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The role of experience during playing bullying prevention serious game: effects on knowledge and compassion

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ABSTRACT

In line with previous findings stressing the importance of the player experience for game effectiveness, the main aim of the study was to explore whether the experience while playing a serious digital game aimed at bullying prevention mediated the relationship between initial and postgame knowledge about appropriate reactions in bullying situations, and initial and postgame compassion for the victim. Participants were 12- to 14-year-old students from 10 European schools ($N = 120$; 51% boys). Students were assessed in schools, by an online survey, before and after gaming sessions, on measures of knowledge about appropriate reactions in bullying situations and compassion for the victim. Students' experience during playing was also assessed. The proposed model showed a good fit to the data, but the mediation hypotheses were not supported. The results indicated that some aspects of the game experience could affect subsequent knowledge and compassion. Specifically, the challenge had a significant effect on knowledge about appropriate behaviour, while immersion had a significant effect on compassion. The model was tested on the wider sample including students who played the control game ($N = 116$; 46% boys). The results of moderated mediation analysis offer further support to this conclusion, as these effects were not significant in the control group.

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Serious game; game experience; bullying; compassion; assertiveness

1. Introduction

The potential of serious games has been recognised for having led to different outcomes, but so far serious digital games have been mostly employed for knowledge acquisition (Boyle et al. 2016). The possibility that serious games could be effective for developing soft skills has also been acknowledged in the last few years, although far less explored. The notion that serious game could complement traditional psychological interventions and not only improve knowledge but also improve psychological well-being in different age groups is certainly noteworthy (Diaz-Orueta 2016). Since school bullying and peer victimisation have been major social problems affecting children and adolescents in all parts of the world, several serious games aimed at bullying prevention were developed. However, most of the studies did not examine or report the effects of gaming on perceived social skills and empathy, nor explored the role of players' experience in game effectiveness (e.g. Bosworth et al. 2000; Kärnä et al. 2013; Vannini et al. 2011). The present study seeks to address these previously neglected issues.

There are many definitions of 'serious games', but maybe the simplest one is that serious games are '… games that do not have entertainment, enjoyment, or fun as their primary purpose' (Michael and Chen 2006, 21). The review by Connolly et al. (2012) revealed that the most frequent outcomes for entertainment games are affective and motivational, while serious games and games for learning aim at knowledge acquisition and content understanding. However, there was some encouraging evidence (Boyle et al. 2016) that serious games could be used successfully for skill acquisition, behaviour change, improving satisfaction and supporting collaborative interactions, soft skills, and empathy. Among different approaches to intervention (e.g. curriculum and school policies, teacher interventions, peer mediation, peer education, etc.), information and communication technologies were found to be suitable tools for intervention with children and adolescents promoting their emotional, psychological and social wellbeing (Nocentini, Zambuto, and Menesini 2015). Therefore, the more intensive focus has been placed recently on development and evaluations of serious games that

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emphasise affective outcomes (Argasiński and Węgrzyn 2019). Papoutsi and Drigas (2016) also noted that there is progress in the design and the development of digital games that aim to provide opportunity and the capability to develop empathy for different purposes, such as for social impact or bullying prevention.

School bullying and peer victimisation are major social problems affecting children and adolescents in all parts of the world. When bullying occurs in school, some students are directly involved, while others (bystanders) witness the incident (Atlas and Pepler 1998) and they represent the largest group of students (Heinrichs 2003). The bystanders may accept or even participate in bullying by giving bullies a sense of power. Conversely, they may try to stop the bully and defend the victim. Therefore, although they play the least active role, bystanders are a critical element in bullying (Coloroso 2005). Bullies, as well as victims, report less assertive strategies in reaction to provocation, which implies their lower social competence compared to children who are not involved in bullying (Camodeca et al. 2003). Perry, Hodges, and Egan (2001) stress that assertive reactions during peer conflicts tend to discourage bullies' attacks, whereas aggressive fighting back does not usually serve to stop an attack. Therefore, it is important that children and adolescents that are victims or bystanders know which reactions are assertive and therefore most beneficial in bullying situations.

One of the characteristics that perpetrators of bullying may also lack is empathy. In their meta-analysis, Jolliffe and Farrington (2004) confirmed the positive relation between antisocial behaviours and low levels of empathy that might become a risk factor for children's future involvement in aggressive behaviour. Similarly, Van Noorden et al. (2015) concluded that bullying was negatively associated with empathy. Singer and Klimecki (2014) argued that empathy usually refers to our general capacity to resonate with others' both positive and negative emotional states. However, it might also lead to empathic distress, a strong emotional response to the suffering of others, accompanied by the desire to withdraw from a situation in order to protect oneself from overwhelming negative feelings. Compassion, on the other hand, refers to a feeling of concern for another person's suffering rather than sharing the suffering of the other. It is characterised by feelings of warmth and care for the suffering person and accompanied with motivation to help. In a study exploring the effects of empathy and compassion on prosocial action in (economic) games, Jordan, Amir, and Bloom (2016) found that compassion, but not empathy, was predictive of prosocial actions. Therefore, compassion might be an especially important outcome in interventions aimed at bullying prevention and victim protection.

A systematic review of antibullying ICT-mediated interventions (Nocentini, Zambuto, and Menesini 2015) yielded 13 intervention programs and data about their effectiveness, seven of which were serious games. It was concluded that only four programs showed some evidence of effectiveness in reducing bullying and cyberbullying. In most studies, the effectiveness of serious games was evaluated by assessing knowledge about bullying and appropriate reactions and/or reported (planned) behaviour in bullying situations. However, the goal of anti-bullying program should be not only to raise awareness and knowledge about bullying and coping strategies but also to increase empathic engagement and improve the quality of social relationships (Nocentini, Zambuto, and Menesini 2015).

