



Exploring empathy in cyberbullying with serious games

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ABSTRACT

This study examined whether experiencing a multiplayer serious game could foster cognitive empathy in adolescent bystanders of cyberbullying, empathic concern for these situations and affective empathy towards those involved during game play. We also explored the players' self-reflections about cyberbullying scenarios in the game. A quasi-experimental design was used. While participants in an alternative intervention group read the game's storyline and filled in activities on paper, players in the experimental group interacted through a fictitious social network on themes related to organizing a school field trip and other activities. The control group had their regular classes. Quantitative (ANCOVA and Multilevel) and qualitative (Content analysis) results from 221 7th and 8th-graders recorded in classroom settings, showed that overall players reveal higher levels of cognitive empathy, empathic concern and affective empathy than those who did not play the game. Players referred appraisals and factual cognitions against cyberbullying, empathy towards the victim. Our game can help improve adolescents' cognitive empathy and prosociality in cyberbullying.

1. Introduction

Human social interactions may be determined by the level of empathy of those involved in the communication process (Davis, 2004). However, understanding what others are feeling during interaction is often difficult (Kumano, Otsuka, Mikami, Matsuda, & Yamato, 2015), especially in online communication where there is physical distance and a lack of contextual information and emotional cues (Knauf, Eschenbeck, & Hock, 2018). In hostile situations, such as cyberbullying, it becomes crucial to understand the social-cognitive and affective reactions that emerge because of the impact they may have on those involved. For instance, the reactions of victims to cyberbullying may influence bystanders' behavior (Ortega, Elipe, & Mora-Merchán, Calmaestra, & Vega, 2009) and generate opportunities for the latter to experience empathy (Sokol, Bussey, & Rapee, 2015).

Cyberbullying is a phenomenon of social interaction (Souza, Veiga Simão, Ferreira, & Ferreira, 2018) and has been defined as individuals' intentional repeated acts of aggression towards peers with the use of technology (Belsey, 2005). It can lead to anger,

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loneliness and unhealthy behavior and it is often undisclosed by victims (Francisco, Veiga Simão, Ferreira, & Martins, 2015). Bystanders' presence can increase throughout time, extending and intensifying the negative effects of this phenomenon on victims (Kubiszewski, Fontaine, Potard, & Auzoult, 2015). Their reaction to cyberbullying is critical, as they may influence those involved and the occurrence of events (Allison & Bussey, 2017). Therefore, this type of social interaction needs to be investigated further, specifically regarding the factors that may influence bystander empathy in these situations (Olenik-Shemesh, Heiman, & Eden, 2017).

Many cyberbullying prevention resources which have been developed are either not based on empirical data or are designed according to the face-to-face anti-bullying literature, excluding imperative features to prevent and intervene in cyberbullying (Pingault & Schoeler, 2017). Digital games are a promising resource to foster empathy in individuals since they allow participants to take on different roles in an immersive manner through vicarious experiences (Belman & Flanagan, 2010; Calvo-Morata, Alonso-Fernández, Freire-Morán, Martínez-Ortiz, & Fernández-Manjón, 2020). Furthermore, these games can be enriched with social agents that can set the scene and help players understand how to deal with cyberbullying experiences. Agents can play a role in sharing problem-solving strategies, helping players engage in pro-social behavior. Social agents have been a focus of recent research to investigate different socio-emotional behavior in individuals (Calvo-Morata et al., 2020; Leite, Castellano, Pereira, Martinho, & Paiva, 2014; Yalcin & DiPaola, 2018), and constitute an increasingly vast application of Artificial Intelligence to daily experiences (Dowling, 2002).

One resource which showed promising results with regards to cyberbullying intervention, was the Embodied Conversational Agent (Van der Zwaan, Dignum, & Jonker, 2010), which simulated peer support for victims. This agent was designed to help children cope with negative emotions due to cyberbullying and manage these situations and provide support by giving advice. However, to our knowledge, research on serious games with social agents in fostering empathy in negative daily experiences, such as cyberbullying, has so far been scarce (Van der Zwaan et al., 2012). There are few studies (e.g., DeSmets et al., 2018) assessing validated games' efficacy in real world settings (Calvo-Morata et al., 2020), and no studies using these resources to intervene in a longitudinal manner with social interaction among peers.

Some of the literature has called for research to focus on how empathy and prosociality can be fostered through human/agent interaction in social simulations using studies with individuals in virtual or real environments (Paiva, Santos, & Santos, 2018). In view of this, we question: Can multiplayer serious games foster empathy in bystanders of cyberbullying when played in classroom settings? To answer this question, we propose to study bystander empathy in cyberbullying situations, which can lead to pro-social behavior (Goleman, 2007), with a serious game and social agents. We expect to implement this virtual environment in a real classroom setting with adolescents using a quasi-experimental design. Specifically, we aim to understand whether experiencing a multiplayer serious game can foster cognitive empathy in adolescent bystanders of cyberbullying. We also propose to examine whether bystanders may experience empathic concern for cyberbullying situations and affective empathy towards those involved during game play. Lastly, we intend to explore the players' self-reflections about these cyberbullying scenarios in the game.

1.1. Empathy and cyberbullying

The emotional impact cyberbullying has on victims is often not visible to others due to the physical distance between those involved, and this may influence those who witness the situation (Obermaier, Fawzi, & Koch, 2016). Accordingly, emotions are essential for moral development and impact moral judgments, which are part of moral agency which determines how individuals behave in specific situations (Prinz, 2006).

Emotions consist of factual cognitions (beliefs) and a constant series of appraisals, responses and reappraisals which operate to improve adaptive behavior (Reisenzein, 2015). It is through these evaluations that individuals perceive whether events are of their concern or responsibility, are probable, unexpected, desirable, and morally good or bad (Scherer, 2001). Moral agency involves self-directedness through moral reasoning considering personal, behavioral and environmental factors that contribute to individuals' development and regulation of behavior according to their moral standards (Bandura, 2016).

Empathy can be considered as an emotional or cognitive response and refers to the ability to understand and feel the emotions of others (Batson, 2009). It is multidimensional, including cognitive and affective empathy. While cognitive empathy refers to the ability to understand the emotional situation and take the perspective of others, affective empathy is the ability to experience the emotions of others (Hoffman, 1991, pp. 275–301). Specifically, cognitive empathy pertains to how accurately individuals can perceive and understand the emotions of others (Hodges & Myers, 2007, pp. 296–298). Accordingly, individuals learn to recognize and understand others' emotions as a form of processing their own emotions and behavior. Some studies have provided evidence that cognitive empathy affects affective empathy (Batson et al., 2003). Affective (i.e., emotional) empathy involves feeling the same emotion as another individual and according to some authors (e.g., Hodges & Myers, 2007, pp. 296–298), may refer to experiencing distress and compassion as a response to someone else's dilemma. Moreover, being able to feel empathic concern with regards to another individual's situation is positively correlated with the willingness to help others (Goleman, 2007). Empathic concern may be considered an emotion that emerges as a response to a specific social situation where there is someone in need of help (Zickfeld, Schubert, Seibt, & Fiske, 2017).

Some studies (Macháčková, Dedkova, Sevcikova, & Cerna, 2013) have found that affective and cognitive empathy predicted support for victims in offline bullying, but only the first predicted support in cyberbullying. This could be due to the distance provided by online interaction. On the other hand, research has confirmed the importance of cognitive empathy in reducing negative behavior (Galinsky, Ku, & Wang, 2005), therefore, it is imperative to investigate and understand whether cognitive empathy can be fostered in cyberbullying situations. In fact, research has shown that children who experienced an intervention with digital resources that promoted reflection to address bullying, revealed more cognitive empathy towards others and more positive perceptions of their school environment (Paiva et al., 2005). Accordingly, feeling empathy increased the probability of helping others.

