-learning process of children with Special Education Needs (SEN). A child with SEN shows specific conditions, social and emotionally, that may need the support of special education services during the entire (or part of) his/her school years to facilitate the academic and personal development [1]. Playing is an activity that is part of childhood. It is the first contact with the surrounding world. By playing and more specifically, playing computer games, the child has the possibility to develop and enhance the psychosocial, cognitive and communicative functions, while simultaneously answering challenges and acquiring knowledge spontaneously [2; 3]. So, the game can become a complementary instrument, facilitating the diagnosis and intervention in children with SEN [4].

The Information and Communication Technologies (ICT) can be considered fundamental tools for the improvement of the quality of the educational processes, increasing the creativity and innovation in the teaching/learning process [5; 6].

The development of new technologies, and with the support of specialized technicians, it was possible to build specific equipment for children with SEN, which promote opportunities regarding interaction, sharing, knowledge and the accessibility improvement [7].

There are several platforms in the Internet which provide games for children with special education needs, for example, Aiello (source: www.jogoseducacionais.com), whizkidgames (source: www.whizkidgames.com), Laureate Learning Systems (source: http://www.laureatelearning.com), 4kidz (source: http://4kidz.org), Smart Tutor (source: http://www.smarttutor.com) or Social Skills Builder (source: http://www.socialskillbuilder.com). These platforms include games for helping children with the spectrum of autism, disorders to language impairments, Down's syndrome, self-confidence, delayed developmental disabilities, attention span, hand-eye coordination, reading and math, social skills, among others.

However, we did not find any game that had, as an objective, the development of sequences of actions that could be personalized and adapted to the children level of complexity. The proposed game has two different ways to play, creating sequences and identifying the right sequence. In order to facilitate the usage of the game, we present two completely characterized contexts (school and the general environment) where the undertaking of good actions is encouraged. It is the authors' opinion that games can be a useful tool for children with attention and concentration difficulties, enabling learning and social promotion. So, with this project, we aim to design and develop an interactive game, "Doing Good Deeds!", to allow children with SEN to learn and/or improve some social skills. At the same time, an administration module was developed, the back office, responsible for managing, administrating and maintaining the application. This module will allow the personalization of the game. With this functionality, the tutor can easily include new sequences and challenges adapted to the specific special needs of the child to increase its motivation and focus on the need being developed with the game.

The paper is structured in 4 sections: Section II, Game Development, describes the technologies applied in the development of the game; Section III, Game "Doing Good Deeds", presents the game operation, *story board* and *back office* and finally, Section IV, "Discussion and Final Remarks", enunciates some final comments and future work developments.

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II. GAME DEVELOPMENT

The game runs in Web environment. The WAMP (www.wampserver.com) development environment was used. WAMP is a conjugation of different technologies (Windows, Apache, MySQL and PHP) which allow the creation of dynamic Webpages.

Apache allows showing the Webpages when these are remotely requested [8]. MySQL allows saving and updating the dynamic content of Web applications [9]. PHP is a language that it is used in the development of Web applications [10; 11]. WAMP integrates the PHP Hypertext Preprocessor server, which is used by Apache to process commands in PHP language. Additionally, WAMP enables the PHP MyAdmin application, which allows for the management of the MySQL database, in order to create tables and manipulate their content.

In order to allow the creation of animations and incorporate the dynamic elements of the game, a graphic interface was developed using the Adobe Flash software [12]. Using the ActionScript 3.0 programming language, property of Adobe, Adobe Flash can incorporate dynamic elements from the game, accessing content from the MySQL database by integrating commands in PHP language, as shown in Fig. 1.

HTML (Hypertext Markup language) and CSS (Cascading Style Sheets) (source www.w3.org/Style/CSS) are the base technologies used in the development of the Webpages. HTML defines the structure and CSS sheets define the appearance [13] [14].