Although there is a growing interest in exploring the limits and strengths of using digital games as 'empathy machines' (Farber and Schrier 2017), most of the studies exploring the effectiveness of bullying prevention games did not examine or report the effects of gaming on perceived social skills, empathy or compassion (e.g. Bosworth et al. 2000; Kärnä et al. 2013; Vannini et al. 2011). The exception is the study of DeSmet et al. (2018), which found positive effects of the Friendly Attac anti-bullying game on students' perceived social skills, but no effect on their empathic skills. Players' experience and subjective feelings while playing the game might be crucial in determining whether the game is going to be effective, especially if the game is targeted on developing soft skills and empathy.

Great variety exists in game genres and players, and as a result, there is no general agreement on the dimensions of player experience. Boyle, Connolly, and Hainey (2011) refer to several psychological theoretical constructs that have been proposed to explain the subjective feelings experienced while playing games: flow, immersion, and presence. Csikszentmihalyi (1991) described the flow experience as complete absorption or engagement in an activity. The state of flow has the following characteristics (Nakamura and Csikszentmihalyi 2002): increased and focused attention on the current activity, merging of action and awareness, loss of reflective self-consciousness, a sense of control over one's actions, distortion of time experience and experience of the activity as intrinsically rewarding. Providing an adequate level of challenge has been viewed as a key reason why players experience flow in a particular game (Csikszentmihalyi 1991). The player will feel bored or frustrated if his or her existing skill exceeds or falls short of the challenge at hand. However, negative experiences such as frustration are sometimes necessary to enhance the overall experience, but the player should have the skill to overcome them (Gilleade and Dix 2004).

The concepts of flow and immersion clearly overlap. They both imply a sense of distorting time and providing a challenge that involves a person in a task. Jennett et al. (2008) considered immersion as a precursor of flow: while the flow is an optimal and therefore extreme experience, immersion is not always so extreme. A player might be immersed in the game without achieving the flow experience. The authors also view immersion as not only a positive experience: negative emotions and uneasiness (i.e. anxiety) also run high, and the role of these emotions in the overall game experience should be further explored. Similarly, Cairns, Cox, and Nordin (2014) see immersion as more of a graded experience, whereas they describe flow as an all-or-nothing experience of being 'in the zone', which might be also described as total immersion.

In a study by Hamari et al. (2016), the experience of being in the flow was operationalised by engagement and immersion, while challenge and skill were seen as conditions that predict the flow experience. Presence is also tightly related to both flow experience and immersion. It relates to the feeling of *being there*, i.e. actually being in the scene, regardless that the scene is artificial (Boyle, Connolly, and Hainey 2011). The relationship between presence and immersion is complex, as the same term, *presence*, is used to explicitly cover the idea of immersion but at the same time has many more meanings (Cairns, Cox, and Nordin 2014).

Several studies have explored the precursors of flow and other experiences in serious game play, as well as their effect on the games' outcomes. Iten and Petko (2016) found that enjoyment had a positive impact on students' motivation to continue engaging with the game. However, they did not found an effect of enjoyment on self-assessed or tested learning gains. Martinovic et al. (2016) concluded that children performed better on games that exercise cognitive skills in which they were more engaged. Similarly, Hsieh, Lin, and Hou's (2016) findings implied that students who had higher flow experiences, especially a time-distortion experience, tended to have higher learning performances. In a study dealing with affect and engagement in a game-based learning environment based on a microbiology curriculum, Sabourin and Lester (2014) found that group of efficient problem-solvers reported more positive affective states and felt more competent and interested compared to other students. In contrast, inefficient problem-solvers engaged in more off-task behaviour and felt more bored while playing the game. Georgiou and Kyza (2018) investigated the impact of immersion on learning in location-based augmented reality settings. They found that engagement (seen as lower level of immersion) had a stronger relationship with student learning gains than higher levels of immersion (engrossment and total immersion).

To summarise, most of the studies showed beneficial effects of positive game experiences like flow and immersion on various learning outcomes, mostly knowledge acquisition and skills development. However, the role of the game experience was far less explored in serious games aimed at enhancing soft or social skills. In one of them, that dealt with the aftermath of the earthquake, Bachen et al. (2016) found that presence was a powerful predictor of flow, character identification, and empathy felt during the games. Flow mediated the effect of presence on females' identification, contributing to interest in learning, as well as the effect of presence on males' empathy. These results suggest that players' experiences during serious games might be important not only for knowledge improvement but also for enhancing empathy and social skills, which are prominent goals of some serious games, especially ones aiming at mental health improvement and bullying prevention.

2. The present study

Bearing in mind the importance of players' experience, the effects of serious anti-bullying games on empathy and compassion should be further explored. Although some programs have begun to be implemented in the field of bullying and cyberbullying prevention, using the benefits offered by virtual environments, they have not been focused on the role of gaming experience. Therefore, the present study aimed to explore the role of game experience during playing serious game aimed at bullying prevention in achieving the goals of the game: increasing knowledge about appropriate reactions while witnessing bullying situations, and increasing compassion for the victim.

The anti-bullying game named *School of Empathy* was designed with the main focus on applied behaviour analysis. Each player had the opportunity to play three different roles consecutively: the victim, the bystander, and the bully. The game consisted of various social situations occurring in the school, mostly representing bullying incidents, in which the player had to choose reactions or responses in presented dialogues that he/she found most suitable. All the players progress through the game in the same order. Firstly, they experience the victim role and learn behaviours for protecting themselves. Then, in the bystander role, they recognise bullying situations and learn appropriate helping behaviours. Finally, in the bully role, they experience the negative consequences of bullying behaviours and positive consequences of prosocial behaviours.

The game also included several mini-games that required the player to complete school tasks while being bullied by other characters (the victim role) or by being tempted to perpetrate bullying behaviour (the bully role). At the beginning of the victim role, missions and mini-games were intentionally made difficult to pass, so that the player could experience the helplessness and frustration that the victim feels in such situations and therefore increase compassion for the victim. In each role, appropriate, assertive, and empathic reactions in dialogues were reinforced by providing points that reflected an increase in self-efficacy, strength, and courage, allowing players to proceed through the missions. Aggressive and passive reactions were punished by the loss of points for self-efficacy, strength and courage, and hindering progress through the mission.