Empathy is also a flexible motivation-oriented phenomenon that may be influenced by social and contextual factors (Decety & Knafo, 2015) and therefore, empathic outcomes to specific situations can be changed by altering individuals' motivation to empathize (Keysers & Gazzola, 2014). Recent studies have revealed that individuals tend to avoid empathy and empathy-eliciting situations, as it is perceived to have cognitive and emotional costs, such as effortful helping and inefficacy, and distress, respectively (Cameron, Harris, & Payne, 2016; Cameron et al., 2019). However, when empathy is perceived as efficacious, empathy avoidance does not occur, showing that perceived cognitive costs may lead to empathy choice. Thus, it is crucial for research to provide an understanding of whether specific social and contextual factors can influence empathic reactions and how individuals may be motivated to engage in empathy, as our study proposes to do (Singer & Lamm, 2009).

In view of this, we propose that individuals' empathy towards cyberbullying and those involved may differ depending on whether they observe an incident directly, they know about it asynchronously, or on whether they do not experience a situation at all.

1.2. Exploring empathy with serious games and social agents

Different games have been developed to foster empathy and pro-social behavior explicitly or implicitly in different contexts (Belman & Flanagan, 2010). For instance, the game Hush by Jamie Antonisse and Devon Johnson (<http://www.jamieantonisse.com/hush/about.html>), allows players to take the perspective of a character and identify with her situation, as a form of implicit empathy induction. In this game, players go through the characters' experience which consists of maintaining a baby quiet in a context of war so that enemy soldiers will not capture them. Accordingly, the player's actions closely resemble the character's behavior.

Another game, Peacemaker by Impact Games (<http://www.impactgames.com/peacemaker.php>), is a game that provides the context of a political conflict where players play the role of either side of the conflict. The objective of the game is to have a peaceful conflict resolution for both sides. The features of the game enable players to choose to behave aggressively or pro-socially in a unilateral or collaborative manner. The game fosters empathy (i.e., affective and cognitive) by providing players with the opportunity to choose either side of the conflict and view the consequences for those on the opposite. For ethical purposes, in cyberbullying situations adolescents are not placed in the role of the victim or the aggressor because they may be prejudiced and therefore, in the serious game developed in this study, participants only played the role of bystanders.

Another example of a game to foster empathy is Layoff by Tiltfactor (<https://tiltfactor.org/game/layoff/>), which requires players to make decisions with regards to managing a company during a financial crisis and its employees. It elicits empathy from players with regards to the characters in the game, namely those who are employees since they must decide on whether to fire them but, must consider their profile and needs. This creates a moral dilemma for players and invokes empathy towards the employee characters, especially those with more vulnerable profiles.

An intervention with FearNot! an anti-bullying virtual learning game with empathic agents, enhanced coping skills in primary school children to deal with bullying situations (Paiva et al., 2005; Sapouna et al., 2010). This game included empathic agents with whom participants could identify with and to whom they could provide advice for managing and coping with bullying situations.

Considering these findings with regards to characters, the game we present in our study includes social agents who play different roles and have different background stories to examine whether empathy may be fostered in cyberbullying. Although some resources have been designed to foster empathy, to our knowledge, research on serious games with social agents to tackle cyberbullying specifically, has been scarce (Van der Zwaan et al., 2012).

Some of the literature has highlighted that the way in which social agents interact with individuals in a game, should be similar to human interaction (Nass, Moon, & Green, 1997). Accordingly, these social interactions have the potential to arouse social responses and foster behavioral changes (Ruijten, Midden, & Ham, 2015). For instance, individuals tend to adapt their behavior more if they are given social feedback from the social system (Midden & Ham, 2009). This may be explained by the fact that social feedback can increase the probability of a social agent being perceived as human-like. In addition, since individuals experience affective and cognitive empathy towards those with whom they identify with or have a relationship with, it is important to consider the proximity and characteristics of the agents and the participant (Paiva et al., 2005). Thus, designing a digital application, such as a serious game, should involve the degree of proximity of the social agents involved.

Games such as Friendly Attac (DeSmet et al., 2018) have been developed considering a social cognitive approach as a way of providing a specific framework for development. As proposed by Bandura (1977), the Social Cognitive Theory emphasizes the influence that observing others and self-regulation can have on one's own behavior and learning. Specifically, self-regulation enables individuals to gain control over their thoughts, feelings, motivation, and actions (Bandura, 2006). Accordingly, it requires individuals to engage in intentional forethought, to self-react, and self-reflect on occurrences. We argue that since in adolescence the maturation of learning to regulate emotions is in progress, enabling the capacity to appraise and reappraise one's own and others' emotions and feelings (Decety, 2010), empathy plays an important role in the social cognitive triadic model of self-regulation, where individual, behavioral and contextual variables influence individuals' behavior (Bandura, 2006). By fostering empathy, which is driven by goals, intentions, motivations and context (Decety, 2010), social behavior and emotional states may improve. Reflective Interfaces is another digital resource in the form of a social network developed to address cyberbullying from a self-regulation approach and involves using messages to encourage self-reflection in online behavior (Dinakar, Jones, Havasi, Lieberman, & Picard, 2012; Van Royen, Poels, Vandebosch, & Adam, 2017). Cyberbullying is a phenomenon of social interaction (Souza et al., 2018) where observing others is usual and self-regulation is important to guide individuals' emotions and behavior in these negative situations (Bandura, 2006). Thus, we infer that a multiplayer game with social agents based on self-regulation may have a greater impact on players' empathy regarding cyberbullying incidents, which in turn, may lead them to engage in prosocial behavior.

To generate behavioral change in individuals, serious games should include specific features, such as immersion (i.e., complete

involvement or engagement), which has been connected to enjoyment (Ritterfeld, Shen, Wang, Nocera, & Wong, 2009); identity (i.e., aiding players in creating an identity through personalization), which can be achieved through personalizing the game's experience with custom avatars (Feldon & Kafai, 2008); agency (the player's ability to act and drive changes in the game's state); interactivity (i.e., the player's ability to act and receive feedback, which may result from the occurrence of events; narrative (i.e., a storytelling that enables creators to develop a connection with players, help explain game mechanics and encourage gameplay); feedback (i.e., the possibility of receiving information pertaining to the way a task was performed); and a challenge (i.e., the different complexities to overcome in a game) (Blumberg, Almonte, Anthony, & Hashimoto, 2013).

Considering this conceptual framework of game design that we present as having the potential to foster empathy, we expect that players who vicariously take on the role of a bystander in an immersive environment of a serious game with social agents:

Hypothesis 1a: will reveal higher levels of cognitive empathy than those who do not; Hypothesis 1b: will present different trajectories of empathic concern towards cyberbullying throughout time, than those who do not; Hypothesis 1c: will present different trajectories of affective empathy towards the cyberbully throughout time, than those who do not; Hypothesis 1d: will present different trajectories of affective empathy towards the victim throughout time, than those who do not.

Lastly, to provide a detailed understanding of bystanders' reactions towards cyberbullying, we explore players' in-depth written reflections regarding the cyberbullying situations they observed in the game.

2. Material and methods

2.1. Design

This study's design is quasi-experimental with two control-groups (with pre and posttest), and includes process data which was gathered in classroom settings (Klug, Ogrin, Keller, Ihringer, & Schmitz, 2011), as well as qualitative data retrieved from the students' reflections at the end of each session. We had a total of three groups, an experimental group (EG), an alternative intervention group (AIG) and a control group (CG) to control any possible Hawthorne effects, which indicate that there was a significant difference in results because the participants experienced something new, rather than having been influenced by the experiment itself (Schmitz & Wiese, 2006). This evaluation was conducted to understand whether Com@Viver could foster empathy in bystanders of cyberbullying.

2.2. Participants

A total of 221, 7th and 8th grade, students participated in this study. Students belonged to eight different classes from three different schools. Students were randomly assigned to the EG which played the game ($N = 115$); the AIG which did not play the game but viewed the storyline on paper and registered their reactions on paper to provide us with longitudinal data to compare with the EG ($N = 50$); or the CG which did not play the game or view the storyline, but rather had their usual classes on citizenship ($N = 56$). All groups participated in the pre and post-tests in this study.

