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# Applicability of a cyberbullying videogame as a teacher tool: comparing teachers and educational sciences students

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**ABSTRACT** *Conectado* is a serious game designed to increase the awareness of young people on bullying and cyberbullying in schools. It is designed as an educational tool for teachers, to be used in classrooms with their students to provide a common experience in class about bullying and cyberbullying. Playing the game, students are placed in the role of victims, making them reflect on the problems, consequences, and strategies that do and do not work. Additionally, by making students role-play as victims, the game increases empathy with actual victims. After a game-play session, teachers can start an open conversation about bullying and cyberbullying with students, based on their shared in-game experiences. Since the game is designed to be used in the classroom as an educational tool, it is not only important that it is effective, but also that current and future educators find it potentially applicable to their classrooms. This article presents the results of how the serious game *Conectado*, previously validated with students, has been tested with 93 actual teachers in 8 schools; and with 113 educational sciences students in 2 university centres. *Conectado* has been well accepted, and both teachers and students of educational sciences see it as a useful tool for classroom use, which can help to promote empathy with victims and raise bullying awareness among their students.

**INDEX TERMS** serious games, bullying, cyberbullying, game-based learning.

## I. INTRODUCTION

An increasing number of schools have classrooms equipped with computers, tablets, whiteboards and/or other electronic devices that are used by teachers in their lessons. Along with these new devices there is an increase in the use of new educational media (e.g., videos, interactive presentations, virtual classrooms), and even in the use of educational games (a.k.a. serious games) in the classroom to provide a more interactive and authentic learning [1]. Serious games have been effectively used in different domains such as medicine [2], [3] or business education [4]; and for different purposes [5], such as increasing knowledge [6] or changing user attitudes [7]. Serious games can provide authentic learning environments that help to break the student 10-minute limit of attention to traditional lectures [8], while providing immersion, and a free and safe exploration of simulated domains where students can test and apply their knowledge, and can experience the results of their actions with very short feedback cycles [9], [10]. However, use of serious games is

still not generalized [11], due to a wide variety of problems [12], [13], including among others, the following issues:

1. Lack of scientifically validated serious games aligned with the curriculum, or that fit in the allotted times for lessons.
2. Use of new technologies that teachers do not master or feel at ease with, and of time to train those teachers to familiarize them with use of video games.
3. Shortage of devices, as many institutions do not have enough computers or tablets to provide one per student in the class.
4. Game deployment issues, including platform compatibility, network issues, and the complexity of installing and maintaining the games at the classroom.

On one hand, many of these issues are technical, and can be addressed by improving the infrastructure and its maintenance, making the use of games more straightforward for teachers. Nevertheless, teachers also need to be better trained in the use of technologies, instead of relying on self-

training, to make them feel more comfortable not only to use technology more effectively in their classrooms, but also to gain a greater sense of agency while doing so. Increasing numbers of subjects and specializations within educational sciences studies already cover the use of new technologies within the classroom, for example as part of teaching methods, virtual classrooms, or even serious games [14]. On the other hand, regarding the topics addressed by the games and their applicability to classrooms, while there are a significant number of educational games focused on specific domains (e.g. physics), the number of serious games that focus on social problems to raise awareness is still very limited when compared to these. Games can be especially helpful to address social problems, as they allow students to better understand a problem by actively experiencing stressful situations within the safe game environment. For example, [15] can help players to have a better idea about the extreme difficulties of life in a refugee camp. By having to make in-game decisions to deal with the problems that arise from such situations, and then experiencing the consequences of those in-game decisions, students playing serious games are both immersed and engaged, and afterwards exhibit greater empathy towards those that suffer similar problems in real life [16].

This paper focuses on the use of a serious game to address peer aggression in school (i.e. bullying, cyberbullying), a serious social problem. Bullying is a global problem [17] that has historically been frequently and wrongly considered as a normal rite of passage for children and adolescents [18]. It was not until the 1990s that bullying began to be considered as a serious risk to the mental and physical health of young people [19]. Now, bullying is globally recognised as a serious problem due to its high impact and long-term effects on the life of the victims [20]. Among its most common effects, there are problems associated with attention, behaviour and emotional regulation, which can not only interfere with students' ability to learn and adapt in schools [21]–[23] but also with students' life, as both psychological disorders and even suicides have been documented [24].