Results of the experimental study on the effectiveness of the game on players in-game behaviour (Kolić-Vehovec, Smojver-Ažić, Martinac Dorčić, & Rončević Zubković, 2020) indicated a weak positive effect of the game on students' behavioural choices i.e. preferring helping behaviour. Also, it was concluded that students' initial social behaviour determined their playing activities: the more assertive students were more likely to successfully progress through the game. However, neither gaming experience nor student compassion was addressed in that study.

The main aim of the present study was to explore whether the game experience mediates the relationship between pre- and postgame knowledge about appropriate reactions in bullying situations, and compassion for the victim. It was expected that students who initially had better knowledge about appropriate reactions in social situations and had more compassion for the victim would also be more knowledgeable and compassionate after playing the game. However, we hypothesised that initial levels of knowledge and compassion could affect the game experience. That is in accordance with previous findings showing that player characteristics and personality traits can impact in-game behaviour (Kolić-Vehovec et al., 2020; Worth and Book 2015) and game experience (Bachen et al. 2016; Birk et al. 2015).

In the present study, we focused on three game experience dimensions from Game Experience Questionnaire (GEQ; IJsselsteijn, de Kort, and Poels 2013): Immersion, Tension, and Challenge. We considered both empirical and psychometrical issues (see Appendix) in selecting game dimensions. Firstly, immersion was chosen as it is more likely for players' to be immersed in the serious game, than to experience flow. As argued by Cairns, Cox, and Nordin (2014) immersion is more of a graded experience, while flow as an all-or-nothing experience. Furthermore, psychometric properties of the Immersion scale were better than psychometric properties of the Flow scale. Positive affect scale was not selected as it referred to more general experience, and it was highly correlated with Immersion. Since previous studies (e.g. Jennett et al. 2008) stressed the need for exploring unpleasant gaming experiences, Tension scale was also employed. It had better psychometric properties than more general Negative affect scale. Finally, we also considered Challenge and Competence, as more cognitive aspects of players' experience that could reflect the difficulty of the game, and thus the learning success. However, Competence scale had poor reliability and convergent validity, so it was not included in the model and analyses.

In the proposed model, we hypothesised that initial levels of knowledge could affect the challenge experienced while playing the game, as well as subsequent immersion. If players have a high knowledge of appropriate reactions in bullying situations, the game could be too easy for them and the perceived challenge during playing might be too low. However, higher knowledge would enable students to be more immersed and imaginative in exploring the game. Also, we assumed that initial levels of compassion could affect the experience of immersion and tension: students who are compassionate could feel more immersed in a game that offered them situations in which they could exert empathy and help, while students with lower levels of compassion could feel more tension if compassion was needed to progress with the mission. That would be in line with the results of studies showing that players who are kind and patient (have high agreeableness) were more inclined to helping behaviour and positive interactions in the game, while players with psychopathic traits had higher tendency to aggressive behaviour in game (Worth and Book 2014, 2015). Additional analysis of in-game behaviour in *School of Empathy* game also indicated that assertiveness had impact on player in-game behaviour (Kolić-Vehovec et al., 2020), and therefore it is plausible to expect that initial characteristic could contribute to the game experience. That is in accordance with prior studies showing that baseline (pre-game) empathy affected game experiences, such as presence, in a serious game that promoted empathy (Bachen et al. 2016).

Furthermore, we hypothesised that perceived challenge could affect post-test knowledge: higher challenge in the game in which progress is dependent upon appropriate reactions could have positive effects on knowledge about similar reactions. On the other hand, immersion

and tension could affect subsequent compassion, as deeper immersion and less tension in an anti-bullying game could lead to increased compassion for the victim. Additionally, in accordance with some previous findings (e.g. Georgiou and Kyza 2018), we also presumed that immersion could have an effect on subsequent knowledge.

To conclude, following hypotheses were examined:

Hypothesis 1 (*pretest variables → game experience*)

H1a: Pretest knowledge has a negative effect on challenge

H1b: Pretest knowledge has a positive effect on immersion

H1c: Pretest compassion has a positive effect on immersion

H1d: Pretest compassion has a negative effect on tension

Hypothesis 2 (*pretest variables → post-test variables*)

H2a: Pretest knowledge has a positive direct effect on post-test knowledge

H2b: Pretest compassion has a positive direct effect on post-test compassion

Hypothesis 3 (*game experience → post-test variables*)

H3a: Challenge has a positive effect on post-test knowledge

H3b: Immersion has a positive effect on post-test knowledge

H3c: Immersion has a positive effect on post-test compassion

H3d: Tension has a negative effect on post-test compassion

Hypothesis 4 (*mediational role of game experience*)

H4a: Challenge mediates the effect of pretest knowledge on post-test knowledge

H4b: Immersion mediates the effect of pretest knowledge on post-test knowledge

H4c: Immersion mediates the effect of pretest compassion on post-test compassion

H4d: Tension mediates the effect of pretest compassion on post-test compassion

H4e: Immersion mediates the effect of pretest compassion on post-test knowledge

H4f: Immersion mediates the effect of pretest knowledge on post-test compassion

The hypothesised model is shown in Figure 1.

We hypothesised that the proposed model would be appropriate for games aimed at fostering compassion; however, the proposed effects should not be apparent in games that do not have the same aim. Therefore, we also tested the model on the whole sample of students, including students who played the control game, and explored whether the group membership moderated the proposed effects.

3. Methods

3.1. Participants and procedure

Students from 10 European schools (five in Spain, three in Malta, one in the United Kingdom and one in Ireland) participated in the study. Schools were recruited via an open call for participation in *eConfidence* project. The call was open for schools from Spain and English-speaking countries and 31 school applied. Preselection of schools was made based on the availability of students and a research coordinator, interest, quality of the internet connection, and availability of an IT laboratory or classroom. Online interviews with representatives of the 15 schools were conducted, and ten schools were selected to participate in the pilot study. In each school, 36 students in targeted age groups were assigned by random sampling into three groups (experimental gaming group, control gaming group and control without gaming group). For the purpose of this study, data for gaming groups are provided. The age range of the students was from 12 to 14 years old ($M = 12.75$; $SD = 0.7$ for *School of Empathy* group: $M = 12.65$; $SD = 0.72$ for control game group). The sample was gender-balanced ($N_m = 61$, $N_f = 59$ for *School of Empathy* group; $N_m = 54$, $N_f = 62$ for control game group).