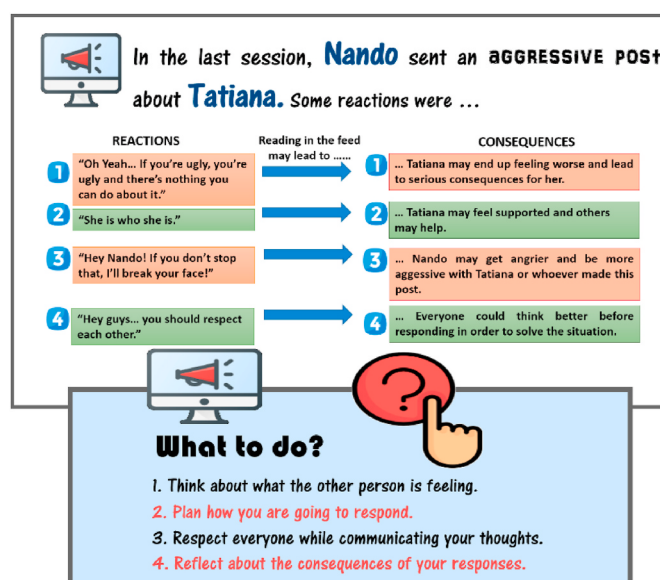


Fig. 1. Example of self-regulation strategies to foster empathy and pro-sociality.

2.3. Instruments and resources

2.3.1. Perspective Taking Scale of the Interpersonal Reactivity Index

To measure cognitive empathy (Hodges & Myers, 2007, pp. 296–298) with pre-post-test data, an adapted version of the Perspective Taking Scale of the Interpersonal Reactivity Index (Davis, 2004) was used with all three groups to gather the participants' overall cognitive empathy levels. Confirmatory Factor Analyses were used to confirm the internal structure of the instrument with our sample, since this instrument had been previously validated for the Portuguese population (Limpo, Alves, & Castro, 2010). For the confirmatory factor analysis, we used (IBM, SPSS AMOS 25.0) estimation procedures of unweighted least squares, including, fit indices such as chi-square, Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Comparative Fit Indices (CFI), Incremental Fit Index (IFI) and Akaike Information Criterion (AIC). The CFI and IFI values close to 1 suggest a good statistical fit (Bentler, 1990), whereas RMSEA indicates a good fit if equal to or less than 0.08 (Browne & Cudeck, 1993). Concerning the AIC, the lower the value, the better the fit. Lastly, it is suggested that the SRMR is close to zero for a good fit. The unidimensional instrument presented good fit values according to the literature (Hooper, Coughlan, & Mullen, 2008), namely, $\chi^2(9) = 18.40$, $p = .03$, $\chi^2/df = 2.04$, CFI = 0.97, GFI = 0.93, IFI = 0.97, RMSEA = 0.07, LO = 0.02, HI = 0.12, AIC = 54.40.

2.3.2. The multiplayer serious game Com@Viver

Conceptualization of the serious game. The multiplayer (groups of three) serious game used in this study was Com@Viver, which was designed to study bystander reactions and foster empathy in cyberbullying situations, which in turn, could promote pro-social behavior. The game has an introductory session (0) for players to learn how to play, a diagnostic session (1), and three intervention sessions based on empathy (Batson et al., 2003) and a social cognitive perspective of self-regulation (Bandura, 2006; Zimmerman, 2013), where specific self-regulation strategies are introduced to help players reflect on their decisions, take the perspective of others and regulate their behavior (Fig. 1). This type of feedback offers players information regarding their past behavior and strategies on how they can improve it in terms of empathy towards those involved and prosociality. At the end of each session, players register their self-reflections about the cyberbullying situation.

A narrative unfolds initially in the game, in a school context where social agents (i.e., portrayed as school colleagues) with different profiles are introduced to players. Each social agent has a background story, a profile picture and characteristics which potentially resemble some of the players therefore, making them more believable during their interactions and inducing distinct levels of empathy in different players. Five of these agents belong to the players' in-group of friends to create proximity and conduct empathy induction, while the remaining agents are in the outgroup (Fig. 2).

A description of the players' main objective is provided, mentioning that their challenge is to earn a seat on this year's bus field trip, where there is a limited number of seats. To do so, each group of players must perform tasks to organize the trip while interacting with the social agents and two other colleagues on a (hypothetical) social network. This network includes a public area, the feed, and a private area, the chatroom (Fig. 3). To personalize the game experience, each player can choose a profile photo and create their identity.

Three players can log in to the same network at the same time and interact with each other and the social agents about themes related with organizing the field trip and other school activities in the social network. The social agents and the players are divided into five work groups (i.e., players are all part of one group) with specific tasks to accomplish for the field trip. Players are informed they

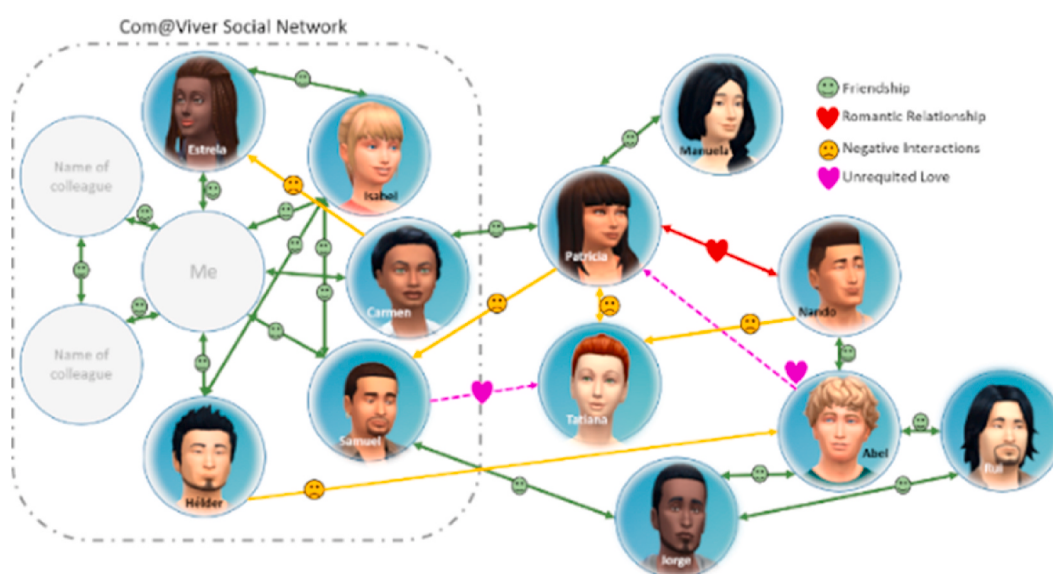


Fig. 2. The social agents as being part of the players' in-group and out-group.

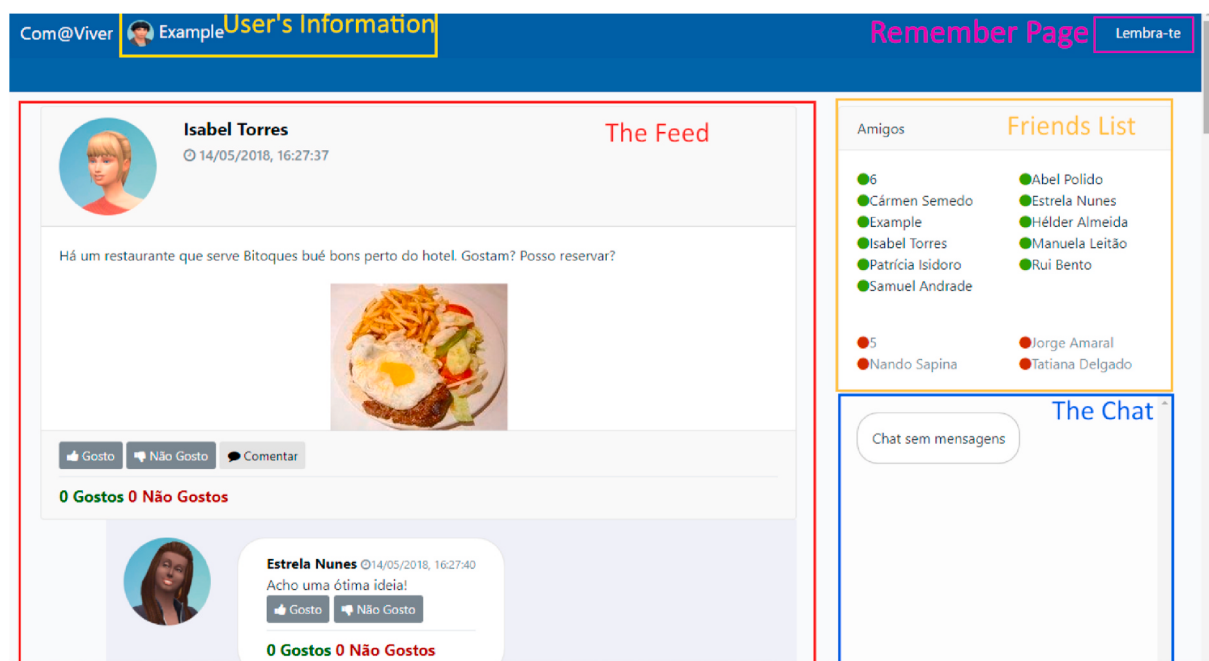


Fig. 3. Com@Viver's interface of the player's feed, friends list and chatroom.

can vote for the three groups they think should go on the field trip. Accordingly, they are also informed that the other groups will also vote for three groups (theirs included). The three groups with the most votes at the end of the game, go on the trip. All the players' reactions to their colleagues and the social agents' posts influence whether the latter vote for them to go on the field trip.

