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Serious Games for Social Problems

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Abstract. Videogames have proven their usefulness in numerous fields such as education and training. This kind of videogames, usually called serious games, can also be powerful classroom tools for raising awareness about complex societal issues (e.g., gender discrimination, sex stereotypes). In this paper we describe the process followed to develop a video game to raise awareness about gender discrimination. The videogame provide students with a first-hand experience of what is feeling discrimination. With this shared experience, teachers can open a discussion on the topic in a post videogame session. We describe the first formative evaluation of the videogame with 26 users, showing some initial positive results and initial feedback to continue working to improve the videogame. Once validated the game will be accessible as open code to be freely used and even adapt and localize it to different cultures. This work will help other researchers who want to develop serious games to address social problems and also serves as an example of the usefulness of video games in addressing complex problems such as discrimination.

Keywords: Serious Games · Game Design · Awareness · Gender Discrimination · e-Learning

1 Introduction

Gender discrimination, sex discrimination or sexism refers to a set of discriminatory attitudes and behaviors focused at an individual or a group of individuals based on their gender. It is recognized not only as a serious societal problem but also as a global health issue. This type of discrimination is not only a personal belief based on individual attitudes; it is also linked to each country's culture and traditions, manifesting itself in numerous society institutions. As a result, many of these sexist behaviors have become normalized, making it a difficult problem to address [1].

This discrimination is more common in the case of women and is based on the gender roles that society has traditionally created. In many cases, it is based on sex stereotypes, where in most cultures men are more socially valued and more competent than women in a variety of activities, leaving women for secondary roles such taking care of the home and other people (e.g., kids, elderly) [1].

Sex discrimination is a complex problem prevalent across the world even if it varies greatly across continents, countries, cultures and even social environments. Many publications distinguish between hostile sexism, benevolent sexism and ambivalent sexism

[1]. But in all cases, this discrimination has serious consequences including inequality and violence. For example, in the labor market, even in the most developed countries, is reflected in the salary gap and the glass ceiling effect [2, 3]. Sexist behaviors in personal relationships are linked to couple violence (physical and psychological) [4, 5]. In education, women can be directly banned from school or discriminated when considering some disciplines such as engineering or STEM [6]. Because of these serious consequences, sexism is a global problem that must be addressed at all ages, but we consider that is especially important to create effective tools that can be used at school to educate children breaking this vicious cycle that perpetuates the problem.

Serious games are video games with an objective that goes beyond entertainment and have proven their effectiveness in very diverse fields such as research, defense, health, business and education [7, 8]. Serious games have been used before to raise awareness about social problems such as bullying and other issues related to human rights [9, 10]. Videogames have properties that make them suitable for use as powerful educational tools. Among these educationally desirable features we can find [11, 12]:

- Videogames provide a joyful experiential learning. Videogames propose challenges and conflicts that the player must overcome to advance, making the player want to improve. They also increase in difficulty giving the player the feeling of advancing.
- Videogames' feedback loop is short, the player gets an immediate response to all his actions.
- The attention span that the player keeps on the activity increases.
- Video games show the player scenarios, personalities and events based on reality.
- The player can safely place themselves in risky scenarios and allow them to explore the consequences of hazardous behaviors.

We use the features of video games to promote reflection on sex discrimination by putting players into a situation where they will feel discriminated. However, as previously stated, sexism is a very complex phenomenon that presents itself in many contexts of society and is also influenced by each country's culture and society. It is also challenging to develop resources that effectively address the issues associated with sexism because students come in with bias and prejudices that need to be addressed. Our videogame makes players experience the discrimination that a woman may face when she enters the labor market for the first time after her STEM studies.

We believe that our work will help other researchers in: designing effective serious games to address social issues; explaining the benefits of video games; and showing the applications of games in educational context. To this purpose, Sect. 2 briefly describes other video games aimed at address violence and discrimination and the design and validation processes that are usually followed when developing them. Section 3 details the developed game as well as the process carried out for it, from its design to user testing. Section 4 describes the results obtained and finally Sect. 5 discusses the conclusions obtained from this work and its limitations.

2   Related Work

In the literature we can find reference to several videogames that address gender violence or gender discrimination as a main theme. However, many of these games are no longer available and usually there is no information on how they have been developed to address their objective or evidence of their effect or shortcomings [13]. This lack of information makes it difficult to take advantage of the knowledge of these developments to create more effective educational games that address the problem from the same or new perspectives. For instance, for those videogames it is very unusual to find the game design document or the experimental design of their validation in schools and let alone that the videogames are available as open code that can be reused or adapted for a different culture or situation. This lack of information about the development or access of serious games is also common on other videogames addressing societal problems [9].