Participants (students) and their parents were provided with information sheets about the project and student participation. Expressed written consent was collected for all participants and their parents, before the pretest phase. The applied survey was anonymised by giving an arbitrary index number to each student.

All students were assessed in schools using an online survey before the gaming sessions and after the gaming sessions. The gaming sessions also took place in schools. School research coordinators in each school organised and scheduled the playing sessions. Each coordinator reported that students played the game four to six hours, divided into several sessions (optimally two half-hour sessions a week). During playing sessions,

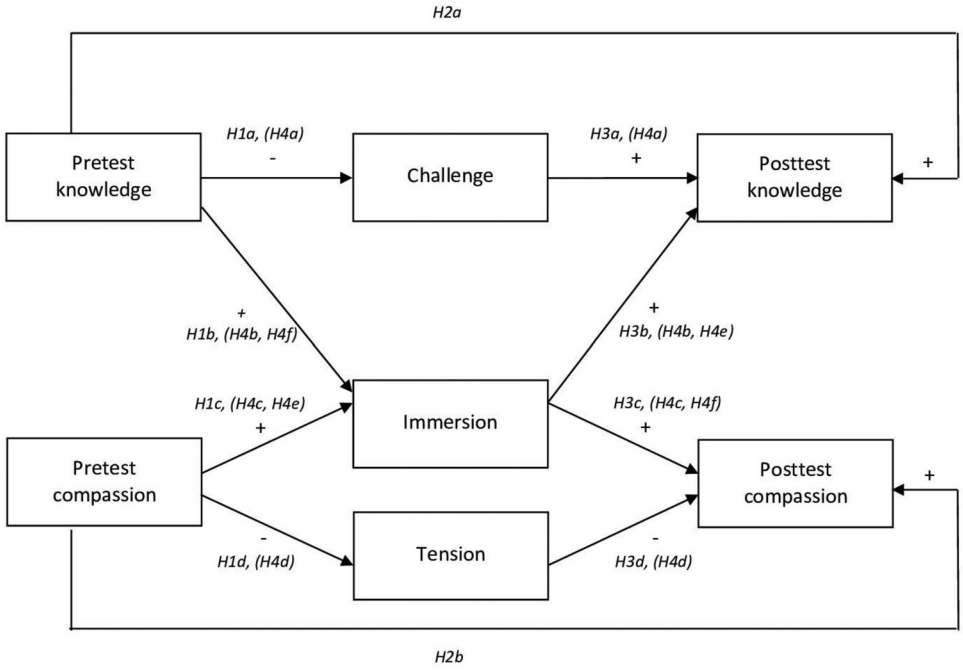

Figure 1. Hypothesised multiple mediator model for pretest knowledge and compassion and game experience variables on post-test knowledge and compassion.

two gaming groups played different games developed within *eConfidence* project: experimental group played *School of Empathy* game, while control group played the game related to the safe use of internet (using strong passwords, distinguishing between reliable and unreliable contacts etc.). The survey and the games were designed in Spanish for students in Spanish schools and in English for students in the UK, Ireland, and Malta.

3.2. Instruments

The online survey consisted of numerous scales assessing different constructs related to the projects' aims. For the purpose of this study, several scales were taken into account: knowledge about appropriate reactions and compassion for the victim, assessed before and after the gaming sessions; and game experience, assessed only in the post-test.

Knowledge about appropriate reactions. The questionnaire was composed from vignettes inspired by study by Costley, Sueng-Lock, and Ji-Eun (2013). Six vignettes described social situations involving bullying, while two vignettes described social situations in which the victim was unintentionally hurt. Since bystander compassion and assertive reactions were desirable in all social situations, answers in all the vignettes were taken into account. First, students had to rate if the vignettes described bullying situations (yes, no, maybe), then they had to rate the appropriateness of three presented reactions in each social situation. Out of the presented reactions, one was appropriate and assertive, one was more passive and one was more aggressive. Students evaluated if each reaction was appropriate (yes, no, maybe). When students rated an assertive reaction as appropriate, they were given two points; if they rated it as maybe appropriate, they were given one point; and zero points were given if students rated an assertive reaction as inappropriate. When other responses (aggressive and passive) were rated as appropriate, students were given zero points, responses rated as maybe appropriate were given one point, and responses rated not appropriate were given two points. The total score was computed as the sum of all scores (range: 0–48). The internal consistency (Cronbach's α) of the scale was .74 in the pretest and .73. in the post-test.

Compassion for the victim. Compassion for the victim was assessed in the same eight situations (vignettes) by using the question *Would you feel the compassion for the boy/girl … ?* Students gave their answers in the same way (yes, no, maybe). The *yes* answer was awarded two points, *maybe* with one and *no* with zero (range: 0–16). The internal consistency (Cronbach's α) of the scale was .60 in the pre-test and .76 in the post-test.

Game experience. In the present study, we used a shorter version of the In-game Game Experience Questionnaire (GEQ; IJsselsteijn, de Kort, and Poels 2013). The GEQ consists of seven dimensions: Sensory and Imaginative Immersion, Tension, Competence, Flow, Negative Affect, Positive affect, and Challenge. Systematic literature review and validation study of the GEQ (Law, Brühlmann, and Mekler 2018) showed that the original seven-factor structure was

unstable, and while some subscales appeared reliable and structurally valid, others might not fully reflect the construct that was intended to be measured. Therefore, we decided to use a shorter and more concise in-game GEQ that originally consisted of two items per dimension. Since the GEQ has never been administered to early adolescents, we extended the concise In-game GEQ with one additional item for each component in order to increase the reliability of the scales measuring each component. The players rated each of 21 statements on a five-point scale (not at all, slightly, moderately, fairly, and extremely).