The cyberbullying situations emerge as posts in the feed. Although these situations are fictional, they were created based on real stories and the actual language (Veiga Simão, Ferreira, Francisco, Paulino, & Souza, 2018) that was used in these contexts. This information was retrieved from adolescents who participated in a preliminary study. Each cyberbullying incident has a victim, an aggressor and bystanders. All victims and aggressors are social agents of the game who generate posts and chats to communicate in humanlike interaction. Bystanders are social agents and players. There are social agent bystanders in favor of the aggressor, others in favor of the victim, and those who do not position themselves by not giving a reaction. Participants in the EG play the role of a bystander. There are a total of four cyberbullying situations: 1) a victim and an aggressor of the players' out group; 2) a victim and an aggressor of the in group; 3) a victim of the in group and an aggressor of the out group; and 4) a victim of the out group and an aggressor of the in group.

Affective empathy and empathic concern responses. Players may react to the cyberbullying situations (and the other posts) by posting likes/dislikes or predefined comments on their feed or in the chatroom. These predefined answers were developed so that students could not attempt to bully each other or the agents on the network. The chatroom content, which is a private form of providing feedback through interaction between the player and one or two agents, is about the cyberbullying case they have just observed. The possible responses given in the cyberbullying post and chat message were all developed according to a theoretical background based on the Bystander Intervention Model (Latane & Darley, 1970; Ferreira, Veiga Simão, Paiva, & Ferreira, 2020), mechanisms of moral disengagement (Bandura, 2002) and affective empathy towards the victim or the cyberbully (Nickerson, Mele, & Princiotta, 2008). At the end of each session, players could also report whether they experienced empathic concern for the cyberbullying situation or not (Goleman, 2007).

For this study's purpose, we analyzed the players' affective empathy and empathic concern in the form of pre-defined comments they could choose to use or not as a response to each cyberbullying situation. We also used players' responses in terms of empathic concern towards the situation. Specifically, players could react with empathic concern towards the cyberbullying situations with varying responses, and with different affective empathy responses towards those involved (Goleman, 2007). Specifically, players reported how they felt about the situation through empathic concern (e.g., "I felt worried about Tatiana's situation."). Players could also respond with affective empathy towards the cyberbully (e.g., "Oh come on, leave it alone because Nando is nice.") and the victim (e.g., "I feel sorry for her. She could get hurt."). However, players could also choose to respond aggressively or not respond at all. The data concerning both empathic concern about the cyberbullying situation and affective empathy about those involved (aggressor and victim) constitute our longitudinal data to compare the trajectories of the EG and the AIG.

Players' detailed written self-reflections. At the end of each session in the game, players could provide a detailed written account of what they thought about the situation and those involved. This moment in the game enabled players to engage in self-reflection, which is a crucial phase of self-regulation (Bandura, 2006; Zimmerman, 2013). This self-regulation phase allows individuals to examine their own and others' behavior/performance, but also enables them to engage in forethought for any possible

future similar events (i.e., since self-regulation is a cyclical process). These written reflections comprise our qualitative data.

Procedures.

We requested written authorization from The Ethical Commission of the Faculty of Psychology of the University of Lisbon, the Ministry of Education of Portugal, the Portuguese National Commission of Data Protection, the schools' boards of directors, the teachers, the parents and the adolescents themselves. All authorizations were granted.

The study consisted of a longitudinal study with five game playing sessions. The face validation was done with the elements from session 1, including a cyberbullying case, where participants (i.e., other than those in the main study) had the opportunity to test the game with the intent of providing suggestions and information regarding whether they understood how to play, the objectives of the game, and the overall quality of the interaction.

As for the longitudinal study, participants had 5 sessions with the game, that is, session 0, where they learned how to play the game with no cyberbullying content (not included in the analysis); session 1, which was diagnostic including a cyberbullying scenario to assess players' reactions initially in the game; and sessions 2, 3 and 4, where cyberbullying scenarios were presented, along with strategies to foster empathy and accordingly, pro-social behavior. These scenarios and strategies were presented as posts, most of which were presented by social agents.

Students from the EG, AIG and CG filled out a questionnaire in the pre and post-tests. The questionnaire was administered by researchers in a classroom context with computers with Internet access in schools. All participants were informed that they could quit the intervention at any time they wished to and had psychological assistance available to them with a professional psychologist.

2.4. Data analyses

The initial practice session (session 0) was not used in the analyses. The data analyses were conducted in various phases (Fig. 4).

2.4.1. Pre-post group comparisons of cognitive empathy

An Analysis of Covariance (ANCOVA) for repeated measures was computed from the pre and post-test survey data on cognitive empathy of the EG, AIG and CG due to pre-test differences with IBM, SPSS, 25.0. All statistical assumptions were met.

2.4.2. Process data of the EG and AIG for empathic concern and affective empathy

We used the data from the participants in AIG and in the EG, namely, participants' empathic responses to the cyberbullying posts from the four sessions of the story on paper (AIG) and game (EG) as our process data. Namely, empathetic concern (measured from 1 = totally disagree to 5 = totally agree), affective empathy towards the aggressor (coded 1 for no response and 2 for response), and affective empathy towards the victim (coded 1 for no response and 2 for response), which were the dependent variables. Time and the experimental condition were considered the covariates. Aggregation was done by day to have a mean score per group for each empathy variable per day.

Multilevel Linear Modeling (IBM, SPSS, 25.0) was used for repeated measures to assess the difference between the EG and the AIG concerning their empathetic concern and their affective empathy towards the aggressor and the victim, throughout the four sessions. We organized the data at the within-person in time level (level 1) and the between person level (level 2). Level 1 pertains to the amount of variability that occurs within each individual throughout time, whereas level 2 evaluates the differences between individuals regarding the studied variables. Therefore, a sample size of 660 session entries (4 session entries per student measured on four occasions) was used for empathetic concern towards the cyberbullying situation and affective empathy towards the aggressor and the victim at level 1, and of 165 students at level 2.

Maximum Likelihood was used to estimate all analyses, which is a commonly used technique that offers asymptotically unbiased estimates (McCoach, 2010), and introduced the variables in SPSS in three steps to test the interaction effects. Moreover, a scaled identity covariance structure was used for the effect of the repeated measurements, as well as a variance components covariance structure for the intercept random effect, since we intended to study the quantity of variance in the outcome within and between individuals. The scaled identity covariance structure has one estimated parameter and presumes there is a continuous variance throughout occasions with no correlation between components (Heck, Thomas, & Tabata, 2013).

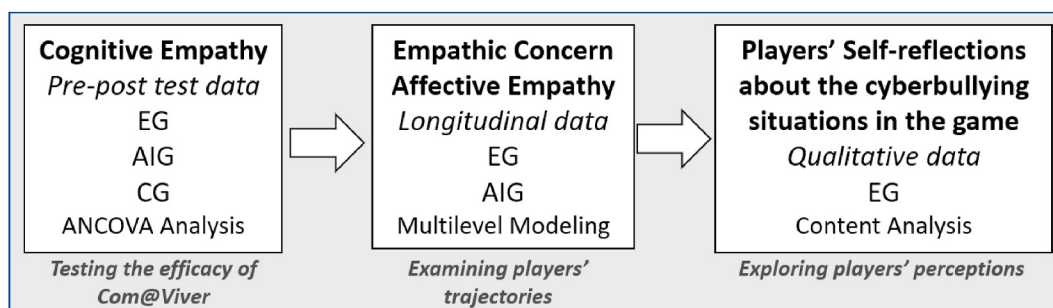


Fig. 4. Flow diagram of the data analyses pipeline.