With the generalization of new technologies in our society, the pervasive use of mobile devices and social networks, and the early age at which young people begin to use these technologies, other form of harassment has emerged, termed cyberbullying: “repeated verbal or psychological harassment carried out by an individual or a group against others through online services and mobile phones or bullying taking place on the internet” [25]. This phenomenon is even more complex because it makes young people vulnerable both at school and at home, especially because they are not fully aware of the effects and consequences that may be triggered by their online actions [26]. Cyberbullying can occur at any time, and the consequences for victims are just as serious and important as for victims of traditional bullying [21]. It should not be forgotten that both bullying and cyberbullying are universal problems which affect all countries to a greater or

lesser extent, regardless of the culture and country of origin of victims and aggressors [17].

Conectado is a videogame developed within the e-UCM Research Group, designed to increase awareness on bullying and cyberbullying in schools among young people between 12 and 17 years old. The game itself has been tested in actual classroom settings and initially validated through experiments with students [27]. However, the game is not intended to be used in isolation. Instead, it has been designed as an educational tool to help teachers: once students have played Conectado, teachers can conduct a controlled discussion with their students based on the experience they have just shared. To ensure Conectado's fitness as a classroom tool that elicits productive discussion, the acceptance and feedback from teachers who would use it is a vital second half of the validation.

This work presents the results of evaluating Conectado through different experiments with actual full-time teachers and with students pursuing degrees in educational sciences. The goal is to evaluate the complexity and the perceived usefulness, for both current and future teachers, of applying the game and using it in class as a tool to create a fruitful discussion based on a common game experience. In general, current teachers, who have been teaching with traditional materials for years, can be expected to be less technologically up-to-date than aspiring teachers. Using both groups in experiments provides a greater robustness to our results, and partially accounts for the rapid pace of technological change.

The rest of this paper is structured as follows: Section 2 details the methods and materials used in this study. Results of the analysis of the data collected with both teachers and students of educational science studies are presented in Section 3. Finally, Section 4 summarizes the main conclusions of the work, and describes future lines of work.

## II. METHODS AND MATERIALS

The *Conectado* game has been deployed in 8 different schools with at least one researcher present in every session. Experimental sessions have also been carried out with teachers and students of educational sciences, to test whether the game is perceived as applicable by current and future educational professionals and whether they see it as a useful and practical tool; and to study possible differences between these two groups.

This game was previously tested only with students to validate that it increases student awareness and that they consider it as a game. Results with 250 students showed, on a 7-point scale of cyberbullying awareness, an increase statistically significant of 0.66 points between a 5.72 point average on the initial questionnaire (pre-test) and a 6.38 point average on the final questionnaire (post-test), answered immediately after having played the video game [27]. The effect was also found to be significant for each gender, and when considering each school in isolation, even if those schools had previously carried out one or more awareness-

raising actions on bullying (e.g. with the collaboration of the police).

In this article, we focus on the experiments and results obtained in the sessions carried out with 206 users, 93 of them in-service teachers and 113 educational sciences students (ESS). The 93 teachers are a representative sample from 8 schools all around Spain both in large cities and in rural areas, which in turn are representative of the actual mix of private, charter and public schools found in Spain [28]. Educational sciences students are from 2 different educational centres in Madrid: Complutense University and Escuni. All sessions, both with teachers and ESS, lasted one and a half hours, and were composed of the following activities:

1. Pre-test: the initial questionnaire that users were asked to complete before the start of the game, containing questions to assess cyberbullying awareness.
2. Game session: users played the game *Conectado* for about 40 minutes, or until completing the game.
3. Post-test: after playing the game users were asked to fill out a questionnaire, assessing post-game cyberbullying awareness, their use of social networks, their opinion of the game, and what they consider they have learned.
4. Applicability Questionnaire: users completed this questionnaire to evaluate the degree to which they find the game useful, applicable in their classes, and to which extent they would use it with their students.
5. Discussion: for half an hour, users and the researcher in charge of the experiments talked about the game, its design decisions and what each part of the game represents; as well as how teachers can use the common experience it builds with players as a starting point for a more in-depth discussion about bullying and cyberbullying in schools.

Activities 1-3 overlap with the previous experiment to validate the applicability of the game with actual K-12 students. This allows teachers to know exactly what their students are going to do, since in the schools where the game was used, sessions were also held with young people to collect data to assess the game's effectiveness for students. Activities 4 and 5 were specifically designed for the experiment that is presented in this paper.

The common part of the pre- and post-test is a set of 18 statements that were adapted from other questionnaires, including CUVE3 [29], ECIP-Q [30], EBIP-Q [30] and the Cyberbullying Test [31], which are used to assess violence and different types of bullying and cyberbullying within schools. These pre-existing tests have been previously validated both for bullying and cyberbullying with students in the target age-groups in Spain. Users indicate their level of agreement with the different statements using a 7-point

Likert scale, with 1 being the lowest agreement and 7 the highest agreement. The 18 statements have one of the following forms:

- X action is bullying.
- Y action is cyberbullying.