There are models, frameworks and even authoring environments that can be used to simplify the design of new serious games [14, 15]. However, these are usually too generic and it is still complex to adapt them to complex problems such as raising awareness about a societal problem. While these models have characteristics in common that can help us in the development process, we must keep in mind that there are many different game genres and mechanics available that can be used to achieve the educational objective. And not all of these can be equally effective, and they imply a wide range of development costs. This is where it becomes more important the need for accessing other serious games that allow us to compare their effectiveness on the same objective as well as information on their development and design decisions.

3   Methods

3.1   Objectives

This work has different objectives:

- To design and develop a video game to address the problem of gender discrimination by teaching the topic in the classroom.
- To provide a use case of serious games with real data for the purpose of raising awareness of gender discrimination
- To exemplify the process to develop a serious narrative game with an awareness-raising objective, highlighting the issues faced. This will help other researchers improve their serious game design and development processes.

3.2   The Game

The title of the developed game in this work is *"La Entrevista"* ("The Interview"). This serious game is a point & click game in first person and its educational purpose is to address gender discrimination. Specifically, it focuses on discrimination against a person for being a woman as this type of discrimination is considered to encourage discrimination against women. The game is aimed at players between 18 and 25 years old (although it could be used from 16 years old). It is aimed at young people of the age to enter the working world. The video game is structured in 4 distinct sections.

- The introduction. The players are informed that they have recently completed their degree and are looking for a job. The players must answer some questions based on a CV that is provided by filling out an application to look for work.
- The exploration. The players are free to explore the scenarios within the company where they must do the interview and must interact with the characters that appear.
- The interview. The players take the interview proposed as an objective from the beginning of the game.
- The reflection. The game proposes 10 questions. The players must answer why the different situations they have experienced are uncomfortable or strange. These questions are presented as a reminder of the conversations the players have had during the game.

Fig. 1. Screenshots of the game "The Interview". At the top left the players must choose the job position for which they want to do the job interview. At the top right are the cafeteria, one of the explorable areas of the game where the players must interact with some characters. Bottom left is one of the questions asked during the job interview. Finally at the bottom right is the end of the game where it is revealed that the protagonist has been playing in the skin of a woman.

The videogame provides students with a first-hand experience of what is feeling discrimination. The players play the four parts of the game as a woman character without knowing it, the game throughout the conversations gives no information about the gender of the main character (the player). The gender of the main character will be revealed once the player completes the interview, at the end of the third part of the game. The goal of hiding that all players play as female characters during the game, this aims to make all conversations seem strange and discriminatory to the players, allowing them (specially to male players) to conclude that was because they had played as female character. Figure 1 shows the current appearance of the video game.

The game objective for players is to succeed in a job selection process. But this objective is only a way to show the player situations of discrimination. Students should use the game without knowing the educational purpose to avoid being reticent to the message

or having initial biases before they experience the discriminatory situation through the game. Of course, this is not the only correct or valid way to use *"La Entrevista"* as an educational tool and the final decision always remains the teacher's.

3.3   Developing a Serious Game

Although there does not seem to be a specific model to follow for the design of serious games focused on social problems, in the literature we can find models and frameworks with common characteristics that can be useful to create our video game [16]. We will describe how the next 4 phases based on literature have been carried out: Analysis, Design, Development and Evaluation. It should be noted that although the details of the process are described as an iterative process, this is not really the case, and if necessary, it is possible to go back from one phase to any of the previous phases.

Analysis
The analysis phase consists of analyzing and selecting the characteristics of the problem to be represented and choosing the model to address it. In this phase we addressed the following items: Topic and pedagogical objective; Demographics of the players; Context of use; and Game genre.

In this case, we start from the generic topic of addressing the social problem of sexism. However, when studying the problem we found a great complexity, so it was necessary to limit the problem addressed. As a result, we decided to focus on gender discrimination in the workplace. The pedagogical goal chosen was to increase awareness about this issue by showing the players situations of discrimination in the workplace, making them think about why these situations are considered sexist. We also decided to focus the game on ages 18–25, when users can start their first job. The context of use identified was to use the game as a tool to introduce the topic of sexism in the classroom, so that the teacher can take benefit from the experience obtained by the gameplay to create a later reflection in groups.

Simulation and adventure games are the most appropriate game genres given the pedagogical objective and topic. These two game genres allow the design and use of characters that the player can relate to and perceive reality through. However, considering the cost of development, the existing tools and the knowledge of the development team, we chose the point & click adventure game genre. This choice allows us not only to show a reality but also to focus on the dialogues and reduce costs by allowing us to make a simpler game where not all the real options are represented.