Firstly, we computed an intercept-only model to establish how much variability there was in bystander empathy at each level. Secondly, we examined the shape of the growth path. We tested a model with a linear trend, a second model with a quadratic trend and another with orthogonal polynomials. The later did not yield any significant results in explaining bystander empathy growth. The model with linear time yielded significant results for empathetic concern and affective empathy. Thirdly, since we intended to understand if the treatment (game) was associated with varying growth patterns, we examined differences in growth between the two groups of participants. Therefore, we combined the level 1 model with time defined as linear (empathetic concern towards the cyberbullying situation, as well as affective empathy towards the aggressor and the victim) to explain students' growth over time, assuming the intercept varied between subjects and that the time slope varied randomly. We wanted our model to be as parsimonious as possible, as suggested in the literature (Heck et al., 2013).

We assessed the improvement of the models in comparison with the previous one considering the corresponding likelihood ratios. The variation in likelihood approximates is in accordance with the chi-square distribution (difference in degrees of freedom between models: subtracting the number of new parameters added to the model from the parameters of the previous one). Therefore, we present the differences in the deviances (by subtracting) to substantiate that the model that better fit the data was the one with the covariates and that the model with the intercept and time fit the data better than the intercept only model.

2.4.3. Qualitative data of players' self-reflections

We performed content analysis with an inductive category application of the data from the players' (EG) written self-reflections at the end of each session. The theoretical orientation of the interpretations in this study was considered only as a general set of principles to guide our analysis. The context unit in this study were cyberbullying situations in a serious game. All the content analysis performed in this study went through a pilot phase, a re-checking phase, and a trial phase in which two or more researchers reviewed the coding schemes and guidelines. The coding units we established were players' reactions to the cyberbullying situations (Amado, 2017) (Fig. 5).

3. Results

We aimed to understand whether experiencing a multiplayer serious game could foster cognitive empathy in bystanders of cyberbullying. We also proposed to examine whether bystanders could experience empathic concern for cyberbullying situations and affective empathy towards those involved during game play. Lastly, we intended to explore the players' reflections about these cyberbullying scenarios in the game.

To reach these objectives, we measured the EG, AIG and CG's cognitive empathy in pre- and post-tests, the EG and AIG's empathic concern towards cyberbullying and affective empathy towards the aggressor and victim in each session, and acquired the EG's (players) written self-reflections with regards to the cyberbullying situations in a serious game.

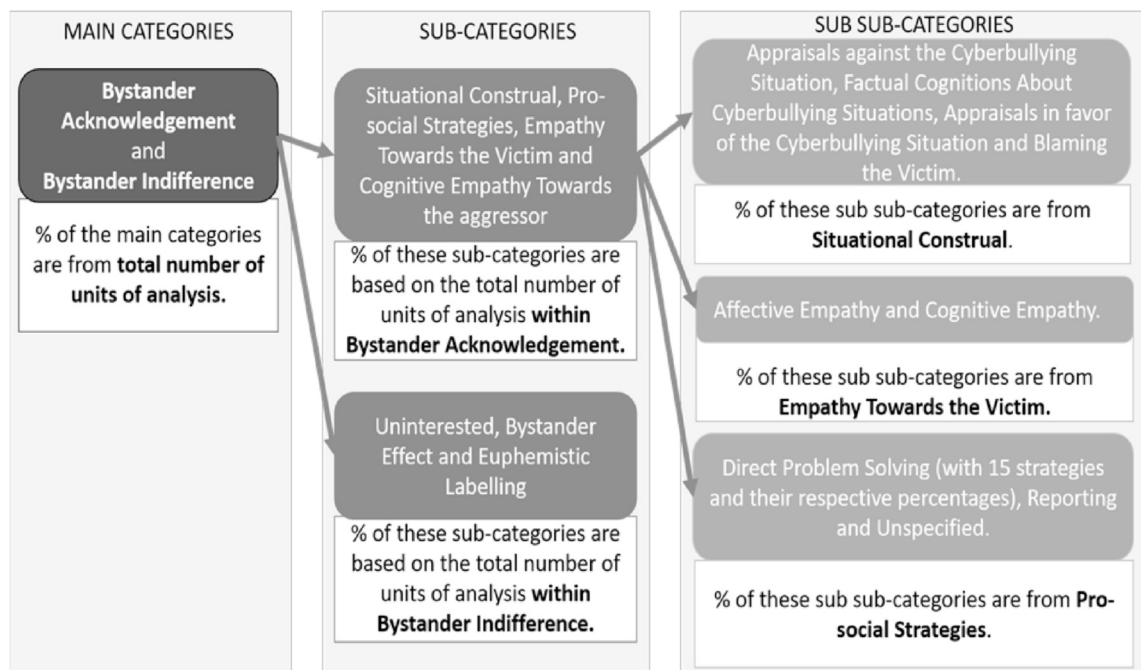


Fig. 5. Categorization of units of analysis.

3.1. Fostering cognitive empathy in bystanders of cyberbullying

We proposed that players in the EG would reveal greater levels of cognitive empathy than individuals who did not experience the game (*Hypothesis 1a*). Results from the ANCOVA demonstrated that those in the EG revealed higher levels of cognitive empathy after the intervention in comparison with those in the AIG and in the CG (Fig. 6), $F(2,190) = 35.76$, $p < .001$, thus confirming *hypothesis 1a*. In light of Cohen's (1988) cut-off points for small ($hp^2 = 0.009$), medium ($hp^2 = 0.058$) and large effects ($hp^2 = 0.137$), we observed large effects for players' reported cognitive empathy ($hp^2 = 0.273$).

3.2. Bystanders' empathic concern towards cyberbullying and affective empathy towards the aggressor and victim

Firstly, we computed the means, correlations and reliability coefficients of each variable considering the level 1 (within-subjects) and 2 (between-subjects) of analyses (Table 1).

At level 1, the variance refers to the variability in the average bystanders' empathic concern towards the cyberbullying situation (*hypothesis 1b*), and affective empathy towards the cyberbully (*hypothesis 1c*) and (*hypothesis 1d*) the victim estimates around their growth trajectory (Singer, Willett, & Willett, 2003). Moreover, the estimates of variance for levels 1 and 2 of empathic concern towards the cyberbullying situation ($Z_w = 13.70$, $p < .001$; $Z_w = 5.86$, $p < .001$, respectively), affective empathy towards the cyberbully ($Z_w = 13.69$, $p < .001$; $Z_w = 3.85$, $p < .001$, respectively), and affective empathy towards the victim ($Z_w = 13.82$, $p < .001$; $Z_w = 4.20$, $p < .001$, respectively), indicate there was enough variation in intercepts across bystanders. The amount of variance (ICC) was estimated with a one-tailed test for variances, revealing a variance between individuals (i.e., Level 2) of 41% empathic concern towards the cyberbullying situation, 25% for affective empathy towards the aggressor, and 23% for affective empathy towards the victim. Moreover, it presented 58% of variance within individuals (i.e., Level 1) for empathic concern towards cyberbullying situations, and 75% of affective empathy towards the aggressor and 78% towards the victim. Thus, we concluded that there was variance within and between bystander empathic reactions over time.

We compared the intercept-only models, which only contained the intercept, with the intercept + time models. The intercept + time models showed a significant progress over the intercept-only models (i.e., empathic concern towards the cyberbullying situations: $deviance = 10.91$, $df = 1$, $p < .01$; affective empathy towards the aggressor: $deviance = 18.43$, $df = 1$, $p < .01$; and affective empathy towards the victim: $deviance = 11.55$, $df = 1$, $p < .01$). This means that the differences occur not only between individuals (Level 2), but also throughout time within individuals (Level 1), which supports the assumption for the adoption of a multilevel methodological approach. In this second model, the intercept pertains to the bystanders' empathy at the start of the study. A linear time variable was significant in describing the growth of bystander empathic concern towards the cyberbullying situation and affective empathy towards the cyberbully and the victim.