The effect of the game on players is measured by comparing the mean of the 18 responses in the pre-test with the mean of the responses in the post-test. On the post-test part, the Test of Cyberbullying is only relevant for the students, but was also included in these experiments so teachers and ESS could see the exact pre-test and post-test that their students would fill in. The questions on social networks are intended to study whether differences in awareness are related to social network use.

In these experiments, the Applicability Questionnaire is the new and essential part, as we want to know if education professionals perceive the game as a useful tool for their classrooms. This questionnaire focuses on the opinion of the videogame as a tool and its applicability. The questionnaire's 6 questions were answered on a 4-value scale, with 1=Yes; 2=Maybe; 3=Not usually; and 4=No:

- Q1. Do you think this game is applicable in classrooms to raise awareness about bullying in school?
- Q2. Would you use this game in your classroom?
- Q3. Would you use other video games in your classroom?
- Q4. Do you see the game as an effective tool to motivate a guided discussion in class?
- Q5. Do you think the game gives students a realistic view of bullying and cyberbullying?
- Q6. Do you think that students who are bullied can identify with the main character?

Additionally, there were 5 open-ended questions:

- Q7. How do you think that this game can improve classes?
- Q8. What would you change and/or improve in the game to improve its use as an educational tool for classrooms?
- Q9. What do you think of this video game?
- Q10. What did you like best about this videogame and why?
- Q11. What did you like the least and why?

Q1, Q4 and Q6 focus on whether the user considers the game to be useful and applicable in the classroom, as a tool to help teachers deal with the problem of bullying. Q2 and Q3 are designed to find out if users would use the game in classroom, and their general stance on using games in school. These two questions check if users would use *Conectado* in class, but not other games; or vice-versa. Q5 is intended to find out if participants consider the events depicted in the game to be both plausible and realistically described.

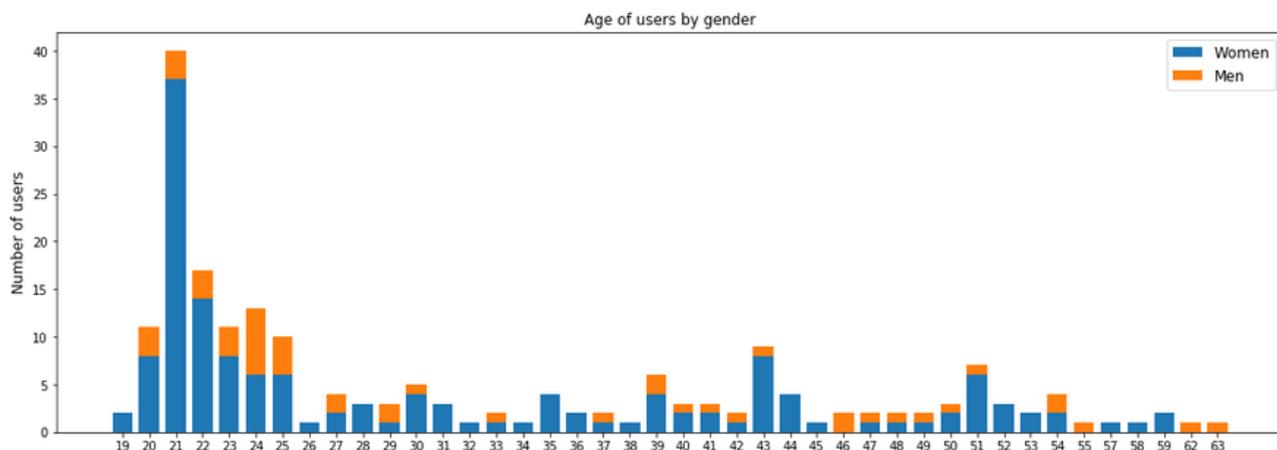


FIGURE 1. Age of users by gender.

The open-ended questions part of the questionnaire focuses on how professionals would use the game as a tool in their classrooms. It therefore explores how they think that it can be useful, and whether there is something about the game that they would change or improve. To avoid influencing the views reflected in the questionnaires, participants in these experiments (both teachers and education science students) were minimally briefed on the exact nature and goals of *Conectado*, and were asked not to talk with each other about their experiences until after completing the game and feedback questionnaires.