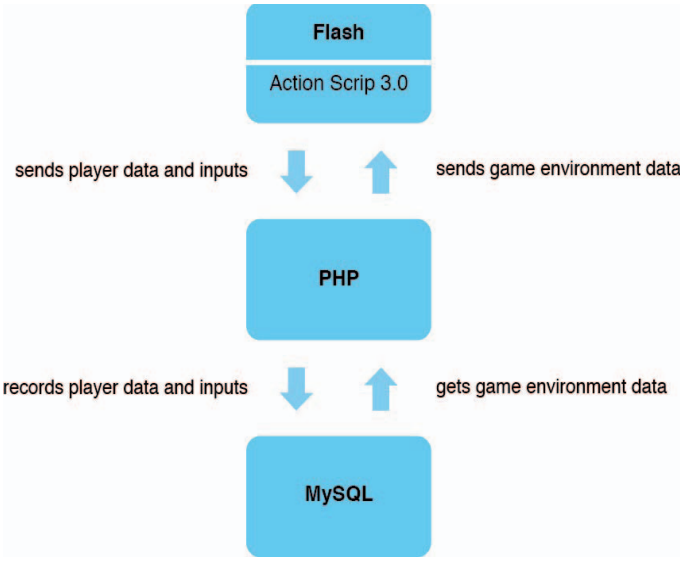

Fig. 1. Connection between Flash, PHP and MySQL

In order to obtain a high quality appearance and consistency between Webpages, the CSS technology was used. It is a language that can be used to create presentation styles, and defines the appearance of HTML documents, including fonts, colors, margins, lines, height, positioning, among others [15]. The CSS style sheets were used in the development of the back office page, and in the positioning of the game in the Webpage.

Ajax (Asynchronous JavaScript and XML) allows the exchange of information with the server without having to reload the HTML page [16]. AJAX was used in the development of the authentication on the administration panel.

III. GAME "DOING GOOD DEEDS"

The main purpose of the game is to be a form of entertainment, and also to act as a promotor of the development of social skills.

In the design phase of the game, the teachers of children with SEN and the psychologist were involved. There was a kick-off meeting with the research team to define:

- the skills the game should improve;
- the way to promote the defined skills;
- the definition of positive feedback;
- to implement a collaborative game;
- the performance indicators the Back office should save;
- to implement the possibility to create and edit new contexts and sequences.

A. Game Operation

The game is divided in two categories: the "sequences game" and the "game of the right and wrong".

The first task is the creation of a virtual character. The definition of an Avatar can increase the confidence of the user, enabling an improvement on the process of interaction between him/her and the computer [16]. By selecting the "Play" button, Fig. 2, a set of Avatars is shown, which correspond to the images presented in Fig. 3a). The player should choose his/her Avatar as an in-game representation of himself/herself. Next, the player should write his/her name, as shown in Fig. 3b).

Fig. 2. Initial Menu

As it is shown on Fig. 4, the user should select which type of game he/she wants to play, the Game of the Right or Wrong, or the Sequences Game, Fig. 4a). In each game type, the user selects the desired context, Fig. 4b): School and Environment. In each game environment, three difficulty levels are set, according to the number of images that are presented: 2, 4 or 6.

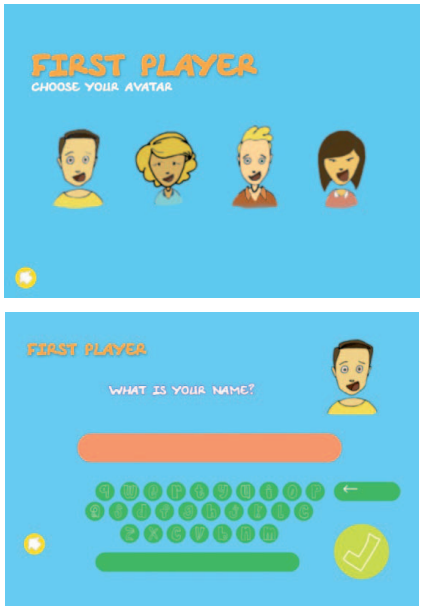

Fig. 3. The first player chooses the avatar he/she wants to play with a), writes his/her name b).