Design
The design phase includes the choice of the characteristics that the game will have (game mechanics, the desired user experience, main events, characters, scenarios, etc.). This design was carried out taking into account the characteristics decided in the analysis phase such as the game context, the age of the players, the game genre and the pedagogical objective. In this phase, the following items were specified: Story, Scenarios and Characters; Game and Learning Mechanics; Dialogs and Graphic Design.

To adapt the videogame to the game genre and the pedagogical objective, we decided that during the game story, the player would put himself in the shoes of a person who has

just finished his career and must make his first job interview, giving the player the goal of passing the interview. To choose the situations of discrimination that the game would show, we interviewed 10 people, 8 girls and 2 boys, with engineering and mathematics studies with jobs in technology companies. In these interviews these people were asked about situations of sexism they had experienced. With the events chosen to be shown in the game we identified the need for 7 different scenarios and 11 characters.

Among the mechanics to be implemented, those generic of the point & click adventure game genre were chosen, such as dialogues and exploration of the scenarios. To achieve a greater immersion of the player, we decided that the character would be in first person, being what the computer screen shows what the character sees in the game. However, as part of the learning design, the character played by the player is a girl and this is not mentioned until the end of the game. The main character uses a name that can be used by both boys and girls (Alex) and no dialogue uses adjectives that might give clues as to the gender of the character being played. With this decision we want to get the immersion of the player regardless of their gender, but also, in the case of a male player we want the situations to look weird and at the end of the game when the gender of the protagonist is discovered.

Also, at the end of the main story, we designed a section with question-answer mechanic to promote the players' thinking about the sexist situations shown in the game. In this section the player must revive some key conversations and indicate why they are weird, the player has 3 answer options of which only one is correct.

On the other hand, to avoid the monotony of the dialogues, two other mechanics were selected. One of them is the decision making, giving the player the opportunity to answer in different ways in the dialogues and having (limited) effect on them. The other mechanic is to give the main character a curriculum that the player can access during the game, in this way the player must answer the interview questions according to this curriculum trying to tell his experience as best as possible to succeed in the interview.

Development

The development phase consists of the creation of the video game itself, keeping in mind the game platform, the technical needs of the design, the development cost, the development time available and the experience of the developers.

For the development of this game we used the *uAdventure* authoring tool, which allows us to create simple narrative games in a fast way, providing facilities for the next phase of evaluation [17]. In addition, *uAdventure* allows us to export the game for Windows and Linux devices, in a portable version with which the games do not need to be installed. This allows us to deploy the game in most of schools.

Evaluation

The evaluation phase consists of performing the necessary tests on the developed game to check its adequacy with the design and the pedagogical objective. This phase is very important, since it is difficult for a first version of the game to fulfill all the requirements. There may be missing requirements in the design, the players' experience with the game may not be the expected, or some mechanics may go against the educational objective. For this reason, it is important that from the first playable prototype, tests are carried out

with experts and with users with the demographics as close as possible to those of the end users.

To carry out this evaluation, we must first define the information we want to obtain and then choose the game variables with which to obtain this information. In addition, it is necessary to define how the data will be collected and stored, paying attention to the applicable data protection regulation as well as the technological standards used to deploy the game and collect/send data.

In our case, the *uAdventure* tool integrates interaction data collection, using the xAPI format and sending data anonymized by a set of random characters by user [17]. Although the information to be obtained and the variables needed should be identified prior to testing, it is recommended that the game collect information from all interactions, whether the need for them has been identified.

In order to evaluate the game, we are interested in information about if:

- Players read the dialogues. We can obtain this information by measuring the time that runs between the time a dialog appears and disappears. Too long times may indicate that the player is distracted or bored while too short times will indicate that the player is not reading.
- Players have any difficulties with any part of the game. Repetition of the same interaction or a set of interactions may indicate that the player is having trouble making progress.
- The playing time is adequate. We can measure the time that has passed between the first interaction and the last interaction. Since the game is intended to be utilized in a classroom session, we do not want the game time to be excessively long.
- There are differences in responses to game dialogues in different groups of users (boys, girls, by age, etc.). We need to collect the age and gender of each player through an external questionnaire, so we can compare the decisions made in each dialogue according to the gender of the players and their age.
- The game succeeds in making players think. In this case we can know if the player identifies sexist events through the final questions of the game, but we will also need an external questionnaire. The goal is to verify that the game design is right and that the pedagogical objective is fulfilled.
- Education professionals see the game as an appropriate educational tool to use in their classrooms. We need an external questionnaire. As in the previous point, we must evaluate that the game is pedagogically right, regardless of the fact that professionals in the field have been involved in the design of the game.
- General opinion. We are interested to know if players like the game, and if they find it entertaining or interesting. Although the data on playing time, completion and inactivity time can give us a hint, it is recommended to carry out a questionnaire.