Finally, once the questionnaires had been completed, a discussion was held with all participants. In this discussion, the researcher explained how the game is intended to be used in class, the intended meaning of some of the events that occur in the game, and how the shared experience was intended to elicit in-class discussions for the students to participate in.

The videogame includes a game analytics module that tracks player actions inside the game. All in-game user interactions are captured, anonymized and sent as traces to a game analytics server. Those traces are used to build a real-time dashboard that displays the number of active players, how long they have been playing, what part of the game they are in, and their friendship level with the characters of the game, among other visualizations [32]. Interaction data allows us to check that the users have actually played the game, and are later analysed further, to look for relationships between in-game interactions and questionnaires responses. This is possible because both interactions and the responses to the questionnaires, while anonymous, are related to each other with unique 4-character identifiers, which are randomly generated and handed out to participants at the start of the experiment; with the request that they use the same identifier in all their questionnaires and play-throughs. All high schools and the two educational centres have signed the corresponding informed-consent forms, which specified that

all collected data would be pseudonymized and not traceable back to individual students.

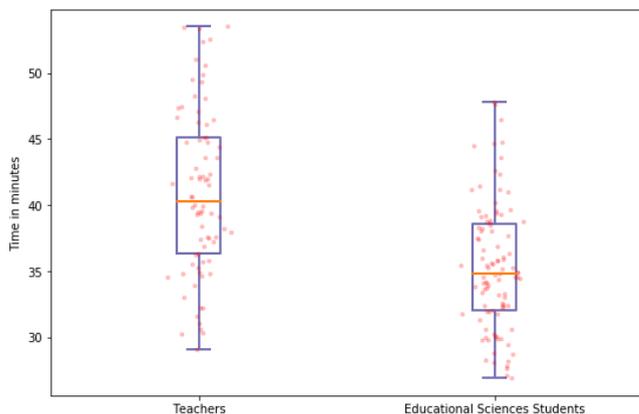
Based on questionnaire responses and player interaction data, we want to test the following hypotheses:

- H1: Players can finish the game without getting stuck, and within 50 minutes.
- H2: There is no variation in awareness between before and after playing.
- H3: *Conectado* is seen as a useful and applicable tool in a class.

We chose a single group pre- and post-test design without a control group over other alternatives for several reasons:

1. Choice of control treatment: participating schools used other resources and prevention programs such as mentors and professional talks (e.g. police program). Finding an additional resource to use as a control which would be both comparable to *Conectado* and new to all centres would have been extremely difficult.
2. Feasibility: finding educational centres that agree to participate is already difficult, as schools must modify their planning accordingly, and not all of them have the required infrastructure for deployment to perform the tests. Requesting additional teacher time and resources to accommodate a control would have made it harder to find participants.
3. Cost/benefit analysis for schools: participating schools expressed interest in having a maximum number of teachers receiving the training with the game, in order to be able to use it in their classes.

To address the effect of questions on participants' perceptions and responses (test effects), we added additional indicators, and compared related responses in different parts of the questionnaires. In particular, in the open-ended questions part of the post-test, a question asks players whether they considered that they had learned anything by playing. Answers to this question were compared with the increase in awareness as assessed by the pre-post. The open-ended questions on applicability were also analysed to be contrasted with the applicability questionnaire.

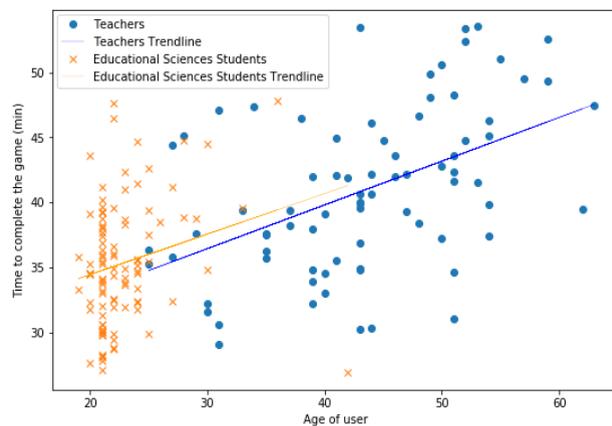


**FIGURE 2. Time to complete game by users' profile.**

### III. RESULTS

The main goal of the experiments with educational sciences students (ESS) and with actual in-service school teachers is to verify that the game is applicable in class by a teacher, that it is both easy and useful to do so, and that it is perceived as such. Using both in-service teachers and the ESS that will be the next teachers-in-training tests whether these requirements are met, both for the current generation of teachers and for the next one. Due to quick technological changes, we expect a different technology literacy and adoption between both participant profiles, particularly in relation to social networks and games. In this section, we describe the results obtained from the questionnaires carried out during the experiments. The results are evaluated both globally and segmented by age and profile to locate and analyse possible differences.