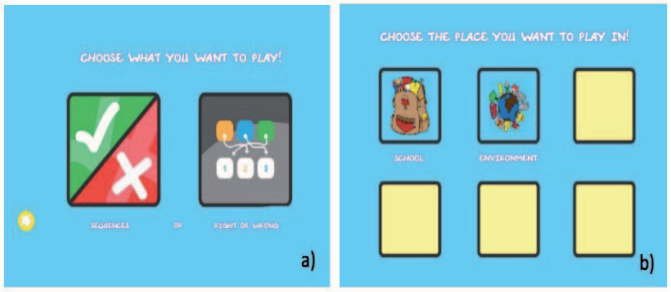

Fig. 4. Selection of the game type a) and context b).

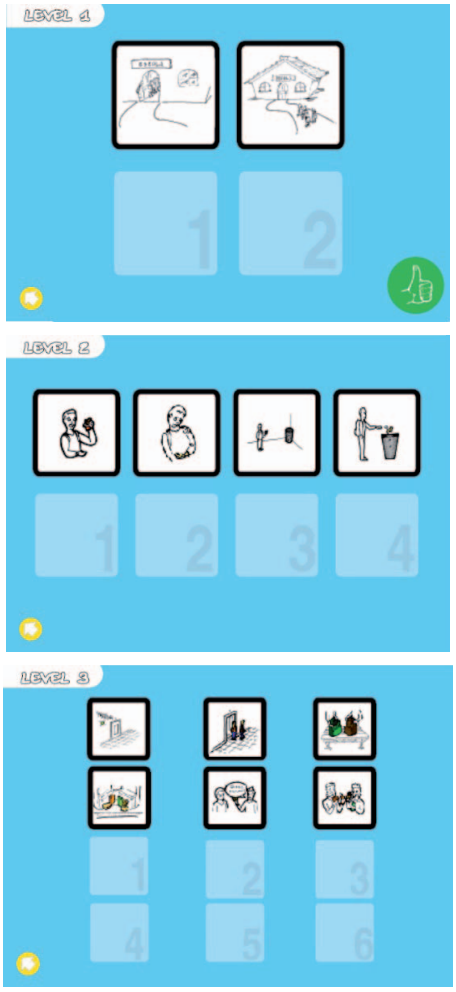

Fig. 5. Levels (1 to 3) of the Sequences Game, in the selected context.

In the Sequences Game, there are two good deeds to sequence for each level. The sequences consist of paired images, in order to make each player sort out the same number of images (due to the number of players being even). In the easiest level, there are just two pictures to be sequenced, in the intermediate level there are four images, and in the hardest level, there are six images.

As it can be seen in Fig. 5, the images appear in the first line, in a disorganized way, while in the second line several blank squares will appear (to which the players must move the correct image to organize an action). The order by which the user play, appear inside each square, represented by the Avatar, and chosen in the beginning of the game. The game only continues when both players can successfully complete the good deed.

In the Game of the Right or Wrong there are also two good deeds for each level. In the easiest level, sequences of two images appear, in the intermediate level there are sequences of four images, and in the hard level there are six images, Fig. 6.

For every good deed, two sequences of images appear: one is the right sequence, the other is the wrong sequence. The players must move the "right" and "wrong" symbols, respectively, to the orange rectangles adjacent to the sequences. The order in which each player can play is indicated by their Avatar. The game can only continue when the players identify the correct and the wrong sequences.

The game has a module that performs the *back office* operations. Through an authentication procedure provided by the administrator, it is possible to create and edit new contexts and sequences.

The administrator can access these statistics, as for example, the period of time that it took for each player to make a run, and the number of failed attempts, which allows an analysis of the evolution of the players. It is worth mention that the two contexts, Environment and School, cannot be altered.