The model with the predictor variables and their interaction revealed a significant progress over the intercept + time models for empathic concern towards the cyberbullying situations: $deviance = 10.84$, $df = 2$, $p < .01$). The scores of the AIG were lower by 0.24 points for empathic concern towards the cyberbullying situation, than the EG. Specifically, the AIG revealed lower empathic concern towards the cyberbullying situation than the EG, thus confirming *hypothesis 1b*. Players experienced different empathic concern towards the cyberbullying situation (Fig. 7) than those who were exposed to these incidents in an asynchronous manner.

The model with the predictor variables and their interaction showed a significant progress over the intercept + time models for affective empathy towards the cyberbully: $deviance = 12.15$, $df = 2$, $p < .05$. The scores of the AIG were higher by 0.05 points for affective empathy towards the cyberbully, than the EG. That is, the AIG revealed higher affective empathy towards the cyberbully than the EG, thus confirming *hypothesis 1c*. Players experienced different affective empathy towards the cyberbully than individuals who were exposed to these incidents in an asynchronous manner (Fig. 8).

The model with affective empathy towards the victim did not present a significant improvement: $deviance = 10.03$, $df = 2$, $p > .05$. However, although not significant, the scores of the AIG were lower by 0.003 points for affective empathy towards the victim, than the EG. In other words, the AIG revealed slightly less affective empathy towards the victims than the EG, but non-significant results do not

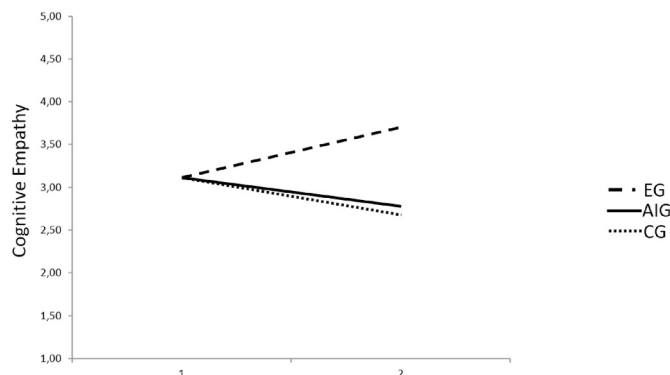


Fig. 6. Differences between the EG, the AIG and the CG regarding cognitive empathy.

Table 1
Correlations and descriptive statistics of bystander empathy.

Variables	Correlations				Group	Level 1 (N = 620)				Level 2 (N = 155)
	1	2	3	4		0	1	2	3	M(SD)
1. Condition		.11	.20*	.27**		M(SD)	M(SD)	M(SD)	M(SD)	M(SD)
2. Empathic concern towards cyberbullying	.09*		-.22*	.20*	EG	3.92 (1.24)	3.98 (1.10)	3.83 (1.27)	3.84 (1.15)	3.89 (1.20)
					AIG	4.20 (1.00)	3.55 (1.34)	3.56 (1.39)	3.20 (1.57)	3.63 (1.38)
3. Affective empathy towards cyberbully	.14**	-.17**		.07	EG	1.25(.43)	1.16(.37)	1.09(.29)	1.05(.22)	1.11(.32)
					AIG	1.04(.21)	1.02(.16)	1.00(.00)	1.02(.16)	1.03(.16)
4. Affective empathy towards victims	.17**	.16**	.10*		EG	1.58(.50)	1.50(.50)	1.56(.50)	1.33(.47)	1.50(.50)
					AIG	1.34(.48)	1.36(.48)	1.41(.50)	1.13(.33)	1.31(.46)

Note. * $p < .05$; ** $p < .01$. EG = Experimental group; AIG = Alternative Intervention group. Below the diagonal are day level correlations ($N = 660$). Above the diagonal are person-level correlations ($N = 165$). The Level 1 means and standard deviations are in accordance with the time variable (from 0 to 3).

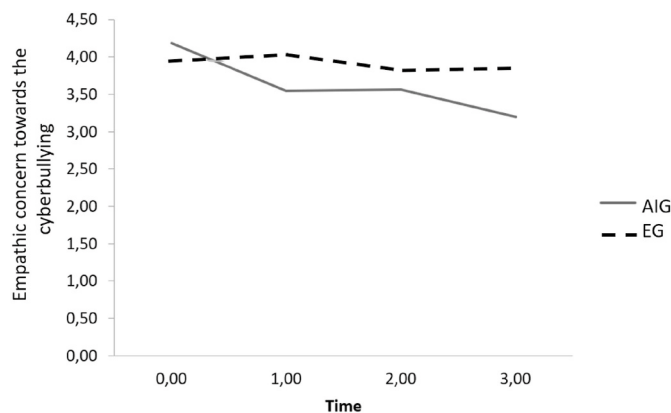


Fig. 7. Bystanders' empathic concern towards the cyberbullying situations.

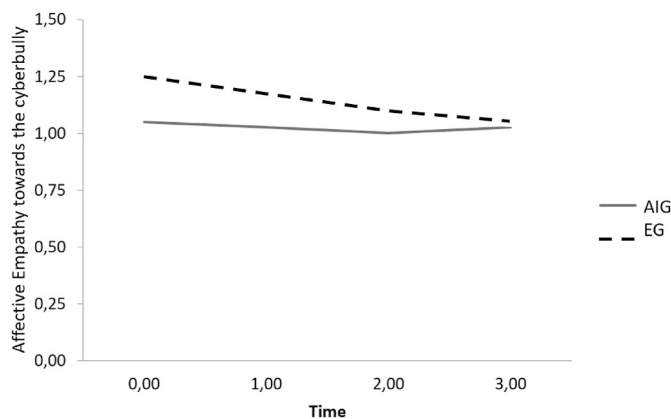


Fig. 8. Bystanders' affective empathy towards the cyberbully.

enable us to confirm *hypothesis 1d*. Players experienced slightly different empathic reactions towards cybervictim than individuals who were exposed to these incidents in an asynchronous manner. Even though this result was not significant, slight differences may be seen in the trajectories of both groups (Fig. 9).

Table 2 shows the model fit information (likelihood ratios) and estimates for the fixed and random effects of all models. These results indicate that there were significant differences in the growth rates of empathic concern regarding the cyberbullying situation and affective empathy towards the cyberbully over time between the two groups in favor of the EG. The trend for affective empathy towards the aggressor seems to have been negative for the EG. There were no significant differences in the growth rates of empathic

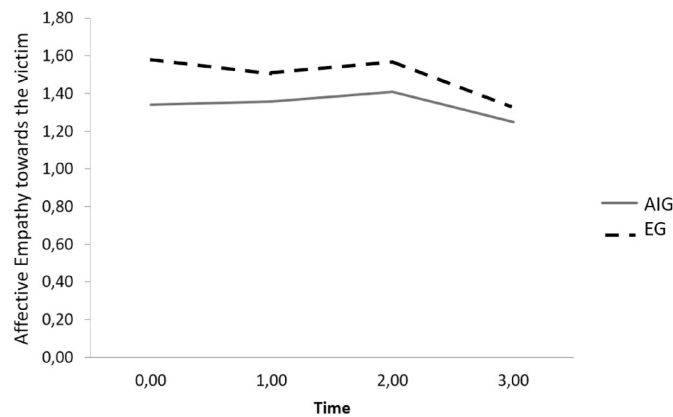


Fig. 9. Bystanders' affective empathy towards the victim.

Table 2

Fixed and random effects parameter estimates for models predicting bystander empathic reactions.