A total of 206 people participated in these sessions, of whom 93 were teachers and 113 were ESS. 8 teachers have been excluded from this data set as they did not send any of the questionnaires; and the server did not receive any interaction traces from 1 teacher and 9 ESS, indicating either that these 10 users did not actually play the game or a network problem. Therefore, the total sample is composed of 188 users, with 84 teachers and 104 ESS. A total of 76.6% were women and 23.4% were men, which is in line with



**FIGURE 3. Time to complete game vs participant age**

observed gender distributions in Spanish education [33], where ~70% of in Secondary Education teachers are women. Figure 1 depicts the distribution of age and gender of all users.

#### A. TIME AND COMPLETION

To allow teachers to adequately use the game in class, it is important that the length of the game is adequate and that teachers can complete it without problems, so that they can help students who may get stuck. If teachers do not understand their tools, they will not be able to use them effectively or be able to help students to so.

Of the 188 users, only 4 (3 teachers and 1 ESS) failed to finish the game in less than one hour. Analysing completion times, we find that the average time spent by the teachers in finishing the game was 43.23 minutes (SD = 6.25 minutes) while the ESS average time was 34.65 minutes (SD = 4.73 minutes.) The distribution of times according to user profile can be seen in Figure 2. Analysing these times by age, we can see that age strongly influences the time it takes to complete the game, and in general the older the player, the longer the time to finish (see Figure 3).

Only 7 of the players took more than 50 minutes to finish, and most of the 124 players took less than 40 minutes. That is, 87% of the teachers and ESS managed to complete the game without problems in less time than the typical duration

**TABLE 1**  
Results of pre and post by type of user

	Number of users	Pre-test		Post-test	
		Mean	SD	Mean	SD
All Users	188	6.28	1.10	6.72	0.72
Educational Sciences Students	104	6.28	1.16	6.76	0.75
Teachers	84	6.28	1.02	6.68	0.68

of a class in Spain. The outlier in Figure 3 corresponds to a very fast 42-year-old user, which finished the game in under 30 minutes. According to the data, H1 is therefore satisfied: players in general have been able to complete the game without complications within the time class of 50 minutes.

In addition, both variables (age and duration) follow a normal distribution; and a t-student significance test shows that both variables are dependent with  $p < 0.01$ .

### B. AWARENESS

Teachers and ESS filled out the same pre- and post-test questionnaires that their students would be asked to fill in if the game were to be applied in their classrooms. Although the main goal of these sessions was not to check if there was a change in awareness, our data found such a change. Results show an increase of 0.44 points over 7, where 6.28 (SD = 1.10) points were obtained in the initial questionnaire and 6.72 (SD = 0.72) points in the final questionnaire, after having played the video game. There are no significant differences between teachers and ESS (see Table 1). H2 is therefore not satisfied: contrary to what we expected, the game creates a positive change in awareness in both teachers and ESS.

We have looked for the explanation of this fact in the post-test question “Do you think you have learned anything?” to check whether this observation could be due to the test itself. Answers to this question suggest that the increase is due to the video game, which gives users a new perspective of bullying cases that can happen in schools, and helps them to empathize with the victims who suffer mainly insults or discrimination: 60% of all users answer the question by stating that the game has taught them something. 27% leave the answer blank, and only 13% say they do not know or that they have not learned anything. About 30% of affirmative answers say that the game has made them understand victims better, think about bullying cases and their consequences, and that they are more aware of the issue after playing the game. 21% say that the game has made them see how actions they did not think could have serious consequences could, on the

contrary, greatly affect people. Another repeated answer is that users consider that they have learned a new tool to use with the students to prevent bullying (9.5%), and that they have learned how video games can be very useful tools when dealing with important issues such as social problems (8.6%).

### C. APPLICABILITY

Once it has been proven that the game fulfilled its main goal of increasing awareness with both in-service teachers and ESS, and not only with secondary school students, as shown in a previous study [34], it is important to check that the educators who will be in charge of applying it in class perceive it as a useful tool, which they will be able to use with their students.

Regarding their opinion of the videogame and its applicability, there are few differences between both participant profiles. The clear majority of participants see the game as a useful tool that can be applied in class, and answered that it satisfies the goal of being a tool that promotes a discussion in class based on the common experience of players. Both teachers and ESS see the game as a tool that depicts a reality, and think that its players can readily identify themselves with the different characters of the game.