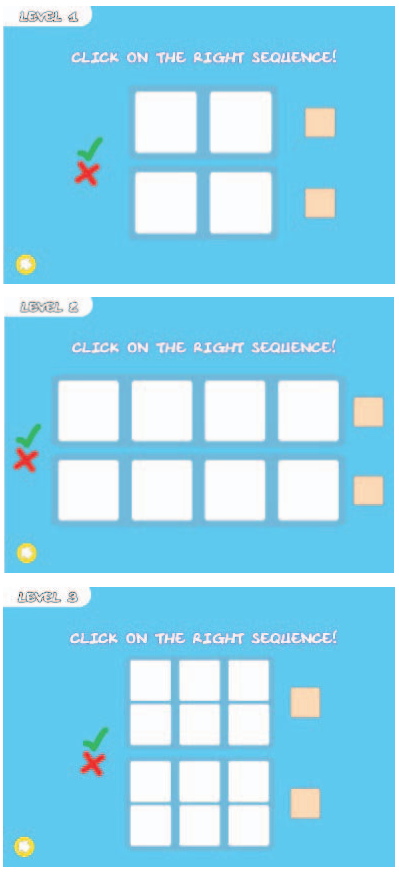

Figure 6 – Levels of the Game of the Right or Wrong, in which there will be presented both a right sequence and a wrong sequence, with images from the chosen context.

B. *Storyboard and Back office*

The storyboard [17] aims to develop the story of the game by having a sequential set of images. The storyboard for the two contexts that are available in the game were also developed.

In each context, several tasks are defined. In the level 1 of the School context, two tasks were designed: "do not scratch the tables" and "do not push". On level 2, there are the social skills "do not throw garbage on the ground" and "respect your turn". The 3rd level includes the options "sharing snacks", presented in Fig. 7, and "helping the wheelchair-bound friend".

Regarding the Environment context, two actions were defined in level 1: "helping the pregnant lady exiting the car" and "giving our seat to an elderly person on the bus". On level 2 the programed action was "recycling", that is presented in Fig. 8. Finally, in level 3, "helping an elderly person to cross the street" and "do not step on the garden" were the selected activities.

Fig. 7. Action "sharing snacks", level 3 of the School context.

Fig. 8. Action "recycle", level 2 of the Environment context.

The game contains a *back office* module for administration, Fig. 9, which allows the management of contexts and sequences, consulting statistics and designing new functions.

The administrator can check the data related to the games that were played, the duration of each game and the number of successful or unsuccessful attempts. This functionality can be useful on the critical analysis of the evolution of each player.

The objective of allowing the introduction of new games/functions is to enable an adaptation of the game to each student, depending on the specific objectives of the

intervention. The educational agent can manage the game, creating or altering contexts, levels of difficulty and sequences.

The learning method principle applied in these game is based on the "Learning-by-Doing" which is a methodology with proved efficiency [19].

Fig. 9 – Interface of the back office module.

IV. Discussion and Final Remarks

The main objective of this work was the development of a didactic game which allows the support of children with special education needs on their educational, social, and personal development processes. The platform allows the professionals to change the game, enabling the design of new contexts and respective sequences, taking the specific individualized needs of each children into account.

The ease and aptitude of the younger generation to the use of technology allows for its application on a ludic manner to teach rules, concepts and practices.

The target skills of the game were prior defined in a meeting with the research team and the teachers for special education and psychologist. During the development phase, the game was tested in laboratory by adults and children without special educational needs to validate the correct operation of the game.

As the game is particularly focused on children with special needs, further tests are necessary to evaluate the usability of the game.

In the near future work, we intend to test the game in a real school environment, with children with special education needs. With this test it will be possible to analyze the reaction of the children to the game and to study the performance of each player, as well as studying the knowledge extraction processes through data mining. Also, the addition of different activities by the teacher will be analyzed. The goal is to test if the teacher is able to include new actions in a friendly and easy way.

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