Confirmatory factor analyses were conducted on these 21 item using Mplus-8.1 (Muthén and Muthén 2017). The analyses were performed using a maximum likelihood (ML) estimation. To identify the models, the variance of each latent factor was fixed to 1. The fit of the seven models was tested, starting with one latent factor and ending with the original seven-factor structure. Models 1 through 5 all provided a poor fit to the data. Model 6 and Model 7 approached the thresholds for acceptable model fit, but Model 7 fit the data significantly better than did Model 6 ($\Delta\chi2 = 16.11$, $p < .05$) and had the lowest AIC. Modification indices indicated correlations between the error-terms of several items. Model 8 was an improvement on the seventh model in which these error terms were allowed to correlate ($\Delta\chi^2 = 30.22$, $p < .001$). It had good fit estimates ($\chi^2 = 242.71$; CFI = 0.93; TLI = 0.91; RMSEA = 0.063; SRMR = 0.080). The results of the confirmatory factor analysis (Model 8) are presented in the Appendix. All of the subscales demonstrated relatively satisfactory levels of internal consistency (Cronbach's α), ranging from .63 to .85. However, some of the scales had very low convergent validity indicated by AVE values lower than 0.50. Additionally, the scales relating to positive emotional experiences were mutually highly correlated. In order to avoid high mutual correlations between mediators and simplify the model, we decided to use only three subscales according to our research aims: Challenge, $\alpha = .85$; Immersion, $\alpha = .78$; and Tension, $\alpha = .79$.

4. Results

4.1. Descriptive statistics and model testing for School of Empathy *game sample*

Table 1 presents the descriptive statistics and intercorrelations between the study variables. Pretest (pregame) knowledge about appropriate reactions in bullying situations and compassion for the victim correlated positively, as well as the post-test (postgame) knowledge and compassion. In addition, positive correlations existed between pretest and post-test knowledge and compassion. The components of the game experience were mutually correlated. Pretest knowledge and compassion were mostly not correlated with game experience components. However, challenge correlated positively with post-test knowledge, and immersion correlated positively with both post-test knowledge about appropriate reactions in bullying situations and post-test compassion for the victim. Additionally, we tested whether the examined variables were related to the playing time. The correlations of playing time with pretest and post-test knowledge ($r = 0.00$; $r = -0.02$; $p > .05$) and compassion ($r = 0.08$; $r = -0.02$; $p > .05$) were not significant. Likewise, the correlations of playing time with game experience dimensions (challenge, immersion, and tension) also did not reach significance level ($r = -0.10$; $r = -0.18$; $r = -0.05$; respectively, $p > .05$).

Structural equation modelling (Mplus-8.1; Muthén and Muthén 2017) was employed to examine the hypothesised multiple mediator model presented in Figure 2. Model parameters were estimated using a maximum likelihood (ML) estimation.

The mediation of the effects of pretest knowledge and compassion on post-test knowledge and compassion by game experience variables was tested by examining the significance of the indirect effects using a bias-corrected bootstrap method with 95% confidence intervals (MacKinnon, Lockwood, and Williams 2004). The mediator residuals were permitted to covary as recommended in

Table 1. Descriptive statistics and bivariate correlations of knowledge, compassion, and game experience variables.

	1	2	3	4	5	6	7
1. Pre-test knowledge	–						
2. Pre-test compassion	0.51**	–					
3. Challenge	−0.02	−0.01	–				
4. Immersion	0.14	0.18	0.47**	–			
5. Tension	−0.19*	−0.06	0.37**	−0.16	–		
6. Post-test knowledge	0.63**	0.36**	0.19*	0.22*	−0.02	–	
7. Post-test compassion	0.38**	0.52**	0.13	0.29**	−0.03	0.65**	
M	41.87	14.56	2.70	2.77	2.80	40.15	14.08
SD	4.19	1.70	1.00	1.05	1.15	5.60	2.51
Range	21–48	6–16	1–5	1–5	1–5	22–48	5–16

Note. ** $p < .01$, * $p < .05$.

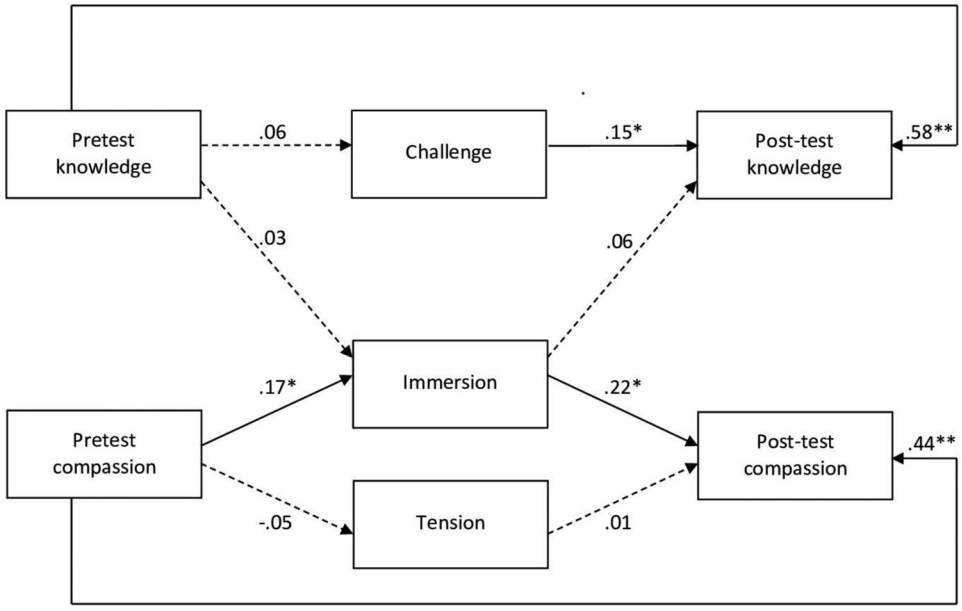

Figure 2. Multiple mediator analysis for post-test knowledge and post-test compassion (*School of Empathy sample*). Nonsignificant paths ($p > .05$) are represented by dashed lines. Covariances are not displayed in order to simplify presentation. Explained variance was $R^2 = 0.40$ and 0.28 for post-test knowledge and post-test compassion, respectively. *$p < .05$, ** $p < .01$.