Parameter	Bystander Empathy								
	Empathic concern towards cyberbullying			Affective empathy towards cyberbully			Affective empathy towards victim		
Fixed Effects	Intercept-only	Intercept + time	With predictors	Intercept-only	Intercept + time	With predictors	Intercept-only	Intercept + time	With predictors
Intercept	3.80**(.08)	3.40**(.10)	3.98**(.12)	1.08**(.05)	1.15**(.02)	1.19**(.02)	1.44**(.03)	1.52**(.04)	1.58**(.04)
Time		−0.13**(.04)	−0.05(.05)		−0.04**(.01)	−0.06**(.01)		−0.06**(.02)	−0.06**(.02)
Condition			0.12 (.21)			−0.16**(.04)			−0.18**(.08)
Time*Training			−0.24**(.08)			0.05**(.02)			−0.003 (.08)
Random Effects									
Repeated measures	0.94**(.06)	0.91**(.07)	0.89**(.07)	0.06**(.00)	0.06**(.00)	0.06**(.00)	0.19**(.01)	0.18**(.01)	0.18**(.01)
Intercept	0.65**(.11)	0.66**(.11)	0.64**(.11)	0.02**(.00)	0.02**(.00)	0.02**(.00)	0.06**(.01)	0.06**(.01)	0.05**(.01)
Deviance	1591.50	1580.58	1569.74	121.84	103.41	91.26	710.30	698.75	688.71
AIC	1597.50	1588.58	1581.74	127.84	111.41	103.26	716.30	706.75	700.71
BIC	1610.20	1605.52	1607.15	140.59	128.40	128.75	729.04	723.74	726.20

Note: Standard errors are in brackets. * $p < .05$; ** $p < .01$.

reactions over time between the two groups in terms of affective empathy towards the victims. Nonetheless, there was a slight positive trend of empathic reactions towards the victims in favor of the experimental group.

3.3. Players' self-reflections regarding the cyberbullying scenarios in the game

We also tried to better understand players' empathy by exploring their written reflections regarding the cyberbullying situations they observed in the game. Content analysis provided categories and subcategories with insights into how players perceived the cyberbullying situations and those involved, which complements the results presented previously.

As shown in Fig. 10, players acknowledged the cyberbullying situations mostly, as opposed to being apathetic to them. By acknowledging the situation (a first step in bystander intervention, Latane & Darley, 1970), players firstly wrote down their perceptions of the cyberbullying situation (Situational Construal), majorly referring to their evaluations (Appraisals: e.g., "I think the entire situation was really bad.") and beliefs (Factual Cognitions: e.g., "I think it's a lack of respect to talk about a colleague like that.") against the incidents. These categories are in line with appraisal models of emotions (Scherer, 2001, 2013). Within players' situational construal, a minority of units of analysis pertained to evaluations (Appraisals: e.g., "I just found it funny") in favor of the cyberbullying situation, as well as Blaming the Victim (e.g., "Estrela [the victim] is a fake because of the stuff she did."). Then, players referred to Pro-social Strategies, with a main emphasis on Direct Problem-solving (e.g., "I think both should talk calmly and in person to avoid this type of situation, not on a website."), Reporting (e.g., "I think Tatiana should have reported the situation to someone instead of talking

to Patricia.”) – which have been found in previous studies (Ferreira et al., 2020) and Unspecified (e.g., “They should resolve things another way.”) (Fig. 10).

Specifically, in terms of Direct Problem-solving Strategies, players:

- (1) suggested all sides keep calm while interacting: 19,29%;
- (2) got involved in defending/supporting the victim: 15,78%;
- (3) suggested resolving the issue face-to-face: 12,28%;
- (4) suggested talking to both sides: 8,77%;
- (5) suggested respecting everyone involved: 8,77%;
- (6) suggested both sides come to an agreement with-out offense: 7%;
- (7) suggested the victim talk to others (friends): 5,28%;
- (8) suggested the victim talk to the cyberbully: 5,28%;
- (9) valued reflecting before acting: 5,28%;
- (10) suggested the victim not attribute value to the cyberbullying: 3,5%;
- (11) encouraged the victim to show the bully that cyberbullying is morally wrong: 1,7%;
- (12) suggested those involved to apologize: 1,7%;
- (13) suggested the cyberbully take the perspective of the victim: 1,7%;
- (14) suggested not to support the cyberbully: 1,7%;
- (15) suggested not to provoke the cyberbully: 1,7%.

Still within players' acknowledgement of the situation, empathy towards the victim were more present in the units of analysis than empathy towards the cyberbully, which is consistent with our quantitative findings. Specifically, players mentioned majorly Affective Empathy (e.g., “She [the victim] might have got hurt and embarrassed with the situation.”) and Cognitive Empathy (e.g., “I know what it's like to be in her [the victim's] shoes ...”) towards the victim and minorly Cognitive Empathy Towards the Cyberbully (e.g., “I understand that Carmen [cyberbully] isn't satisfied with the fact that the trip isn't to where she wanted to go because her parents don't let her.”).

In terms of Bystander Indifference, which appeared less in the units of analysis, players mentioned they were Uninterested (e.g., “No”), experienced the Bystander Effect - a psychological process through which bystanders are less likely to help a victim either

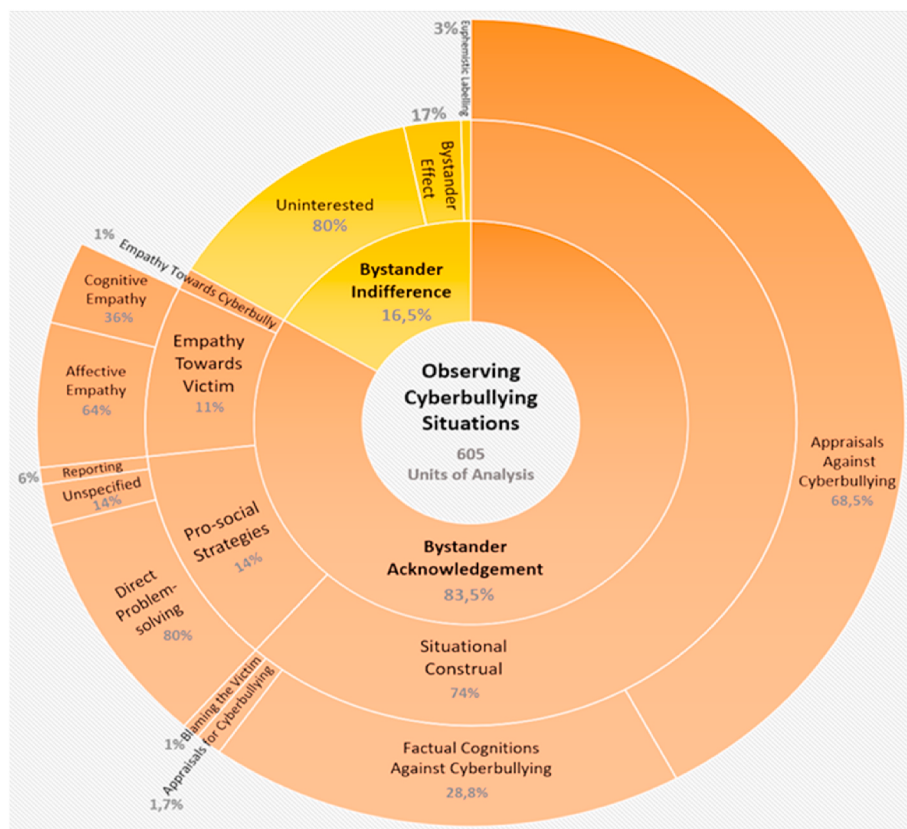


Fig. 10. Players' self-reflections regarding the cyberbullying situations.

because of social influence and/or the diffusion of or lack of assuming responsibility (Latane & Darley, 1970) (e.g., “I have nothing to do with it.”); and used Euphemistic Labelling – a Moral Disengagement mechanism in which individuals use sanitizing language to undermine the emotional intensity of and incident, in this case, to talk about the cyberbullying situation (Bandura, 2002) (e.g., “The situation wasn’t too severe.”).

4. Discussion

This study’s contribution falls on a call for research to focus on how empathy and prosociality can be fostered through human/agent interaction in social simulations using experimental studies with individuals in virtual or real environments (Paiva, Dias, Sobral, & Woods, 2005). Moreover, to design Com@Viver, we used a social cognitive approach, which enabled the game to include personal, behavioral and contextual factors which set the scene for players (Bandura, 2006). We studied bystander cognitive and affective empathy and empathic concern, which can lead to pro-social behavior (Goleman, 2007), in cyberbullying situations, with a serious game and social agents. We implemented this virtual environment in a real classroom setting with adolescents using a quasi-experimental design. Specifically, we examined whether experiencing a multiplayer serious game could foster cognitive empathy in bystanders of cyberbullying. We also aimed to study whether bystanders could experience empathic concern for cyberbullying situations and affective empathy towards those involved during game play. Lastly, we proposed to explore the players’ self-reflections about these cyberbullying scenarios in the game.