Table 2 shows that there are very few negative responses to the game. Q3 “Would you apply other video games in your class?” is the question that has received the least number of “yes” answers. This further highlights the good results of the game, as users are generally willing to apply *Conectado* in class but not so much other types of games. This result is in line with the issues hinders the adoption of serious games in general: lack of validation and alignment with the curriculum; and difficulty for teachers of using technologies that they do not master. Therefore, providing teachers and ESS validated serious games, and offering them a chance to explore them first-hand can clearly change their perceptions on using serious games.

TABLE 2  
Responses to Applicability Questionnaire

Response	Q1		Q2		Q3		Q4		Q5		Q6	
	TEA	ESS										
Yes	78.6	89.4	77.4	86.5	57.1	59.6	89.3	85.6	71.4	80.8	83.3	92.3
Maybe	20.2	9.6	19.0	12.5	29.8	37.5	9.5	14.4	28.6	18.3	16.7	6.7
Not usually	1.2	0.0	2.4	1.0	13.1	2.9	1.2	0.0	0.0	0.0	0.0	0.0
No	0.0	1.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.0

\*TEA = % of responses from teachers

\*ESS = % of responses from educational sciences students

#### D. ACCEPTANCE

Regarding acceptance, the results are quite positive. The free-text comments of most users exhibit a high acceptance of the *Conectado* videogame as an educational tool, although users also provide many responses suggesting ways to further improve the game (e.g. including new cyberbullying situations). These free questions were also used to contrast the previous responses to the questions regarding the applicability of the game.

Comments to questions Q7 and Q9 have been manually coded prior to analysis. First, two of the authors independently coded all responses using binary labels (each answer could be coded with any number of labels). Once labelled, both codings were compared measuring agreement for each of the 3 questions using the average of the Jaccard Index over all responses, and reclassified until a similarity of over 90% was achieved. Once this process was completed, the first author’s coding was used for all subsequent analyses. The results of this coding can be seen in Table 3 and Table 4.

The other questions (Q10 and Q11) asked for feedback on what participants liked, and what they would change or improve. Among the things most liked by players of the game is the decision of having the protagonist be the victim. On the other hand, many complained regarding the small role played by the teacher avatar in the video game. Among responses to Q8, there are several users that propose creating a game mode in which the teacher can use the game with the whole class, instead students playing it on lab computers or their own devices. This would allow actions within the game to be commented by the whole class while playing. Still others mention that it would be good to have a game mode in

which the user is a witness, instead of the victim. As seen in Table 3, most of the comments highlighted the usefulness of the game to put the player in the shoes of the victims of harassment, to understand how they might feel and to raise awareness and make the player reflect about the problems of bullying and cyberbullying and their consequences. Another of the most common answers is that the game is useful to encourage the victims to ask for help talking about their problem with other (e.g. parents, teachers). There has only been a negative response from a teacher that did not agree, as a matter of principle, with the use of games as an educational tool. Only 3.9% of users left Q7 blank. Somewhat surprisingly, ESS mention more often than in-service teachers that the game generates empathy and that it can promote that victims ask for help after playing it. All these answers concur with the results obtained with the previous questions evaluated on a 4-value scale, where about 80% of participants answered that they would use the *Conectado* game in their classes and that they found it applicable and useful. Table 4 shows the comments regarding opinion about the video game. Most comments (84.5%) were positive and only 5.8% of participants did not respond. The most repeated comment highlights the usefulness and usability of the game as well as its possibilities to raise awareness and make players think about harassment. Although it should be noted that in these answers there is a big difference between teachers and ESS since most of these comments come from ESS.

While general acceptance has been high, we can observe that the game has been more popular with ESS. The results can be explained by the age of the players and their

TABLE 3  
Responses to Q7 “How do you think play in class can help?”

Label	Meaning	ALL	TEA	ESS
Nega	Negative opinion: participant does not find the game useful	0.5	1.1	0.0
Empa	The game successfully promotes empathy with the victim	31.6	25.0	35.4
Real	The game is realistic in terms of events and its portrayal of bullying	9.7	9.8	9.7
Refl	The game helps to raise awareness and make the player think.	31.1	32.6	30.1
Help	The game shows the importance of asking for help and helping victims.	13.6	15.2	12.4
Iden	The game makes players feel identified as victims, observers or aggressors.	11.2	8.7	13.3
Talk	The game helps victims understand the importance of dealing with their problem and can give them courage to talk to teachers and parents.	20.4	14.1	25.7
Deba	The game is useful for creating a discussion in class.	18.9	14.1	23.0
Role	The game is useful to identify the characteristics of bullying and cyberbullying and learn about the problem.	12.6	8.7	15.9
Conv	The game showcases the importance of communication; the climate in a classroom can be assessed based on how the students act.	1.9	0.0	3.5

\*ALL = % of responses from all users

\*TEA = % of responses from teachers

\*ESS = % of responses from educational sciences students

TABLE 4  
Responses to Q9 “What do you think of this video game?”