Table 2. Multiple mediator analysis: direct, mediated and total effects.

		Indirect effect via			
	Direct effect	Challenge	Immersion	Tension	Total effect
Pretest knowledge to post-test knowledge	0.58** [0.41, 0.73]	0.01 [−0.01, 0.06]	0.00 [−0.01, 0.04]	–	0.60** [0.42, 0.74]
Pretest compassion to post-test knowledge	–	–	0.01 [−0.01, 0.06]	–	0.01 [−0.01, 0.06]
Pretest compassion to post-test compassion	0.44** [0.22, 0.63]	–	0.04 [0.00, 0.11]	0.00 [−0.02, 0.01]	0.48** [0.28, 0.66]
Pretest knowledge to post-test compassion	–	–	0.01 [−0.03, 0.07]	–	0.01 [−0.03, 0.07]

Note. Values are standardized parameter estimates, values in square brackets are 95% confidence intervals with bias correction. ** $p < .001$.

multiple mediator models (Preacher and Hayes 2008). The model provided a good fit to the data: $\chi^2(6) = 9.11$, $p = .17$, CFI = 0.98, TLI = 0.95, RMSEA = 0.066, SRMR = 0.070. The obtained results of the model are summarised in Table 2.

Pretest knowledge had a positive direct effect on post-test knowledge ($\beta = 0.58$; 95% CI [0.41, 0.73]). Likewise, pretest compassion for the victim had a positive direct effect on post-test compassion ($\beta = 0.44$; 95% CI [0.22, 0.63]). Pretest knowledge exhibited a nonsignificant positive trend with regard to challenge ($\beta = 0.06$; 95% CI [−0.10, 0.22]) and immersion ($\beta = 0.03$; 95% CI [−0.15, 0.25]). Pretest compassion for the victim exhibited a significant positive trend with regard to immersion ($\beta = 0.17$; 95% CI [0.00, 0.32]) and a nonsignificant negative trend with regard to tension ($\beta = -0.05$; 95% CI [−0.23, 0.11]). All of the estimated specific indirect effects of pretest knowledge and compassion on post-test knowledge and compassion as outcomes through game experience variables were not significant (see Table 2).

The effect of immersion on post-test knowledge about appropriate reactions in bullying situations was not statistically significant ($\beta = 0.06$; 95% CI [−0.07, 0.22]). However, challenge had a positive effect on post-test knowledge ($\beta = 0.15$; 95% CI [0.01, 0.30]). Immersion was a positive predictor of post-test compassion for the victim ($\beta = 0.22$; 95% CI [0.04, 0.41]), while the effect of tension on this outcome was not significant ($\beta = 0.01$; 95% CI [−0.14, 0.14]).

In sum, the results indicate that pretest knowledge and pretest compassion exhibited positive direct effects on the corresponding postgame outcome. The obtained direct effects were rather large in magnitude. No mediation effects via game experience variables were found.

4.2. A moderated mediation analysis for School of Empathy and control game sample

The same hypothesised multiple mediator model (see Figure 1) was further tested on a sample consisting of both game playing groups: the *School of Empathy* and the control game group. The model provided a good fit to the data: $\chi^2(6) = 10.84$, $p = .09$, CFI = 0.99, TLI = 0.96, RMSEA = 0.058, SRMR = 0.060.

Multiple-group analysis and Wald tests with one degree of freedom were conducted to evaluate the potential moderating effect of game subgroup membership on relations in the mediation model. The results indicated that game group membership was not a significant moderator of the estimated specific indirect effects. However, the differences in some of the direct effects between groups were statistically significant. The direct effect of pretest knowledge on post-test knowledge about appropriate reactions in bullying situations was found to be significantly different for *School of Empathy* game group ($\beta = 0.63$; 95% CI [0.52, 0.74]) versus control game group ($\beta = 0.46$; 95% CI [0.32, 0.60]). In addition, there was a significant difference between the direct effect of challenge on post-test knowledge for *School of Empathy* game group ($\beta = 0.19$; 95% CI [0.01, 0.36]) and control game group ($\beta = -0.07$; 95% CI [−0.25, 0.11]). Finally, *School of Empathy* game group ($\beta = 0.29$; 95% CI [0.12, 0.46]) differed from control game group ($\beta = 0.06$; 95% CI [−0.12, 0.24]) in the direct effect of immersion on post-test compassion for the victim.

5. Discussion

In the present study, we investigated whether the game experience during playing a digital serious game aimed at bullying prevention mediated the relationship between initial and postgame knowledge about appropriate reactions in bullying situations, and initial and postgame compassion for the victim. The proposed model showed a good fit to the data, but the mediation hypotheses were not supported.

The results of the study suggest that, expectedly (Hypotheses H2a and H2b), knowledge about appropriate reactions in bullying situations and compassion for the victim after playing an anti-bullying game were determined largely by initial levels of knowledge and compassion. Our hypotheses that their relationship could be partially mediated by the game experience (Hypothesis 4) were not confirmed. Nevertheless, the effect of initial compassion on immersion was significant (Hypothesis H1c). The results also indicated that some aspects of the game experience could affect knowledge and compassion. Specifically, challenge had a significant effect on subsequent knowledge about appropriate behaviour (in line with Hypothesis H3a), while immersion had a significant effect on subsequent compassion (in line with Hypothesis H3c).