3.4 First Evaluation

To analyze the items mentioned in the previous section (gameplay time, game issues, behavior, etc.), we carried out two evaluations after the development process of the videogame. The purpose of these evaluations is to assess the game design.

On the one hand we want to check if the users find it attractive as a videogame; if the game meets the pedagogical objective, i.e. if there is any change in the player's perception of gender discrimination; and finally if the developed video game is an applicable tool in the classroom. Taking into account that the game is currently in its first stable version after an internal evaluation, we hope to get feedback with which to improve the game for its final release as a free educational tool.

The first evaluation was carried out with 22 students, between 18 and 25 years old, at the art and design school in Rubí, Barcelona. This evaluation was carried out without any researcher in the room, with the official teacher of the class in charge of deploying the game and conducting a discussion session. In addition to the remotely collected data, the teacher was interviewed for a postmortem. The second evaluation was carried out with 1 professor and 6 students from the Faculty of Education of the Complutense University of Madrid. The 6 students were in their final year of the Master's Degree in Teaching and with stable job or internship.

The structure of both evaluations was as follows:

- Pre-test. Participants are asked to fill out an initial survey which asks about: gender, age, use of video games, household activity, gender most adequate for certain activities, friendship with minorities according to their gender or sexuality, knowledge about friends who have been victims of discrimination because of their sex, and opinion on whether it is necessary to educate about sexism, sexual orientation.
- Gameplay. Participants play the videogame *"La Entrevista"*.
- Post-test. Participants are asked to fill out a second questionnaire asking again about: the gender most appropriate for some activities, friendships that have been discriminated against because of their sex and the need to educate about sexism and sexuality. Finally, they are also asked for their opinion about the video game and if it has made them reflect on any particular topic.
- Discussion session. A class debate is carried out on gender discrimination where the participants can give their opinion about their experience and/or the one lived during the game.

4   Results

A first analysis of the data of the evaluation shows that *"La Entrevista"* makes players reflect. Comments also show that the game can be a good educational tool to use in the classroom as a base for addressing the problem of gender discrimination. Some of the results obtained in the first evaluation with real users are shown below.

In the Ruby experiment, 22 people participated (13 girls and 9 boys, with an average age of 18.4) but 3 people did not complete the second questionnaire.

The data show a change in players' responses to common questions in pre-post questionnaires. The mean time of gameplay was 26.1 min (STD = 4.71; Min = 16.2; Max = 34.6) and only one player, who filled out the final questionnaire, did not complete the game. In the question "Who is best at… ?", there was an increase in the percentage of players who responded that it was independent of gender (Fig. 2).

In question "Do you have friends who have been discriminated against based on their gender?" 59% of people answered yes at pre-test but 74% said yes at post-test.

Regarding the players' opinion, 89% of the players made positive comments about the game, complimenting things such as: the playability, the possibility of being able to always have multiple response options and the way the game deals with the issue of sexism. 58% of the players indicated that it had made them reflect, 11% said they were already aware of the problems represented by the game and 32% answered that the game had not made them reflect. Finally, some players highlighted the need to improve some of the character animations as well as the interface, showing more clearly which character is speaking at any given moment.

During the final interview of the experience, the teacher of the school pointed out that the experience had been very interesting and enriching for the class, giving place to a later discussion about how society can discriminate against people without being aware of it.
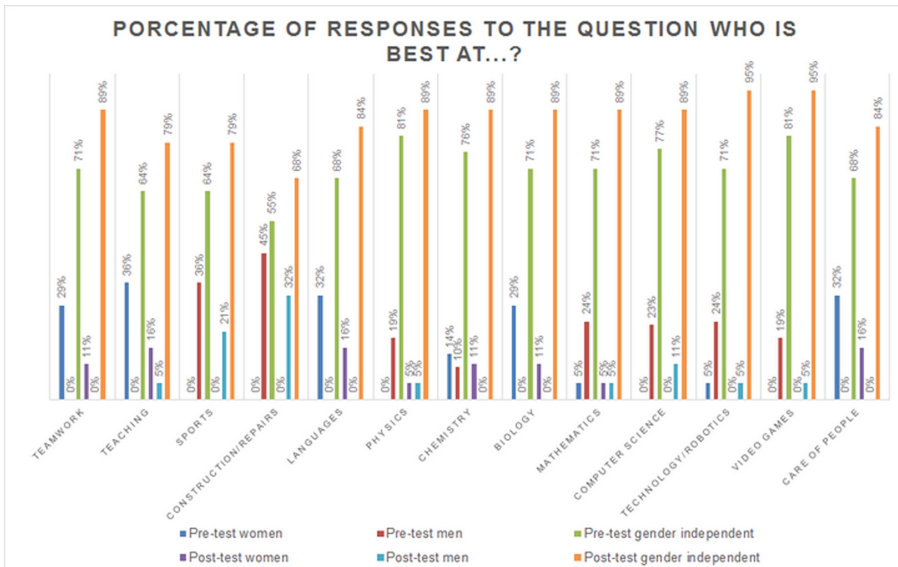