4.1. Theoretical implications

We chose to study cognitive empathy in this study, since it may influence affective empathy (Batson et al., 2003). We found a significant difference in terms of cognitive empathy between groups in the post-test (*Hypothesis 1a*). Specifically, players (EG) demonstrated higher levels of cognitive empathy after the intervention than the AIG and the CG. This result adds to other findings where children who experienced an intervention with digital resources that promoted reflection to address bullying, revealed more cognitive empathy towards others (Paiva et al., 2005; Sapouna, 2010). This result could be due to the level of engagement the storyline provided within a game structure involving social agents who each had a different background. The fact that there were social agents who demonstrated empathy throughout the sessions, positioning themselves in favor of the victim, could have contributed to this result as well. This result provides an important contribution to the literature, since cognitive empathy has been found to influence bystanders’ prosocial intervention in face-to-face bullying, but not in cyberbullying (Macháčková et al., 2013). Our study provides evidence that by offering adolescents emotional cues from the agents and training on self-regulation strategies, that they report greater cognitive empathy.

We also found that players (EG) experienced different empathic concern towards the cyberbullying situations (*hypothesis 1b*) and affective empathy towards the cyberbully (*hypothesis 1c*) than individuals who were exposed to these incidents in an asynchronous manner (AIG). Moreover, although players’ trajectory slopes (EG) of their affective empathy towards victims (*hypothesis 1d*) were not statistically significantly different from those of students in the AIG, results provided evidence that the EG showed higher levels of empathic reactions towards victims, thus revealing a positive trend. This could have been due to the interactive and immersive nature of game experience (Belman & Flanagan, 2010). The results for our hypotheses were reinforced by the qualitative data we gathered from the EG. Most students revealed they were against cyberbullying and showed greater cognitive and affective empathy towards the victim, as opposed to the cyberbully, as we reported in section 3.3. of the results’ section. Specifically with regards to the results referring to affective empathy towards the victim (*hypothesis 1d*), and considering the EG showed a high level of empathy towards the victim in their written self-reflections, we believe that more sessions of the game would help bystanders react more empathically towards the victim.

Our study showed that even in severe situations, such as observing cyberbullying, which is an empathy-eliciting situation involving effortful helping (cognitive cost) and distress (emotional cost) (Cameron et al., 2016, 2019), players (EG) revealed more cognitive and affective empathy and empathic concern than those who read about it (AIG) or were not exposed to it (CG). These findings advance knowledge and contribute to educational research, as they demonstrate how empathy may be invoked through experiencing the cyberbullying situation first-hand as a bystander. Even though individuals tend to avoid empathy due to its perceived cognitive and emotional costs (Cameron et al., 2016, 2019), empathy may be triggered when experiencing inhumane situations. This finding complements previous studies that have suggested empathy induction and expression depend on social and contextual factors (Decety & Knafo, 2015). Finally, according to our study, we suggest that robust theories such as the social cognitive theory (Bandura, 2006), should give more emphasis to integrating empathy as a key individual variable, which can improve social behavior and emotional states considering contextual and behavioral components (Decety, 2010).

4.2. Practical implications

Our study provides important practical implications for teachers, school officials, and psychologists who have to deal with the challenges posed by cyberbullying. Hence, our study provided longitudinal results from an ecologically valid resource to show how adolescents could be trained in educational contexts to be more empathic (Singer & Lamm, 2009) in cyberbullying situations. This may be achieved through serious games, which provide context through engagement to motivate players to empathize. Therefore, serious games are a promising resource to be used in educational interventions through which empathy may be invoked to motivate adolescents to engage in effortful helping. This practical implication may lead toward a better understanding of how bystander empathy

leads to inhibiting aggressive behavior and engaging in prosocial behavior to enable a healthy development of moral reasoning (Eisenberg & Eggum, 2009).

Thus, our results highlight the importance of providing vicarious immersive environments (Ritterfeld et al., 2009) through interaction (Nass et al., 1997) when promoting empathy in serious games to foster prosociality in cyberbullying situations. These interactions may have arisen social responses and fostered behavioral changes in the players (Ruijten et al., 2015). Moreover, they provide insights as to how serious games, which have the potential to foster empathy (Belman & Flanagan, 2010), can be developed with social agents (Dowling, 2022; Feldon & Kafai, 2008) to provide adolescents with training on how to deal with cyberbullying situations. This constitutes an important contribution to the field, as Com@Viver is, to our knowledge, the first multiplayer game to foster empathy and prosociality in cyberbullying situations.

These findings reinforce the importance of providing players with a challenge and the ability to act and drive to achieve goals in the game through an interactive narrative which provides them with feedback (Blumberg et al., 2013). Players may have adapted their behavior to handle the cyberbullying situations presented because they were given social feedback from the game (Midden & Ham, 2009).

The fact that the players in the EG engaged with the game could have had an impact on how they demonstrated prosocial behavior throughout the formative sessions and how they revealed more cognitive empathy because they were immersed in the storyline and interacted with the agents and their colleagues as the game progressed (Belman & Flanagan, 2010). They had instant access to each of the social agents' history, which could have contributed to their level of cognitive empathy and consequently, their prosociality within the game.

4.3. Limitations and future directions

This paper is not without limitations. Other important variables could have been considered, such as bystander behavior within a framework of the Bystander Intervention Model (Latane & Darley). However, this was not the focus of the current paper, but these variables could offer promising leads for future research. Furthermore, even though the volume of data we examined was considerable, we used with a small sample size and future work could use larger sample sizes to examine results as those presented here. Nonetheless, the literature has stated that 30 level-2 units are sufficient to produce unbiased parameter estimates in multilevel linear analysis (McCoach, 2010). Other complex statistical methods could also be used to examine this type of data, such as latent growth curve modeling (Kline, 2011).

Future research could focus on how specific characteristics of games (i.e., possibility of interaction with diverse number of agents and/or colleagues; potential for private vs public prosocial intervention) and its social agents (i.e., physical and psychological attributes; history) could influence players' level of empathy (i.e., cognitive and affective empathy and empathic concern). Moreover, it is also important to consider studying bystanders' emotional reactions longitudinally with more sessions, how they regulate these emotions while witnessing these events and possible reasons behind these reactions, such as moral disengagement. Accordingly, future research could investigate further how empathy could be a key variable within the social cognitive theory of human agency. Lastly, it is also essential to understand how computer assisted learning (such as serious games) can be used in real world settings to enable a high level of ecologic validity.

4.4. General conclusions

The innovation of this study lies on how a digital application, such as a serious game with social agents, can have an impact on players' empathy and improve adolescents' cognitive empathy and prosociality in cyberbullying, a social phenomenon that influences emotions and behavior of those involved (Olenik-Shemesh et al., 2017; Pingault & Schoeler, 2017). Since the reactions of victims may trigger feelings of empathy in bystanders (Sokol et al., 2015) and influence bystanders' behavior (Ortega, Elipe, Mora-Merchán, Calmaestra, & Vega, 2009), the game provides contextual information (i.e., storyline of the agents in a social network and the players' role as either a friend or an acquaintance) and emotional cues (i.e., the social agents' reaction to the cyberbullying scenarios), which cyberbullying often lacks (Knauf et al., 2018). The game presented can be used as part of a more extensive program for adolescents to intervene in cyberbullying. Ultimately, Com@Viver offers a robust approach to foster awareness, empathy and pro-social behavior, since players have opportunities to immerse in the game in a safe environment, self-reflect on their choices, feel empathy and engage in prosociality in cyberbullying situations, as recommended in the literature (Calvo-Morata et al., 2020).

Pertinence

This study answers a call to examine how empathy and prosociality can be fostered through human/agent interaction in social simulations using experimental studies in virtual and real environments.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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