To begin with, the results of the present study highlight the importance of taking into consideration the initial levels of criterion variables when examining the effects of (serious) game intervention. Regardless of the experience students had during game play, initial levels of knowledge about appropriate reactions and compassion had substantial direct effects on subsequent measures. That is not surprising, since students connect new information with their previous knowledge, beliefs and assumptions; they construct new knowledge and understanding based on what they already know and believe (National Research Council 2000). However, as previously mentioned, only a small number of studies that examined the effects of serious anti-bullying games had a longitudinal design that included both pretest and post-test measures (Nocentini, Zambuto, and Menesini 2015). Furthermore, none of them explored the role of the game experience for the expected game outcomes. To our knowledge, only a few studies have taken into account the initial levels of criterion variables when examining the effects of the game experience on either knowledge (e.g. Georgiou and Kyza 2018) or social skills and empathy (Bachen et al. 2016).

Research that has investigated the effects of the game experience on different outcomes has been so far mainly focused on knowledge acquisition and/or motivation/satisfaction enhancement (Buil, Catalán, and Martínez 2018; Georgiou and Kyza 2018; Hsieh, Lin, and Hou 2016; Iten and Petko 2016; Martinovic et al. 2016; Sabourin and Lester 2014). Studies exploring the relationship between game experiences and socioemotional outcomes have been scarce (e.g. Bachen et al. 2016). Therefore, the present study, in addition to knowledge about appropriate behaviour, takes into account a socioemotional outcome: compassion for the victim. That is particularly important in games aimed at bullying prevention, as compassion is characterised by affection and care for the suffering person. Studies show that compassion increases the likelihood of helping the person in need (e.g. Lim and DeSteno 2016).

Camodeca and Goossens (2005) have found that eleven-year-old children most frequently selected assertiveness as intervention strategy against bullying. That means that they are probably aware of the importance and efficacy of using assertive skills in order to stop bullying. However, knowledge of appropriate reactions does not guarantee that assertive behaviour will actually be enacted. Hence, the notion that certain experiences during a bullying prevention game could lead to

increased compassion could be very appealing, since compassion increases the tendency to help (Leiberg, Klimecki, and Singer 2011).

Furthermore, the present study showed that initial compassion did not have an indirect effect (through immersion) on subsequent knowledge about appropriate reactions in bullying situations (Hypothesis H4e). Some previous studies have also shown that immersion was not related to (perceived) learning (Hamari et al. 2016). Therefore, it is possible that players who were more immersed in the story do not become necessarily more accurate in their answers, but it seems that they become more compassionate. Contrary to our expectations (Hypothesis H4c) the indirect effect of pretest on post-test compassion via immersion was also not significant. However, initial levels of compassion affected immersion in the game (Hypothesis H1c) and immersion had a positive effect on subsequent compassion (Hypothesis H3c). It seems that more compassionate players experience more immersive experiences while playing bullying prevention game, but also it seems that higher immersion in a game that required a player to deal with different bullying situations could lead to higher compassion for the suffering persons after playing the game.

With the aim of creating an engaging game, designers have considered several important game features (Garris, Ahlers, and Driskell 2002). The *School of Empathy* narrative includes fantasy elements. Fantasies, especially endogenous fantasies that are closely tied to the learning content, are effective motivational tools (Rieber 1996). The game commences at the beginning of high school. The player's mission is to help troubled classmates to change their behaviour by using a superpower for time travelling and to embody middle school students in different roles (victim, bystander and bully). The main emphasis is on the victim and bystander roles, providing opportunities for players to feel compassion for the victim and supposing that it would enhance helping behaviour displayed in bystander role.

Nevertheless, the average levels of immersion were moderate, suggesting that the game might be immersive for some players but not for others. The challenge of constructing a serious game is immense: the game should balance enjoyable and educational elements and be designed in a way that supports effective and efficient learning (Arnab et al. 2015). The concept of serious game itself is conflicting because it combines seriousness with play, which is by definition a voluntary and unproductive activity that brings joy and amusement (Carvalho 2017). It is quite demanding to merge entertainment and educational elements in a serious game, and provide deep sensory immersion using high-quality graphics that enable subtle face expressions, especially under budget and time constraints. Research showed that rich interactive experiences of game characters and deep interactions with other players could also increase meaningful outcomes of games (Rogers et al. 2017). The use of vocalised speech and/or natural language processing that allows nonplaying characters to adapt to player answers (as in SchoolLife 2016) might also increase immersion, but that should be further explored.

In the present study, we have taken into account not only immersion in the sense of exploration, interest, and imagination during the game, but we also considered negative experiences of tension, which has received far less attention in game experience research. The results showed that initial compassion for the victim did not affect feelings of tension in the game (Hypothesis H1d), nor did tension experienced during the game affect compassion, although we expected an adverse effect of tension on compassion (Hypothesis H3d). As already mentioned, parts of the game were intentionally made difficult to pass, so the player can experience the helplessness and frustration that the victim feels in such situations. That intervention might have increased empathy and compassion for the victim in some players. On the other hand, some players might just feel angry and frustrated because their progression was hindered, so instead of feeling compassionate, they might have felt irritated and even aggressive, and therefore less prone to compassion.

As argued in Gilleade and Dix (2004), frustration is sometimes needed to enhance the game experience, but provoking frustration for an inadequate period of time can have the opposite effect. This finding may serve as a guideline for improving the design of serious games. However, it is difficult to obtain optimal levels of challenge for all players, as players are challenged by activities that are neither too easy nor too difficult to perform (Garris, Ahlers, and Driskell 2002; Hendrix et al. 2018).

In the present study, we expected that initial levels of knowledge about appropriate reactions in bullying situations could lead to lower levels of challenge and higher immersion (Hypotheses H1a, and H1b). However, these assumptions were not supported by our results. Although students had high initial knowledge about appropriate behaviour in bullying situations, the game was constructed in a way that optimal reactions were not always possible, and some mini-games were very difficult to pass, so higher knowledge did not necessarily lead to lower challenge. Additionally, as mini-games required different kinds of skills (primarily motor skills) initial knowledge about appropriate reactions was not relevant for some aspects of the game. However, although the challenge did not mediate the relationship

between initial and postgame knowledge (Hypothesis H4a), it had a small but significant effect on subsequent knowledge (Hypothesis H3a). It seems that players who experienced higher levels of challenge learned more from the game. That is in line with previous findings indicating that challenging games help students learn (Hamari et al. 2016).