Key	Meaning	ALL	TEA	ESS
Nega	Negative opinions.	2.4	4.3	0.9
Neut	Opinions that are neither good nor bad or highlights good and bad things.	7.3	10.8	4.4
Like	Positive opinions.	84.5	78.5	89.4
Inte	The game is an interesting tool.	9.2	15.1	4.4
Usef	The game is a very useful tool that can be used in class.	27.7	14.0	38.9
Real	The game is realistic in terms of events and its portrayal of bullying.	11.7	9.7	13.3
Deba	The game is useful for creating discussion and working on the topic of bullying in class.	5.8	4.3	7.1
Educ	The game is educational.	5.8	2.2	8.8
Refl	The game helps to raise awareness and make the player think.	19.9	10.8	27.4
Empa	It is useful to put the player in the victim's place and show him the feelings of the victim.	10.2	8.6	11.5
Iden	The game makes players feel identified as victims, observers or aggressors.	5.8	4.3	7.1
Youn	The game is ideal for junior high school students.	2.9	6.5	0.0
Easy	The game is easy, simple or intuitive.	1.9	2.2	1.8
Long	The game is long, boring or repetitive.	3.9	7.5	0.9

\*ALL = % of responses from all users

\*TEA = % of responses from teachers

\*ESS = % of responses from educational sciences students

proximity to the new technologies and the target age of the game.

### E. SOCIAL NETWORKS

Social networks play a key role in cyberbullying processes and we wanted to know how teachers and ESS use them, because a minimum understanding of those networks is necessary to better understand technology-mediated aggressions. We discover that the use of social networks between teachers and ESS is significantly different. In the case of teachers, they mostly use WhatsApp, rarely mentioning other social networks. However, ESS also mention, in addition to WhatsApp, using Instagram and Facebook, and are more aware of the existence of other social networks even if they do not use them or use them much less, as can be seen in Figure 4. In general, ESS are more familiar with the use of social networks than teachers. This aligns with the fact that young people tend to be more familiar with the use of new technologies and with computers in general. This was observed in the experiments themselves, where at the beginning of the game teachers, generally the older ones, found it more difficult to understand the game's controls. This can be partly explained by a generational shift in game use: newer generations are much more likely to be familiarized with videogames, as evidenced in the increase of

4 years in average gamer age between 2013 and 2018, from 30 to 34 years old, according to ESA's reports [35], [36].

In principle, we expected a more widespread use of different social networks (and, in particular, Twitter and Facebook). We believe that it would be interesting to conduct further studies on the use of different social networks, and whether they are related to different types of players and their frequency of play; as well as the relationship of these variables with the acceptance of new technologies as educational tools by teachers.

### VII. CONCLUSION AND FUTURE WORK

In this paper we have presented the evaluation of the videogame Conectado as a tool for teachers to use in classrooms to increase the awareness of students regarding bullying and cyberbullying. The game had already been initially tested and validated with its target users (students from 12 to 17 years old). However, to complete its validation and achieve its intended goal of being used as an educational tool in the classroom, it was essential to test the game also with potential teachers, since post-game classroom discussions are a vital feature of the educational game design. Additionally, our experiments have included educational sciences students (ESS), which will be the next teachers-in-training. Comparing active teachers to ESS allows us to partially account for the rapid pace of technological change.