Fig. 2. Results to the question "Who is best at X?" where X is different types of activity.

At the second evaluation, 7 people participated, 2 men and 5 women with an average age of 32.1. The mean time of gameplay was 23.0 min (STD $= 3.60$; Min $= 17.16$; Max $= 28.2$). In this experiment there is no significant difference between pre-post responses. In terms of opinions, 2 of the players highlighted that the game made them feel too long and 2 others that they felt lost in the game. However, all of them positively valued the video game and highlighted the design and the way of addressing the sexism in the game. Finally, only one of the players said that the game did not make him think.

5   Conclusions

Videogames have proven to be an effective and powerful educational tool in different domains. Not only can they be used to teach knowledge or train skills, they can also be

used to address societal problems raising awareness about these issues. But developing video games is still complex and expensive because it requires time and multidisciplinary expertise (developers, education experts, graphic designers, animators). However, we can find tools and models that facilitate its development. On the one hand, using authoring tools can allow us to work with less technical profiles or with less human resources. On the other hand, having previously proved game design models and additional in-depth case studies upon which to base our design enables us to systematize the development process, producing more effective games from the start.

We develop the video game "*La Entrevista*", which aims to address the problem of sexism. This videogame is designed as a teacher companion tool that would provide a first-hand sex discrimination common experience to all the students on which the teacher can built upon a deeper discussion with their students on this complex topic. As a result, we have obtained a 25-min video game and its first formative evaluation with 26 users. This initial data shows the usefulness as an educational tool, promising initial results on its effectiveness and has obtained positive comments from the players. From this formative evaluation we have also obtained feedback that will help us to further improve the game. And we want to continue to collect data that will allow us to better understand the effects of the game.

In this publication we also describe the steps followed for the development of "*La Entrevista*" game following a 4-phase model based on the literature. In the analysis phase, it is necessary to understand the problem to be addressed and to study which game genre is best suited to the educational objective to be achieved. In the design phase, the mechanics and other features of the game should be defined with the educational objective in mind. In the case of an awareness game where a social problem is to be addressed, it is important to represent the problem realistically. Dialogues, exploration and decision making are ideal mechanics for this type of educational objective. However, it is important to combine it with more dynamic game mechanics and/or challenges so that the player does not get bored. It is important to keep the player's attention without overwhelming him with too much text for too long. In the development phase, it is important to take into account the human resources budget and technical knowledge available. Choosing authoring tools or game editors can help reduce the cost and time of development. One option may be to create a more limited first prototype using this type of tools to make an early design validation, before to carry out with the final development. This evaluation phase is important to know the game's effectiveness. It helps us to gain insight about if the game duration is adequate to the context in which we want to use it; to know if the game keeps the players engaged during all gameplay; to know if the educational experts accept it as an educational tool they are willing to use in their classes; or to know if the game has the desired effect on the players.

However, this is still a single case study and we consider that it is important to continue studying the use of video games to address social problems. Since these problems are very complex and it is difficult to address all their characteristics with a single video game. In this work we have focused on sexism in the workplace, but there are many other areas where this problem occurs (within the couple, language, education, institutions, and law). And it is also necessary to study what types of games are most effective at different ages.

In addition, we consider that it is necessary to provide more information about serious games to improve the research and application of these games in education. For instance, making videogames free open code and publishing the design process and the game design documents will help to create better video games in a more efficient way. This type of work serves as a reference of the do's and don'ts when developing a serious game. It is also important that these games that are developed are shared openly and freely once they are finished, allowing other researchers to compare video games with the same characteristics or by replaying tests. Giving access to these video games allows other researchers to translate the game and use it in other countries to compare effectiveness according to other cultures.

As future work, we will continue to improve the game with the comments received in this first evaluation. The collection of more data will allow us to compare the effectiveness of the game in men and women, and to study if it is effective in the whole age range targeted. And once a summative evaluation has been carried out, we will proceed to publish the video game, free, on the research group's website.

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