Of course, perceived challenge in one game should not affect knowledge that is unrelated to the content of the game. In the proposed model, we posited that game experience in bullying prevention game affects subsequent knowledge about bullying and compassion for the victim. We hypothesised that the model would be appropriate for games aimed at bullying prevention, but the proposed effects should not be apparent in game that was not intended to foster compassion and assertiveness in bullying situations. The additional analysis on the sample that included students who played the control game (related to the safe use of internet) showed that playing different games moderated the effect of challenge on knowledge, the effect of immersion on compassion, and the effect of pretest knowledge on post-test knowledge. The direct effect of pretest knowledge on post-test knowledge was significant in both samples but stronger in *School of Empathy* group. More importantly, the effect of challenge on knowledge and the effect of immersion on compassion were significant in *School of Empathy* game group, but not in the control game group. These findings showed that challenge that students experienced in the game that was not related to acquiring knowledge about appropriate reactions in bullying situations did not affect subsequent knowledge about bullying. Similarly, immersion in the game that was not aimed at fostering compassion did not affect subsequent compassion in students.

To conclude, the results of moderated mediation analysis offer further support to the notion that immersion in the bullying prevention game was important for enhancing compassion in students, while challenge experienced during the game affected students' subsequent knowledge about appropriate behaviour in bullying situations.

5.1. Limitations of the study and future directions

In the present study, we considered different game experience components as mediators that were mutually correlated. The main assumption was that they occur in the same period of time (during game play), so they should be taken as mediators between initial, pregame and subsequent, postgame knowledge and compassion. However, we acknowledge that the relationship between those mediators might be more complex, for example, challenge might be precursor of immersion (and tension), as suggested in Hamari et al. (2016). Furthermore, other game experiences could have been taken into account. The analysis of the Game experience questionnaire revealed that not all subscales had satisfactory convergent validity, so future studies should further address this issue. Here, we selected game experience dimensions that were theoretically and psychometrically the most grounded. However, even if psychometric properties of the game experience subscales had been satisfactory, the more complex model with larger set of mediators would have been difficult to test, because of numerous possible indirect effects and mutual reciprocal relations. Nevertheless, further studies should explore such possibilities.

When considering the assessment of the game experience, it should be taken into consideration that it was not done immediately after or during each playing session, but rather that students' reports were retrospective. That allowed students to reflect on the whole gaming experience, and not just on the session they just finished, but those perceptions might differ from those of more immediate reports. In future studies, immediate reports could be collected after each playing session (or even incorporated into the game), and the game experience could be expressed as the composite result of immediate reports. It would be also useful to use alternative assessment such as 'think aloud' protocols, physiological measures or video analysis in combination with in-game data analysis.

When interpreting the results of the present study, the assessment of compassion and knowledge must also be considered. Both measures were constructed for the purpose of the study. Furthermore, the compassion measure was based on students' comprehension of the word *compassion*, which might be differently understood by different children. However, vignettes describing bullying situations and accompanying questions related to knowledge about appropriate reactions and compassion were closely related to the game topic, so we decided to use them instead of more general measures of knowledge about bullying and compassion or empathy.

It also must be acknowledged that children scored quite high on both measures, revealing high initial levels of compassion and knowledge about appropriate reactions. Although children were chosen randomly and they came from different countries and sociocultural milieus, they all attended schools that applied for participation in the project, so the schools might have been more aware and sensitised to bullying issues. Further studies might take different sampling approaches and consider some student factors such as sociodemographic, age, gender, etc.

5.2. Conclusion and contribution of the study

To conclude, although the present study is a small-scale research, it is one of the few studies that has considered the role of different game experiences on both cognitive outcomes (knowledge) and socioemotional outcomes (compassion). The results point to differential effects of particular players' experiences on specific serious game outcomes.

Our findings suggest that immersion in a bullying prevention game is important for enhancing compassion for the victim in students, while challenge experienced during the game affects students' subsequent knowledge about appropriate behaviour in bullying situations. The idea that immersion affects emotional outcomes, while challenge affects knowledge outcomes should be further explored in future serious game interventions.

The study also calls attention to the importance of taking into account the pregame levels of outcome variables. The results implicate that in designing serious games, attention should be placed on constructing optimally challenging games that are adaptive to players' previous knowledge. That could be achieved by the construction of individually tailored games (Hendrix et al. 2018). At the same time, the games should offer immersive experiences, which might be especially important for games focused on enhancing compassion.

Ethics approval

The study was approved by Ethical Committee for Scientific Research of the Faculty of Humanities and Social Sciences University of Rijeka, Croatia.

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Data availability statement

Raw data used for this study is available at Zenodo repository. https://zenodo.org/record/1475758#.XkvsX2hKiM8.

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Appendix. Standardized factor-loadings and convergent validity for Model 8 ($N = 115$)

	Loadings on Tension factor	Loadings on Negative Affect factor	Loadings on Competence factor	Loadings on Challenge factor	Loadings on Positive Affect factor	Loadings on Flow factor	Loadings on Immersion factor
I felt annoyed	0.71						
I felt frustrated	0.84						
I felt irritable	0.71						
I felt bored		0.72					
I found it tiresome		0.58					
It gave me a bad mood		0.50					
I felt skillful			0.49				
I felt successful			0.64				
I was good at it			0.40				
I felt challenged				0.68			
I had to put a lot of effort to it				0.72			
I thought it was hard				0.62			
I felt good					0.69		
I thought it was fun					0.89		
I enjoyed					0.87		
I forgot everything around me						0.48	
I was fully occupied with the game						0.80	
I lost track of time						0.58	
I felt that I could explore things.							0.73
I felt imaginative							0.75
I was interested in the games' story							0.74
AVE (> 0.5)	0.57	0.37	0.27	0.45	0.68	0.40	0.55

Note. AVE = average variance extracted.