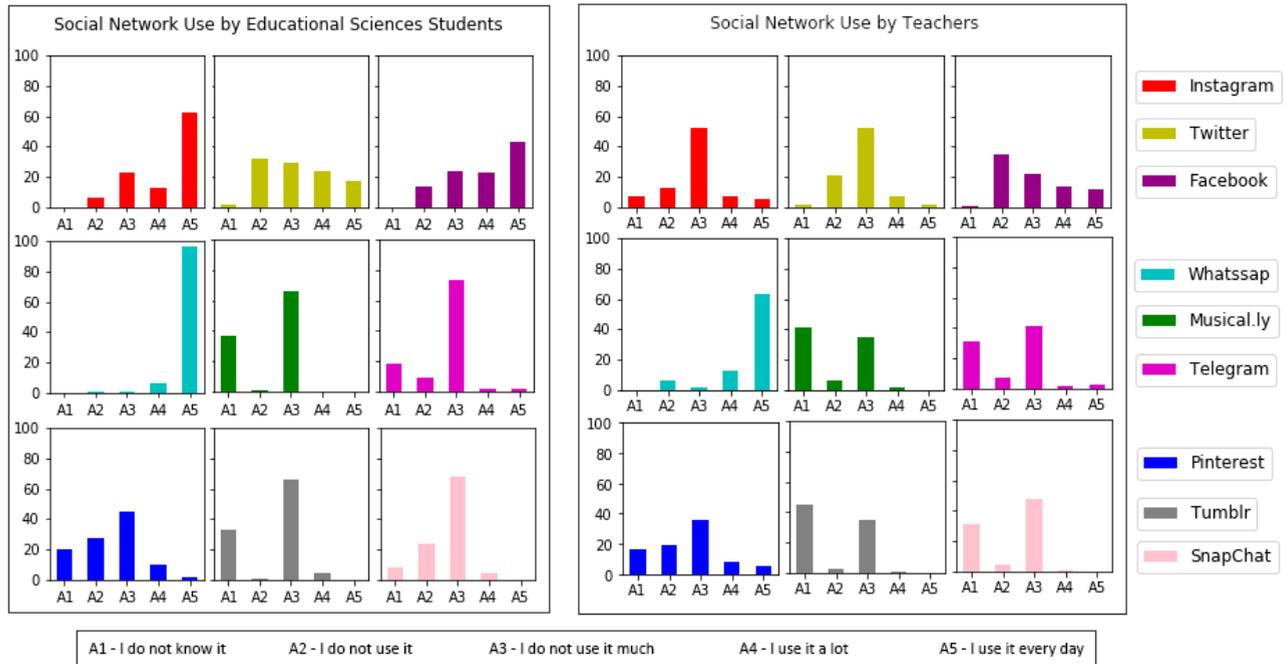


FIGURE 4. Use of social networks by ESS (left) and teachers (right).

Results have shown that the video game also has positive results when tested both with both groups. Therefore, we can say that *Conectado* is perceived as a useful tool that can be applied in class to raise awareness among players and to create a subsequent discussion about bullying and cyberbullying. Both group of users agree that *Conectado* provides a common experience that helps players identify the different aggression roles, and understand how victims of these severe issues can feel. *Conectado* had previously shown that it creates a change in the majority of users who play it, and that although it has a greater effect on its target users of young people aged 12 to 17 (0.66 over 7), surprisingly, and against expectations reflected on hypothesis H2, it also makes users outside this range (teachers and ESS) increase their awareness on bullying noticeably (0.44 points over 7).

Another conclusion drawn from the results is that the differences in completion time in both target groups (teachers and ESS) can be better explained by their age difference than by their different profiles or by their use of the new technologies (e.g. social networks). Results show that age is an important factor when it comes to dealing with the game. For instance, age affects the time it takes to complete the game (the older the users, the more time needed to complete it). This is probably related to their different familiarity and use of new technologies. Questionnaire results have also shown that the game is more popular among users in their 20s and 30s than in older users, as 78.5% of the teachers had positive opinions about the game compared to 89.4% of the educational sciences students.

On the other hand, the differences in the applicability test are very small, with generally positive responses from both user profiles, and both agreeing that the game is applicable in class, that it is realistic and that it serves to raise awareness and create a discussion in class, although this perception is higher in the students of educational sciences. With the answers to question Q3, the game appears to have a greater acceptance than other educational games. Although more than half of teachers would use games in their classes, an additional 21% would use *Conectado*, but not any other video games. In the case of educational sciences students, this difference of percentage is even higher, reaching 30%.

Although we have found no relationship between the use of social networks, the time used to complete the game, the cyberbullying awareness of users, and the acceptance of the game, it would be valuable to study how other variables, such as the subjects taught by teachers, their ease of use of new technologies, and whether they already play or even apply video games in their lessons, can affect their perception of serious game use in their classrooms.

Among the limitations of the study, we can mention that the number of centres of educational science students that have participated in this work is small, and all were in the same region of Spain, which could bias the results. We hope to obtain more data from students of educational sciences from a more diverse set of locations. Finally, we are also working on the creation and validation of a guide for teachers on the different possibilities of using *Conectado* in class.

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